

AGENCY FOR INTERNATIONAL DEVELOPMENT WASHINGTON, D. C. 20523 <b>BIBLIOGRAPHIC INPUT SHEET</b>	FOR AID USE ONLY <span style="font-size: 1.5em; font-family: cursive;">Batch 98</span>
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1. SUBJECT CLASSIFICATION	A. PRIMARY <b>Population</b>	PA00-0000-0000
	B. SECONDARY <b>General</b>	

2. TITLE AND SUBTITLE  
**New perspectives on the demographic transition**

3. AUTHOR(S)  
**(101) Smithsonian Institution. Interdisciplinary Communications Program**

4. DOCUMENT DATE <b>1976</b>	5. NUMBER OF PAGES <b>256p.</b>	6. ARC NUMBER <b>ARC</b>
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7. REFERENCE ORGANIZATION NAME AND ADDRESS  
**Smithsonian**

8. SUPPLEMENTARY NOTES (*Sponsoring Organization, Publishers, Availability*)  
**(In Occasional monograph ser.no.4)**

9. ABSTRACT

10. CONTROL NUMBER <del>PN-128-997</del> <b>PN-AAG-397</b>	11. PRICE OF DOCUMENT
12. DESCRIPTORS <b>Demography</b> <b>Fertility</b> <b>Family planning</b> <b>Economic factors</b> <b>Socioeconomic status</b>	13. PROJECT NUMBER
	14. CONTRACT NUMBER <b>AID/csd-3598 GTS</b>
	15. TYPE OF DOCUMENT

SS  
SI  
Mono. 4

PN-AAG-397

**... Perspectives  
On the  
Demographic Transition**

**Occasional Monograph Series**  
Number Four

ICP Work Agreement Reports

**INTERDISCIPLINARY COMMUNICATIONS PROGRAM**  
Smithsonian Institution

**INTERNATIONAL PROGRAM FOR POPULATION ANALYSIS**

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**New Perspectives  
On the  
Demographic Transition**

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ICP Work Agreement Reports

*Investigators*

Robert W. Morgan  
James E. Kocher  
Manuel Carvajal

David T. Geithman  
Alan Sweezy  
Leela Visaria  
Hananto Sigit

**INTERDISCIPLINARY COMMUNICATIONS PROGRAM**  
Smithsonian Institution

M. C. Shelesnyak, *Director*  
John T. Holloway, *Associate Director for Operations*

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December 1976  
INTERDISCIPLINARY COMMUNICATIONS PROGRAM  
Smithsonian Institution  
Washington, D.C.

Printed in the United States of America

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LIBRARY OF CONGRESS CATALOG NUMBER 76-45592

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## Foreword

This volume, one of a series of ten occasional monographs, contains some of the results reported by investigators who have studied population-related topics during the past several years as participants in the International Program for Population Analysis (IPPA).

The principal objective of the IPPA has been to broaden the base of knowledge and understanding of population dynamics by generating a new capability in analysis and evaluation, primarily in less developed and developing countries, for use by governments who wish to develop adequate population policies. One of the approaches to this objective has been the offer of modest work agreements (subcontracts) to qualified individuals who wished to work in population dynamics, especially investigators new to the field who were without major professional or financial support from other sources, and who showed promise of emerging as leaders and innovators in the exploration of contemporary population concerns.

At the inception of the Program in 1972, it seemed reasonable to believe that a considerable reservoir of talent had been untapped, that many individual population scholars and other social scientists throughout the world were isolated from the mainstream of knowledge in the field by distance, geography, culture, and lack of established affiliations. It was surmised that these scholars held, or could acquire at modest cost, many of the pieces of the immense puzzle that must ultimately be assembled.

During the past four years, the IPPA has attempted to mobilize some of this dispersed and often neglected talent. Emphasis was placed on goal-directed work oriented toward applications to practical nation- or region-specific population problems. The initiative for individual projects came both from ICP staff suggestions and from investigators' unsolicited proposals.

Proposals from scholars already engaged in population research were given full consideration; but particular attention was paid to applications from

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investigators new to the field but with demonstrated relevant competence, innovative approaches, and promise as nuclei of new population dynamics groups in less-developed and developing countries.

Out of a total of 317 proposals from all over the world, 52 were selected for support by a careful and thorough process which included both internal Interdisciplinary Communications Program (ICP) evaluation and peer review. In each case, a judgment was made as to whether the results would be useful in the formulation of workable Third World population policies and translatable into national commitments to viable action programs. No project was funded for more than \$50,000—the average was less than \$24,000. Most were for a period of one year or less.

The work agreements were tailored to individual situations, with the hope that a flexible approach would reduce the administrative burden at both ends and still maintain an essential degree of responsiveness. In addition, whenever an investigator undertook work in a country other than his own, it was required that a host country national be involved as a contact and professional collaborator. This requirement was intended to help ensure the relevance and suitability of the study to local conditions, correct interpretations of observations, and the practical application of results.

These investigators were not selected and then left to work in a vacuum. Other elements of the IPPA were designed specifically to maintain communications channels which, by making information from the Program available promptly and in usable form, linked these investigators to each other, to colleagues in related areas, and to the population community at large. These elements included continuous monitoring and assistance by the ICP professional staff and, when appropriate, participation in one or more of the sixteen IPPA workshop/seminars, six of which were held in Third World countries. Work agreement investigators, together with others on the IPPA mailing list of more than 4500 names, received semi-annual annotated bibliographies on selected population topics and *Population Dynamics Quarterly (PDQ)*, the IPPA newsletter with worldwide circulation. A number of investigators were first made aware of the IPPA through *PDQ*, and articles by many of them have appeared in its pages.

Even now, as the Program is being concluded, it is difficult to assess accurately the effects of the IPPA experiment—and it was an experiment in the fullest sense of the word. During the past four years, it has been shown that a great deal of unrecognized talent exists, that it can be reached by well-designed techniques, and that it can be productive. New approaches and perceptions have evolved. For example, the increasingly popular concept of population impact analysis grew largely from IPPA's concern with developmental determinants of fertility in selected countries.

*Foreword*

In compiling this book and its companion volumes, no attempt has been made to reproduce the complete reports submitted by the investigators. To varying degrees, the reports have been edited, condensed, and sometimes rearranged in format. In some instances, highly specialized terminology has been changed to make the material more readable by a diverse and multidisciplinary audience. Hopefully, these editorial liberties—made necessary by constraints of space and money—have not obliterated the essential flavor of the reports or obscured their principal findings. ICP assumes full responsibility for any changes made in the original manuscripts, since stringent time limitations have made it impossible to return the modified versions to the authors for review. Readers who wish additional information on any of these reports are encouraged to contact the authors directly.

Four years is a short time in which to devise and implement an undertaking of this diversity, let alone evaluate its long-term contribution to the solution of a problem of such magnitude. We hope the contents of this volume and the others in this series will be interesting and informative to a wide variety of readers with eclectic viewpoints. More importantly, we hope these first efforts will serve as a pattern and a source of encouragement for future efforts, and that the network of interpersonal contacts which has been established will continue to flourish.

M. C. Shelesnyak  
*Director*

*Interdisciplinary Communications Program*

John T. Holloway

*Associate Director for Operations*

*Interdisciplinary Communications Program*

## Introduction

In this volume are presented the results of recent empirical research designed to secure a more adequate understanding of population change. The six studies entail analysis of population change in twelve developing countries, seven in Latin America, two in sub-Saharan Africa, and three in Asia. Some findings are presented that reaffirm demographic transition theory; others argue against it. Alternative models of population change are proposed and receive preliminary testing.

As is well known, the demographic transition theory was derived from empirical evidence of changing mortality and fertility levels in western and northern Europe during the eighteenth, nineteenth and twentieth centuries. The theory states that some threshold level of socioeconomic modernization precedes mortality and fertility reduction, usually with a time lag for the latter. Although the theory explicitly holds that modernization is a precondition for such demographic change, its early proponents typically cautioned, "It is impossible to be precise about the various causal factors, but apparently many were important" (Notestein 1953). (A more complete description of the theory, including an account of its history and status, is presented in United Nations (1973), Coale (1973), Van der Walle and Knodel (1967), and Beaver 1975.)

The demographic transition theory has many critics. Some allege that the propositions concerning causal relationships between modernization and fertility decline are not specific enough to predict future fertility decline. Since the propositions are too vague to be validated, they do not constitute a theory.

Another related view is that the theory is merely a description of the experience of some economically developed countries, typically in northern and western Europe. These countries have undergone a similar pattern of

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change which today's developing nations are not apt to repeat because of dissimilarities with premodern Europe. Critics point to such differences as Europe's slow-paced mortality decline, in contrast with rapid mortality reduction in developing countries, and the frequent occurrence in Europe of moderate pretransition levels of fertility, as compared with high pretransition levels in Third World nations. Fertility differences may have resulted from another important difference--the high proportion of late marriages and non-marriage in pretransition Europe as contrasted with almost universal and early marriage in today's developing countries. One should not generalize from the European experience. The demographic transition theory does not adequately depict coming events in developing countries.

Yet another allegation holds that the propositions of the demographic transition theory are highly simplified, often inaccurate descriptions of events in Europe. Social-historical research reveals that premodern levels of fertility in Europe varied from high to moderate, and the variance in pretransition fertility was as great as the ensuing average fertility reduction (Coale 1973). In some places, fertility decline preceded mortality decline (Knodel 1968); elsewhere fertility decline preceded modernization (Sweezy 1973, McIntyre 1975, Goubert 1968).

Lastly, fertility reduction is at least temporarily reversible. The "baby boom" simultaneously occurred in 18 countries, most of which were European (Campbell 1974). Such reversal conflicts with the theory.

Regarding the transition theory's status, authors of a United Nations (1973) summarization on population stated:

The theory is an interpretation of turning points in demographic evolution rather than a system of logically consistent and explicit relationships that provide a basis for pertinent deductions and predictions of future developments (p. 60).

And Coale (1973) holds that, "with sufficient modernization, fertility and mortality change in a predictable manner" even if there is a "difficulty of defining a precise threshold of modernization" (p. 64).

The divergence of views over the relative merits of the demographic transition theory is not merely academic. The views are directly related to the present day controversy between developmentalists and family planners. Policymakers must choose whether to invest scarce developmental capital in socioeconomic improvements or on family planning programs, or on a combination of both. Their efforts to induce fertility reduction through programs of socioeconomic modernization are rationalized by the postulates of the demographic transition theory. But policies favoring family planning programs are based on the rationale that sufficient demand for such services already exists, that the availability of such services will result in fertility

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reduction, and that fertility reduction will help stimulate economic development and social progress.

One plausible course lies somewhere between the two policy extremes. An emerging consensus holds that both socioeconomic improvements as well as increased efforts in family planning programs are necessary if fertility is to be reduced (Teitelbaum 1974).

It is this writer's view that the various policy options are based on questionable theoretical models in their current form. This volume is intended to improve the situation.

The study by Robert W. Morgan (with a section on policy by Olukoye Ransome-Kuti) finds that indicators of modernization such as increased schooling, higher status occupations, and exposure to modern medical practices—all indicators of approaching modernity—are associated with higher fertility among the Yoruba of Lagos, Nigeria. To explain these anomalous findings, the investigator proposes that psychological insecurity accompanying modernization affects fertility.

If society is in flux and traditional norms are challenged, individuals subject to acute forms of psychological stress plunge forward into new forms of modernity while clinging to, and reinforcing, those traditional norms which remain. One of the most important of the traditional norms available to families in flux is continued high fertility . . . .

During the transitional period, families must honor the norms of the old, in fact, may have to overcompensate for their transitional behavior by over-honoring the norms of the old.

James E. Kocher's study of modernization and rural population change in two of Tanzania's northeastern districts is a preliminary test of an elaboration of the demographic transition theory as developed by Richard Easterlin (1975). Kocher asserts that his findings are not inconsistent with the theory and says that where modernization has been greatest in Tanzania, fertility decline is incipient. For example, in such areas, increasing numbers of women report they wish to stop childbearing in spite of having families which are small—three or four children—by local standards. Nonetheless, Kocher also shows that women approaching the end of their childbearing years in the most modernized study area, report a higher average number of live births than their age group peers in less modernized areas. Hence, although Kocher is able to document marked socioeconomic improvement among these rural Tanzanians, his data do not suggest that modernization leads to fertility reduction. Instead, he says, it is probable that modernization is leading to delayed childbearing, followed by shortened birth intervals after childbearing begins. While the net demographic effect of these changes

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is unclear, they probably tend toward fertility increase, at least in the short term. Kocher's findings suggest that Morgan's hypothesis may have wider application than only to urban Nigerian women.

Carvajal and Geithman test a fertility behavior model which posits socioeconomic reference groups as being important to Costa Rica's 1963-1973 intercensal fertility decline. According to them, couples' preferences for family size are influenced by the norms of the socioeconomic group with which the group identifies. The authors hypothesize that within reference groups, higher income is associated with higher fertility. A negative income-fertility relationship, however, will exist between reference groups. And the analysis of Costa Rican census data finds the inverse relationship between status and fertility as predicted by this elaboration of the demographic transition theory.

Alan Sweezy's study yields findings contrary to the demographic transition theory. His investigation of Mexico's economically advancing groups—business and professional people, commercial farmers, and industrial workers—finds their fertility is remaining high. Focusing on fertility decline in southern Europe, Sweezy notes that such decline preceded modernization; in terms of the policy relevance of these findings, he concludes, “. . . the most direct methods of bringing about fertility declines include the use of modern birth control technology and nationwide family planning programs”—a probable non sequitur.

In sharp contrast, Leela Visaria documents the relevance of the demographic transition theory to the experience of the Parsi community of the Indian Subcontinent. As in Europe, fertility decline was accomplished through a combined longterm reduction in both nuptiality and marital fertility. As in Europe, there has been a recent upturn in marriage with fewer Parsis remaining single and more people marrying earlier. But unlike Europe, the upturn seems unrelated to the use of contraceptives. The low levels of contraceptive use among the Parsis suggest that another factor, Parsi modernization—also documented by Visaria—might have played the key role in lower fertility levels.

Hananto Sigit reports on the impact of demographic change on economic growth in Indonesia. His model derives inputs of manpower and capital needed to attain an exogenously determined level of growth in Indonesia's gross national product, and suggests that lowered population growth will dampen economic growth. While somewhat peripheral to the investigation of demographic transition, the study does touch on economic-demographic relationships and addresses itself to a question of major importance: What will be the economic consequence of reduced population growth?

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As these studies show, progress toward attaining an adequate model of population change has been made. For social science eventually to derive such a model, both methods and data must be improved. Meanwhile, the research reports, in this monograph while far from authoritative, bring us closer to the attainment of such knowledge.

James M. Creager  
ICP Staff Social Scientist

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## Yoruban Modernization and Fertility in Lagos

Robert W. Morgan

### Abstract

An analysis of data on socioeconomic and health factors obtained from studies carried out in Lagos, Nigeria, during 1966-1970 reveals that modernization is associated with high fertility.

*Editor's Note: This report was completed in 1975, when the Federal Military Government of Nigeria was revising portions of the country's Third National Development Plan, 1975-1980. Some of the policy recommendations made in this report are included or closely approximated in the new plan. The section of the report on policy was co-authored by Dr. Morgan and Professor Olikoye Ransome-Kuti, Director of the Institute of Child Health, Lagos, and senior advisor to the Nigerian Federal Ministry of Health.*

Up to 1975, the policy of Nigeria's Federal Military Government on family planning was to integrate these services into the overall health care delivery system. The program was not directed toward the reduction of population, nor was the government to be involved directly in the delivery of family planning services, in accord with the statements on population policy and health as contained in the country's *Second National Development Plan, 1970-1974*.

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*Note: ICP social scientist James M. Creager helped prepare this study for publication. Correspondence to Dr. Morgan should be directed to 88 Pinckney Street, Boston, Massachusetts 02114.*

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Early in 1975, the Federal Military Government set up a Population Council whose function is to advise the government on ways to reduce the rate at which the population of Nigeria increases. For the first time, the government was concerned about the size and growth rate of the country's population. However, the mechanisms for attacking this set of problems have not yet been determined.

Nigeria has a population estimated at 70 million, and her great diversity in religion, ethnic groups, and social and cultural behavior is such that it would be difficult to produce a single policy report aimed at reducing the population growth rate of the entire country. Most of the information contained in this present research project relates to the Yoruba tribe in southwestern Nigeria. Although other studies have been or are now being undertaken in other parts of Nigeria, more information will be required from many sources in the country before a national population program can be launched with the necessary sophistication to ensure success.

While it is difficult to predict to what extent the results of the present study can be applied to the country as a whole, some general relationships appear in the data between fertility behavior, the shift from traditional to modern norms, and the individual family's overall life pattern. With an estimated 80 percent of the population in agriculture, for example, an agricultural policy which will enhance the process of farming and attract people back into the traditional sector is called for; the data suggest that variations in such a policy can affect fertility upwards or downwards, and that the government should consider these possible variations. The new *Third National Development Plan, 1975-1980* is being modified, and further detailed study of the plan as announced and as it evolves, is indicated. However, preliminary study of the plan makes it possible to make some recommendations at this time.

### Brief Outline of Research Findings

The data show a consistent relation between transitional status (shift from traditional to modern norms) and increased fertility. This relationship holds when considering the factors of urbanization, occupation, education, social status, and medical behavior. The data on education show that persons with no schooling have traditionally high fertility, persons with some schooling have still higher fertility, and the relatively few persons with advanced education have reduced fertility. As for occupation, persons in traditional occupations have high fertility, and persons whose occupations fall between traditional and modern, have still higher fertility. With respect to medical behavior, persons using modern clinics, or who have some knowledge of modern medical beliefs, have higher fertility than persons who do not use these facilities or who hold traditional beliefs about health and illness. The

### *Yoruban Modernization and Fertility in Lagos*

relation between transitional status and fertility is shown in the data on use of traditional versus modern medicines: Persons using traditional medicines have high fertility, those using both traditional and modern medicines have still higher fertility, and those using only modern medicines once again have lower fertility.

These data are taken from surveys among families in only one section of Nigeria (the Lagos metropolitan area); about 80 percent of the sample are members of the Yoruba tribe. However, data from other surveys in Nigeria support the findings, at least in part, and suggest that urbanization and education are related to increased fertility. Since so few persons in Nigeria today are in the upper class or the modern social statuses associated with reduced fertility, the net effect for the population as a whole is rising fertility rates as people move from rural to urban places and from traditional to modern norms.

#### Data as Related to the Third Development Plan

Because Nigeria lacks intermediate levels of manpower, the country's *Third National Development Plan, 1975-1980* calls for the training of large numbers of this type of worker. According to present plans, the Federal Military Government will guarantee free primary education for all Nigerian children, will partially subsidize secondary education, and will build additional schools and teacher training facilities. The Universal Free Primary Education scheme was due to begin in September 1976, and the total government allocation for education in the plan's five-year period reportedly will be (Naira) 2.5 billion, approximately (\$U.S.) 3.75 billion.

Training intermediate level manpower is essential for the economic growth of the country. On the other hand, the data indicate if the program is carried out in its presently conceived form, the results may be disastrous from a population viewpoint. A program of intensified Western-style education will greatly increase the number of intermediate-level graduates associated in the data with higher fertility rates. Other research indicates it will also increase rural-urban migration.

At this stage in world history, Nigeria, along with many other developing countries, must seek new approaches to economic growth and population policy. Nigeria is moving from a traditional society toward some new form of social synthesis of the traditional and modern norms—what might be called a modern African synthesis. A possible interpretation of our data would be that economic security and meaningful social status, rather than upper class social status, lead to lower fertility rates. In other words, a feeling of access to membership in what we have called the new African synthesis is the important factor. The higher fertility rates shown in our data, on the other hand,

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would then be associated not with intermediate-level jobs, but rather with job insecurity.

This would be the implication of our data if compared to the experiences of China, Japan, and Taiwan, countries which have been through a transitional process and have achieved new forms of synthesis of the traditional and modern norms—and yet, at the same time, have also achieved marked declines in fertility rates. If the new cadre of intermediate-level manpower in Nigeria can be given access to secure and attractive career horizons in urban or rural sectors, which enjoy appropriately high prestige in the country, our data suggest that these persons may be among those with lower fertility.

We will examine these ideas more fully with respect to the data on urbanization, occupation, education, and social class.

*Urbanization.* The majority (an estimated 80 percent) of Nigerians live in the rural areas, but there is a trend for a population movement toward the urban areas. When the country was divided into four regions, there were only about six major cities to which this movement was pronounced. With the creation, first, of twelve states and now of nineteen states, each with a growing capital city, the movement of population from rural to urban areas has increased. The present study, as well as other studies in Nigeria, suggests that urbanization and the associated modernization will lead to higher fertility rates.

Our study indicates that the population of Lagos is increasing at about 12 to 14 percent per year, 4 percent of this increase due to natural increase (that is, births over deaths), and 8 to 10 percent due to migration. This 4 percent rate of natural increase is extremely high by world standards, and other studies in Nigeria point toward a general pattern of fertility rise as families move from villages to towns to larger cities. Therefore, any educational or other developmental policy which contributes to the rapid urbanization rate in the country would seem risky.

The main traditional occupation of the Nigerian people is farming. True, the new development plan emphasizes the support of agriculture, but this was the case in the previous Four-Year Plan. Yet no significant effect on migration away from the land was reported as a result of these policies.

To be effective, the new plan's section on agriculture must stress human as well as material benefits. The plan now emphasizes such material items as fertilizers, pesticides, tractors, and agricultural loans. To be successful, the plan must include institutional measures for improving the prestige of rural life, and the educational, medical, and other social benefits available in rural areas. The experience of China in restructuring rural life, in enhancing the prestige of farming, and in providing educational and medical benefits in rural places, and the accompanying decline in fertility reported in China, is cited in this regard. A similar decline in fertility accompanied land reform and the

### *Yoruban Modernization and Fertility in Lagos*

restructuring of rural life in Taiwan.

If our interpretation of the Lagos data is correct, meaningful social status rather than upper-class social status is most closely related to reduced fertility. With respect to Nigerian agriculture, we will examine this hypothesis further.

*Occupation.* In addition to increasing the number of schools in the country, the government must tailor the new education to fit new job opportunities. Creating new graduates without creating new jobs will have disastrous consequences. Along with the unemployment and social discontent such a situation produces, our data indicate the unemployed in Lagos have the highest fertility rate of any group in the sample.

As to industrial development, Nigeria's new plan once again appears to stress material rather than human goals. Production of motor cars, steel, and petrochemicals, as well as expanded consumer goods industries, undoubtedly will create new jobs. However, the type of job situations thus created is of the utmost importance. The data indicate if these jobs are marginal, if workers can be easily laid off, and if many unemployed laborers are waiting to take their places, then fertility will be high. Government may be guided by the experience of Japan following World War II. After the war, the labor and labor reforms put into effect in Japan led to the wider distribution of wealth and power, the existence of labor unions, and, interestingly, a marked and rapid decline in fertility.

*Education and social status.* The way education is now structured in Nigeria, level of education determines one's movement from traditional to modern norms, and influences one's status in contemporary Nigerian society, a status which may be neither traditional nor modern, but rather transitional and insecure.

The new plan calls for a scheme of Universal Free Primary Education, and expansion of secondary and teacher training education. Universal free education seems to be a worthwhile goal. The Nigerian public must realize, however, that if this education continues in the present mode, the result will be increased numbers of graduates trained for jobs that do not exist, or trained for jobs in cities at the expense of the agricultural sector. In this report, we argue instead for a revised educational system to prepare graduates for intermediate-level careers in agriculture and industry, and also for intermediate-level careers in the traditional and modern arts and crafts. We will speculate as to how the government might bring about such a situation in Nigeria.

If our interpretation of the data from the present study is correct, an educational system leading to secure and meaningful jobs will reduce fertility in these intermediate status groups, an effect which only the small and economically secure upper-class has experienced at present. Again, we must

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point out that the present study focuses on one area of Nigeria and one tribe. More studies are needed of other ethnic groups, particularly the major ones—the Ibos and Hausas—to verify the data of this study and their applicability to the country as a whole.

#### THE MODERN AFRICAN SYNTHESIS

The processes of modernization, variously defined, have occupied the attention of social scientists throughout Africa during much of the present century. The geographer Akin Mabogunje (1968) uses the term "modern" to apply broadly to such diverse and complex processes as urban and industrial growth, functional specialization in the cities and towns, the secularization of traditional values, the development of Western-type educational and modern medical systems, transport and mass media communications links, electrification and other forms of modern technology, "the glamour of modern urban utilities and new employment opportunities," and so on. Olusanya (1971) and the other demographers with whom we are most directly concerned restrict the term "modern" to more readily measured indexes such as years of Western-type education, access to modern medical facilities, urban residence and employment, and "changes in traditional attitudes . . . all these changes are lumped together . . . under the general term 'modernization'."

But modernization is not an entirely accurate description and is used here for want of a better word. Mabogunje (1968) speaks of "traditional" as well as modern elements in interpreting the processes of change. The sociologist Olu Okediji (1968b), in his sociodemographic study of Ibadan, uses the terms traditional as well as modern in defining his sample areas. Both Okediji (1968b) and Olusanya (1967) introduce the term "de-traditionalization" in addition to modernization.

One of the propositions central to the theory presented here is that Nigeria, as well as many other changing or transitional societies, is not becoming modern in the sense implied in many writings on the subject, but rather is moving toward an elaborate synthesis, a fusion of traditional and modern. That such a fusion can occur is apparent when one looks at Japan or China, two countries which have passed through the transitional process, have undergone extensive social and economic change, and yet have not become replicas of the United States, England, France, or the Soviet Union. Rather, each has achieved a synthesis of traditional and modern cultures, which might be called the modern Japanese synthesis or the modern Chinese synthesis. Similarly, West African countries such as Nigeria, Ghana, or the Ivory Coast are not becoming replicas of industrial countries in the East or the West, but are achieving a "modern African synthesis," a unique functional amalgam of norms, values, and technologies selectively chosen from the traditional and

## *Yoruban Modernization and Fertility in Lagos*

modern worlds. In this paper, the term modernization will be used in this sense.

Our concern is also with human fertility, as measured in the various demographic field surveys reported on here. During 1966-1967, Olusanya (1967) conducted retrospective fertility studies in one city, Ibadan; two towns, Ife and Oyo; and five villages in what was then Western Nigeria and is now part of two of the newly created states in Nigeria. Olusanya concluded that fertility levels seemed to be higher for more educated women and younger cohorts: "The pattern is so consistent as to leave us with little doubt that the educated among our survey population tend to be more prolific than their uneducated counterparts." And in his final report on this research, Olusanya (1971) writes, "The conclusion is almost inescapable that something has been happening to the level of fertility in this society," though he quickly adds, "The apparent rise in fertility may well be a temporary phenomenon."

Whether temporary or not, the trend identified by Olusanya is supported in almost every other study of actual fertility carried out in Nigeria, whether via retrospective or prospective surveys. A large number of studies focusing on attitudes toward childspacing and acceptance of family planning do show the expected relation (expected in terms of standard demographic transition theory)\* between increased approval and use of family planning, and such factors as increased levels of Western-type education. Studies focusing on fertility itself generally show an opposite relationship.

Olusanya offers two possible interpretations for this apparent rise in Nigerian fertility: Improved levels of health in the country which enable women to bear more children, and a decline in the traditional belief that a woman should not become pregnant while still breastfeeding a previous child. According to this belief, prevalent in many parts of Africa, a new pregnancy renders the breast milk injurious or even fatal to the nursing infant. This has resulted in a waiting period of several years between pregnancies, or until the existing child is weaned. Olusanya's interpretation, now widely accepted in the population literature on Africa, is that with increasing education and awareness of modern medical beliefs, mothers resort more often to powdered milks and bottlefeeding, avoiding the lactation taboo, and are able to enter into more frequent pregnancies. Data will be offered later in this paper to show that neither of these assumptions are well supported. Fertility data on healthier mothers and mothers employing powdered milks and bottlefeeding suggest they sometimes have higher fertility but more often have lower fertility than the norm.

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\*See Coale and Hoover (1958) for a concise statement of demographic transition theory.

## DEMOGRAPHIC TRANSITION

In this paper, we examine some Nigerian fertility data, to identify a syndrome of particular social, economic, and medical conditions which appear to relate directly to higher or lower birth rates in individual families. Based on these data, we propose a new theory of population change. The data were obtained by demographers working independently in different parts of Nigeria during 1964-1970, including a number of sociodemographic and medical surveys by the authors in the capital city, Lagos, during 1966-1970. The theory presents a comprehensive explanatory framework for interpreting the complex fertility patterns observed in Nigeria. Subsequent papers will examine how well or how poorly the theory fits in other countries. Preliminary examination of data from several other countries which have undergone rapid social and economic change suggest that the model developed in Nigeria may have similar application in transitional societies throughout the world.

The political boundaries of Nigeria encompass many changing societies which appear to be sharing most elements of change not only with each other but also with other societies in adjacent countries of West Africa. Coleman (1963) has said that 248 distinct language groups have been identified within the boundaries of Nigeria, and many of these language groups—for example, the Hausas, the Fulanis, and the Yorubas—extend into neighboring West African countries. Nigeria is Africa's most populous country and the eighth largest country in the world. Censuses in Nigeria have always been a problem from the earliest days (Kuscynski 1948), and Nigerian demographers usually consider the 1952-1953 census to have been the most accurate (Mabogunje 1968, Okonjo 1968, Olusanya 1966). Using that census as a base, assuming a 2.5 percent annual rate of natural growth, and allowing for a certain degree of international migration into Nigeria (although such migration has been increasingly restricted), the present population is about 70 million persons.

While some of the data used in this paper come from nationally drawn random samples, most pertain to the large Yoruba tribe, which predominates in the southwestern quarter of Nigeria, in Lagos, in parts of adjacent Benin (formerly Dahomey), and in Togo. The area within Nigeria occupied by the Yorubas now comprises four states and part of a fifth under the plan announced in early 1976 for the creation of additional states. Comparative data on the populations of various tribal groups in Africa are difficult to obtain, but it is likely that the three largest tribes in tropical Africa are centered in Nigeria: The Hausas, the Yorubas, and the Ibos, and that the Yorubas are now the second largest tribal grouping in tropical Africa with a population today estimated at about 15 million persons (based on a projection from the 1963 census).

In knowing precisely what to measure, the problem is whether one should look at the number of pregnancies a woman may have had, the number of live births she has had, or the number of children who survive. In the retrospec-

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tive studies considered here, investigators have tended to emphasize the number of children ever born to a woman, and in prospective studies, the total fertility rates. Both measures omit the factor of infant deaths, but this important and much debated factor will be examined where the data permit.

Kocher (1973) and Rich (1973) identify the lack of primary data as one serious obstacle in population research today. Kocher states: "At the present time it is not possible to provide adequate statistical tests of the relationships hypothesized here between rural development and fertility decline. . . . Even for high-income countries detailed data . . . are not available." (p. 62) Rich likewise states, "A major and continuing problem faced by researchers working on the correlation of various indicators of development and fertility is the lack of data that adequately reflect the actual social and economic conditions of the societies concerned." (p. 18)

Development itself remains a vague and elusive term. Much disagreement exists among economists and government planners as to just how this term should be used. (The phrases "less developed countries" and "more developed countries" are, in fact, omitted entirely from this present paper. Rather, West Africa is described as an area of changing societies or transitional societies, and the direction of change is cited throughout as being toward a new fusion of traditional and modern—what we have called "the modern African synthesis.")

Recent papers in the population science literature identify a possible connection or syndrome, linking the degree of social and economic inequality in a society with higher or lower birth rates. Repetto (1974) has shown a relation between more equitable distribution of incomes and lower fertility, based on secondary analysis of data from sixty-eight countries. Using economic interpretations, Repetto identifies causal connections going in both directions, that is, equality is conducive to lower fertility, and reduced fertility is conducive to equality. Kocher (1973), in an international review of rural economic development, examines the thesis that "equality in the distribution of the development process . . . will lead to a more rapid modernization process . . . which in turn will lead to a more widespread desire for smaller families. . . . The mechanisms implied within this framework that cause families to desire and achieve fewer births have been put forth in basically economic terms." Rich (1973), in an international review of developmental data, broadens the economic argument slightly to assert his central thesis "that policies combining economic growth, more equitable distribution of the economic and social benefits of progress, and easy access to family planning services can bring about a much greater reduction in fertility than can any one of these factors alone."

In this paper, we will try to identify a somewhat different syndrome and a more specific prescription, relating lower and higher fertility, security and

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insecurity in individual families, and achievement of "the modern African synthesis."

### THE RISING BIRTH RATE IN NIGERIA

The "hump-backed" fertility pattern, that is, a consistent rise in fertility along with the forces of modernization up to a rather advanced level, after which there is a decline in fertility, is found in many of the data runs and is not readily explained. Although it is tempting to say that the demographic transition holds true after a certain threshold has been reached, less easy to explain is why the rise should occur, why there should be a threshold, or why the threshold should be where it is.

Since most persons in Nigeria are in the rising fertility category at present, the net effect is rising fertility with increasing modernization, and the highest fertility rates found in the large towns and Lagos. Several prospective demographic studies have offered further evidence of this trend. During 1965-1966, the Federal Office of Statistics carried out a rural demographic survey in approximately 200 village sites randomly chosen throughout the country, with each site selected to yield between 1,500 and 3,000 residents. Enumerations were carried out in May and November of 1965 and during the summer of 1966. Political events interrupted this survey, so the second round was not fully completed and the third round delayed. However, the investigators appear to have made a careful statistical analysis of the data from each sample area, to have rejected a number of areas as inaccurately reported, and to have added a correction factor upwards for presumed missed infant deaths (Nigeria, Federal Office of Statistics 1968).

One year later, Morgan conducted a similar study in metropolitan Lagos, involving three enumeration rounds in May and November of 1967 and in May of 1968, in 30 sample blocks randomly chosen in the full metropolitan area to reflect population densities as revealed in the 1963 census and to contain resident populations of 400-500 persons each. A correction factor for presumed missed infant deaths also was introduced. These studies provide a comparison of total fertility rates in three major areas of Nigeria which are distinctly different in levels of modernization, that is, rural northern Nigeria, rural southern Nigeria, and metropolitan Lagos.

Some historical explanation is necessary to elaborate these differences. Firstly, both Western education and Western medicine, two primary ingredients of modernization in Nigeria according to the definitions used in this paper, were introduced into the country by the Christian missions and by voyagers during the latter nineteenth and early twentieth centuries. Schools and hospitals were established in the southern areas of the country, but because of the connection with Christianity, these movements were rejected

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for a long time in the largely Moslem north. Since national independence in 1960, all Nigerian governments have sought equalization of educational and medical opportunities in both the north and the south. The present Federal Military Government has as one of its objectives the introduction of free primary education throughout the country. However, for most adults in Nigeria today, the attainment of Western-style education has varied greatly between the north and the south. Perhaps the best appraisal of these differences was given in the report *Investment in Education* (known as the Ashby Report)\* of 1960, which estimated that although the majority of children were completing primary education in southern Nigeria at that time, in the north "only about one in eleven children of school age was at school and in some areas the proportion was as low as one in fifty." For the Lagos metropolitan area, official data are not available, but it appears that about 85 percent of eligible children were attending school at the time of these surveys.

In his three principal publications based on his 1966-1967 fertility surveys in Western Nigeria, Olusanya (1967, 1969b, 1971) produces more than sixty tables and a number of graphs, all showing essentially the same thing: Along with increasing education and urbanization comes increasing awareness, approval, and use of childspacing practices and family planning methods, which of course, is in accord with standard demographic transition theory, and also higher actual fertility. The same effect is seen whether one takes mean pregnancies per wife, mean births per fertile wife, mean births for all wives, and when one controls for age at first marriage and duration of marriage. Comparable data from two other surveys in the federal capital of Lagos also show an unbroken rise in fertility from the more rural to the more urban places and from the less literate to the more literate samples. In assessing the effects of education per se, and again adding in the Lagos data, there is a progressive rise in fertility with increasing levels of urbanization and education, up to the presumed highest level (Lagos women with some schooling), at which point there is a slight decline.

Ohadike (1968) who conducted a random sample survey in central Lagos (the former Federal Territory)\*\* in 1964, interviewed 596 married women. Ohadike employed an unstratified random sample of one in every thirty-two

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\*Historically, southern Nigeria has meant the former Western, Mid-Western and Eastern Regions and Lagos, subsequently the six southernmost states and now, with the recent creation of additional states, the nine southernmost states. The north has been taken to mean the former Northern Region, subsequently the six northern states, now the ten northernmost states. The populations of the two areas have been about equal in the various censuses, although the north occupies about three-quarters of the land area of the country.

\*\*The former Federal Territory comprises about 27 square miles and enjoys such modern amenities as paved streets, pipe-borne water, and some of the best educational and medical facilities in the country—amenities which in general are not available in the rest of the metropolitan area, a metropolitan fringe which now contains at least half of the city's total population.

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houses in central Lagos and was assisted by fifteen trained interviewers from the Federal Office of Statistics. He does not give data on refusals. He reports age-adjusted mean live births per wife of 4.0, with figures of 4.2 for wives with "no school," of 4.1 for wives with "primary," and of 3.8 for wives with "secondary and over." He does not give age-specific figures by educational level, but it is apparent that his figures do fit the overall pattern: The central or most sophisticated sections of Lagos have the highest mean fertility of all groups shown, with the slight drop at higher educational levels found in metropolitan Lagos generally, but not in the other urban or rural samples shown.

A further major survey carried out in Nigeria during this period was Okediji's (1968b, 1968c) sociodemographic study in Ibadan in 1965-1966, presenting fertility data which support the general theme of this paper. In three purposively selected sample blocks representing what he called the traditional area or Old Ibadan, the planned modern area or New Ibadan, and a largely immigrant residential area lying geographically between the other two, Okediji sought to interview all wives and obtain data on attitudes toward childspacing and family planning as well as retrospective material on actual fertility. Okediji presents probably the most complete summation of attitudes toward contraception, broken down by educational level and place of residence, of any of the investigators reported on here. He also concludes that approval and use of contraception rise while actual fertility falls with increasing levels of education and social status.

In spite of some criticism, Okediji's sampling method reported surviving children at the time of the interview rather than children ever born per wife as his measure of fertility. For mean births to women ages 35-plus, Okediji reports figures of 6.2 for his Old Ibadan area, of 6.1 to 6.2 for his immigrant area, and of 4.3 for his planned modern area. The latter sample, however, is an extremely high status area, comprising university professors and higher professionals. Okediji's data, therefore, do not seriously contradict the "hump-backed" fertility pattern involving a progressive increase in fertility up to a high level of modernization, after which there is a decline.

The striking thing is that the apparent rise in fertility with increasing modernization is clearly shown within the material by single investigators, as well as in the comparative material between investigators. On the basis of these studies, one can say there is an apparent rise in fertility in Nigeria at present, and that the rise would probably be reflected more strongly in actual birth rate figures if consensus could be found as to methodologies.

Morgan (1975b) has published a recent, more comprehensive summation of the attitude and fertility data from the Nigerian surveys of the 1960s, and the interested reader is referred to this source. In the meantime, based on the sum total of these studies, one can only support the summarizing statement in the

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Population Policy section of Nigeria's *Second National Development Plan*: "Generally speaking, it can be said that Nigeria is going through a demographic transition phase of a rising birth rate."

### THE LAGOS FAMILY HEALTH PROJECT

The most extensive source of data on modernization and fertility in any area of Nigeria is the Lagos Family Health Project, begun in 1966 as a research and activity project of the Department of Community Health of the University of Lagos College of Medicine. The project subsequently was taken over by the Institute of Child Health, an independent research organization of the University of Lagos, and continues today in Lagos and a number of other areas in Nigeria.\*

The Lagos data are perhaps unique because three different types of surveys were carried out within the same sample of persons: 1) A prospective socio-demographic study in 3,550 households during a 12-month period in 1967-1968, including approximately 2,500 women of childbearing age and 2,100 women who were married throughout the survey period, 2) a retrospective fertility and KAP (Knowledge, Attitude and Practices) study in subsamples of males and females drawn from the above larger sample, following completion of the prospective study in 1968, and 3) several studies of medical behavior in subsamples drawn from the larger sample during 1968-1969. It is, therefore, possible to compare a range of prospective and retrospective fertility measures against social, economic, and medical behavior and expressed attitudes to an extent not possible in many other population studies.

During 1969-1970, the same KAP instrument was used among samples of patients attending a pilot maternal and child health clinic (operated as part of the overall project), and a standard government pediatric clinic, so that social, medical, and attitude data are available from these groups as against the Lagos norms. The material comparing socioeconomic measures and fertility and the medical measures and fertility is reviewed later.

Initially, the Lagos research pursued standard population research lines. The theoretical base for this work stemmed from commonly held beliefs about the demographic transition and from the results of a number of demographic and population surveys already conducted in West Africa and other transitional areas of the world. Hypotheses were set up which held that contraceptive use increases and fertility decreases with rising urbanization, education, social status, and departure from traditional customs, and that these trends

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\*The 1966-1970 research reported here was supported by The Ford Foundation, the College of Medicine, and the International Planned Parenthood Federation.

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should be observable in a rapidly growing metropolitan area such as Lagos. The population of Lagos in the 1952-1953 census was given as approximately 330,000 persons, including peripheral areas not directly within the urban boundaries; the 1962-1963 population as approximately 990,000; and results of later research suggest a 1976 population of approximately 2½ million. At the outset no particular relationships were suggested among patterns of medical behavior such as attendance at clinics or patronage of native doctors. Relationships were expected between fertility and membership in certain religious and ethnic groups, based on commonly held notions in the city rather than on direct evidence. Hypotheses as originally stated were:

- a. Educated, urban, elite families are more likely to practice contraception than less educated lower status rural families.
- b. Apart from the traditional lactation taboo, contraception in its other forms is little practiced in West Africa and the concept barely known and understood.
- c. Certain ethnic and religious groups in Nigeria would be more likely than others to adopt family planning, for varying historical and sociocultural reasons.
- d. In general, the more educated, industrialized, and urbanized areas of southern Nigeria would be more apt to adopt family planning, as well as an interest in medical care generally, than would the largely rural north.

Implicit in these hypotheses are the assumptions 1) that the practice of contraception can always be equated with lower fertility (an assumption questioned in later research), and 2) that the Lagos survey would be extended to rural samples. (The results of the rural studies by other investigators reported in the previous section had not yet come in.) When the results of the Western Nigerian and national rural sample surveys were reported, revealing an apparent relation between increasing modernization and increasing fertility, Hypotheses a and d were challenged at once and early analysis of our Lagos data brought Hypotheses b and c into question as well. Our 1968 KAP survey showed, for example, that over 80 percent of married respondents knew about and understood the use of some form of modern contraception, although only about 10 percent reported having actually used such methods; Olusanya (1968b) reported that 47 percent of wives in his village samples were familiar with and understood contraception. In metropolitan Lagos, there were only minor actual differences in fertility between ethnic or religious groups. Ohadike (1968) in his 1964 survey in central Lagos, though reporting higher measured fertility among Moslems, also stated that fertility differences according to religion were not statistically significant. It may be, of course, that significant differences in fertility exist in the home areas of the various

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ethnic groups in Nigeria, but the data show that once in Lagos, such differences do not appear.

As a result of this preliminary analysis, our first set of hypotheses would have to be recast; unfortunately this reconceptualization took place after most of the actual field data gathering had been completed. As a result, this paper largely represents secondary analysis of our own primary data. As the computer runs proceeded, it was obvious that even the new sets of hypotheses did not go far enough in testing the large supply of data collected in Lagos. What was finally done was to use the format adopted by Merton and Rossi (1949) in their landmark paper on reference groups, that is, to identify a set of concepts and to pursue these concepts through the data as far as the data would carry them.

Merton and Rossi depart from the more usual format of first stating a hypothesis and then proceeding to a statistical test of the hypothesis. They proceed "on the assumption that there is a two-way traffic between social theory and empirical research," that one of their aims is "the extensive re-examination of cases of research reported (in 'The American Soldier' study which is the object of their secondary analysis), . . . with an eye to subsuming the findings under higher-level abstractions or generalizations," and that "in the degree that such connections are established, 'The American Soldier' will have served a further function of empirical research: the provisional consolidation of presently scattered fragments of theory."

A similar effort is made here: The concept of modernization variously defined is pursued through the Lagos data to see what connections can be established in relation to higher or lower fertility. In the next section, such social and economic aspects of modernization as levels of Western-type education, employment in the cash economy, and possession of various items of modern technology in homes reflecting modernization and social status are explored. Then, attendance at modern medical facilities, and other indexes such as use of modern versus traditional medicines, and continued adherence to witchcraft beliefs, are examined in relation to fertility. Finally, consistent connections found in these various fertility studies are discussed.

The Lagos data were collected in a sample of thirty blocks randomly chosen in the metropolitan area on the basis of population densities reflected in the 1963 census, each block defined according to more or less permanent geographical features such as streets, walls, streams, et cetera, and having a residential population of 400-500 persons each. Thirty interviewers, young men and women who in most cases had an incomplete secondary education and at least several years of work experience in jobs involving contact with the public, (that is, salespersons, grade three teachers) were recruited and trained as full-time employees of the College of Medicine. Between survey rounds, interviewers served in various jobs such as data coding and process-

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ing and clinic reception. Each interviewer was responsible for one of the sample blocks and treated this block in much the same way that the classical social anthropologist treats his or her village. The bulk of the prospective fertility data were collected in three survey rounds in May and November 1967 and May 1968, in which all residents were enumerated and data on births, deaths and migrations taken, as well as other standard socioeconomic and environmental material. A total of 13,141; 12,886; and 13,026 persons were enumerated at each survey round, including approximately 2,500 women of childbearing age and 2,100 married women who were recorded during at least two successive rounds of the survey. Following completion of the third survey round, a subsample of 1,565 females ages 15-49 and males ages 20-plus, both married and unmarried, were administered a standard KAP interview.\*

The block sampling method, while having some disadvantages, helped us in dealing with problems typically found in cities in the transitional world in which residential addresses are vague, persons may shift from house to house, others may sleep in the street or in abandoned vehicles, persons may be suspicious of strangers and reluctant to reveal identities, and so on. Our impression during this long survey period was that the interviewers did establish good rapport with respondents and that the refusal rate was nil, although some respondents were absent at various survey rounds. The interviewers becoming full-time employees of the College of Medicine also helped to establish high morale and probably contributed to more accurate data collection. For a fuller account of the sociodemographic survey methodology, see Morgan and Kannisto (1973).

In addition to the sociodemographic material, a number of medical surveys were carried out, during and between the three survey rounds in 1967-1968 and in subsamples of the same populations in 1968-1969. These included surveys of attitudes toward various illnesses, nutritional surveys among children, and use of drugs and medications. One of the more important surveys, carried out concurrently by a doctor from the College of Medicine, involved urine tests for potential diabetes cases among all respondents, with women of childbearing age receiving pregnancy tests at the same time. We were thus able to develop a correction factor for pregnancies reported by interviewers, this factor being used in the determination of possible misre-

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\*Data on migrants into and out of the sample areas were obtained, including data on births and deaths which might have occurred just before or just after the move. In the end, it was decided that these data were not sufficiently reliable, and fertility material was scored only for persons resident at two successive survey rounds. It is recognized that the recent migrants who thus were omitted from this portion of the data analysis may have had special demographic characteristics which were missed. In computing fertilities, statistical weightings were introduced to take account of a woman's presence at all three rounds, or at only two successive rounds.

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ported infant deaths (see Morgan and Kannisto 1973 for a fuller account).

Additional data were obtained during 1969-1970 when Dr. John Wellman of the Department of International Health, Johns Hopkins School of Hygiene and Public Health, Baltimore, administered the KAP instrument to a sample of 300 mothers attending the pilot Maternal and Child Health clinic in Surulere and to another sample of 300 mothers attending a government pediatric clinic in Surulere, a high population density suburb near Lagos University Teaching Hospital. Dr. Wellman made this material available to the Institute of Child Health and it was thus possible to match material on these patients against the Lagos norms.

The result is that a variety of social, economic, and medical data can be matched against both prospective and retrospective fertility for a reasonably large sample of the Lagos population. Assuming that the relation between modernization factors and fertility has important implications for population research, pressing the data beyond the original hypotheses to see what further connections emerge between modernization and fertility seems justified.

#### SOCIOECONOMIC FACTORS, AMBIVALENCE, AND FERTILITY

Most KAP studies in tropical Africa reveal a high degree of ambivalence on the part of male and female respondents as to the value of large families. Tradition demands large families to strengthen the family name, build family pride and prestige, provide help for the elders, and so on; but the same respondents who express these considerations also are concerned about the high cost of raising and educating a child in contemporary Africa. The available data show that all or most of these sets of ambivalent respondents are presently resolving this dilemma in favor of continued high fertility. Morgan's own studies in Lagos indicate fertility at levels still higher than formerly prescribed by traditional society.

In the 1968 retrospective KAP study conducted by Morgan in Lagos, in a random sample of 729 females ages 15-49 and 836 males ages 20-plus (married and unmarried, and drawn from different households), considerably less than half the respondents (41.0 percent of males and 37.7 percent of females) gave the answers we expected relative to the maintenance of family pride and prestige, in response to the open-ended question, What are the good things about having a lot of children? A total of 41.2 percent of respondents answered, There is nothing good about having a lot of children. To the parallel open-ended question asked next, What are the bad things about having a lot of children? 73.8 percent of males and 70.5 percent of females gave an answer reflecting the high cost of raising children in present-day Nigeria; typical answers were that it is "too costly to support them" or "too costly to educate them."

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While primary school tuition at the time was free or virtually free in many parts of Nigeria, children still had to buy books and stationery, pay various fees such as locker fees, and in most schools had to buy uniforms (a residue of the British colonial heritage). Of course, secondary schools had high fees. Nor are Lagos parents satisfied with a simple primary education for their children. To the question, How much education do you plan to provide for your children? the median response was "university" for sons and "school certificate" (that is, completed secondary school) for daughters. In answer to the question, How do you plan to achieve this educational goal for your children? 67.4 percent replied "savings or investments"; 9.0 percent said the child would win a scholarship; and 29.5 percent said, "God or chance will provide"; with other replies making up the remainder.

In the similar survey carried out by Olusanya (1967) in five villages near Ibadan, 38.6 percent of respondents answered "No" to the question, "Do you think it is a good thing to have a lot of children?" Of these, 94.6 percent gave as reasons "Children cost a lot to bring up nowadays," or "Having a small family enables each child to receive a sound education." Of the 61.4 percent who replied "Yes" to the question of having a large family, 36.8 percent gave reasons related to family pride or prestige and 41.4 percent gave reasons related to the fear of child mortality. While Morgan asked his "good thing" and "bad thing" question of all respondents, Olusanya first divided his sample into those for and those against large families, and asked the "good thing" question only of the first group and the "bad thing" question only of the latter, so that the response patterns in the two surveys are not directly comparable. However, the implication of ambivalence based on family pride on the one hand versus the requirements of raising and educating children in modern Nigeria on the other, is evident in both sets of data. The same ambivalence is also apparent in most other such surveys done in tropical Africa. (For a summarizing account see Caldwell 1968.)

To analyze more precisely the ambivalence factor revealed in so many KAP surveys, an ambivalence apparently related directly to these socioeconomic variables, the prospective data are evaluated in this section of the report. Two sets of measures of comparative fertility based on the prospective data are used:

- 1) Cumulative or total fertility rate curves. This seems to present one of the best methods for making comparative assessments of the fertility data. To build up the numbers in some cells and also to offset the "heaping" of reported ages around certain numbers such as 20 and 25, we collapsed the age categories to six, that is, 15-17, 18-22, 23-27, 28-32, 33-37, and 38-49. In compiling total fertility rates, the age-specific birth rates in the first category are thus multiplied by three instead of five, which reduces the impact of possible errors in that cell and the chance that the entire curve might be

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thrown off by first-cell errors. Errors in subsequent cells can be surmised from aberrant slopes of the curve at those points, and in general these have not appeared. According to the new age-group categories, rates in the last cell (38-49 years) are multiplied by a factor of 12, which introduces the possibility of greatly magnified errors here. Such errors, if they occur, might show themselves through skewing the slope of the curve at that point, and apart from one or two instances, this has not occurred.

2). Method of indirect standardization. In this method, which compensates for small N's in some cells in analyzing large blocks of fertility data, fertility rates for the Lagos prospective sample of about 2,500 women were computed, standardized for age and marital status in the survey year, and comparative observed rates were then obtained for each analytical category. It is possible to compare the observed against the expected rates for each category, to make significance tests of these variations, and to compare these variations with those shown in the cumulative fertility curves. In assessing the ambivalence factor and various socioeconomic characteristics relative to fertility, we thus have three assessments of fertility levels to compare, that is, cumulative fertility curves, the indirect standardization models, and where the Ns are sufficiently large, the retrospective data.

#### **Education and Fertility**

Level of Western-type education is probably the most easily measured index of modernization, among the various indexes considered in this paper; for the Lagos prospective sample, a most interesting set of data is the measure of fertility of wives by education of their husbands.

Cross-tabulation of this measure, and total fertility rates, are shown in Table 1.

Fertility tends to rise with increasing education up to a peak at the level of some secondary school for the husband (total fertility rates) or at completed secondary school for the husband (indirect standardization model), after which there is a decline. The completed secondary peak is significant at the .01 level. For wives, the same pattern is discerned but the peak comes earlier, at the primary school level, after which there is a decline. Unfortunately, data were obtained in the survey on attendance at primary school only, rather than on years of attendance.

For the retrospective data, a somewhat different pattern is expected if Olusanya (1967) is correct in his interpretation that fertility levels in Nigeria are rising for younger cohorts. In fact, comparison of fertility of wife by education of husband shows the same "hump-backed" pattern, with the peak at the level of primary school and the differences being significant at the .001 level. Again, peak fertility is expected to be associated with lower levels of

**Table 1**  
**Fertility of Wife, by Education of Husband,**  
**Lagos Prospective Sample**

Age Group	No school		Primary only		Some secondary		Completed secondary		Post secondary	
	No.	Age-specific birth rate	No.	Age-specific birth rate	No.	Age-specific birth rate	No.	Age-specific birth rate	No.	Age-specific birth rate
15-17 (x2) <sup>a</sup>	10	0.119	11	0.585	6	0.667	0	0.000	0	0.000
18-22 (x4) <sup>a</sup>	85	0.359	136	0.436	64	0.330	20	0.554	7	0.896
23-27 (x5)	135	0.224	157	0.315	63	0.431	34	0.514	10	0.111
28-32 (x5)	154	0.229	142	0.230	30	0.153	33	0.410	12	0.200
33-37 (x5)	71	0.275	76	0.120	20	0.316	8	0.000	16	0.146
38-49 (x12)	92	0.059	79	0.097	23	0.091	9	0.111	9	0.000
Total fertility rates	(N=547)	6.372	(N=601)	7.403	(N=206)	8.246	(N=104)	8.168	(N=54)	5.869

<sup>a</sup>Use of multipliers 2 and 4 (rather than 3 and 5) are introduced in some tables in which fertility of wife by characteristic of husband is measured, since not all women would necessarily have been married for the full age-range. Multipliers are based on proportions of women first married at each age level in the full sample, most women (95%) being married by age 23. If multipliers 3 and 5 are used, the "Completed Secondary" group has highest fertility.

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female education and this is the case. The data for the first time show the more traditionally expected relationship between education and higher fertility.

All these data must be interpreted with the utmost care. It is, of course, impossible to say whether Western-type education, or some other related modernization factor, or yet another more distantly related factor is involved in this apparent connection between school attendance and fertility. What can be said is that the connection shows a high degree of consistency in all these data runs.

#### **Occupation and Fertility**

What we have tried to do with the data on occupations is to score fertility in relation to the degree of contact with the forces of modernization which each occupation suggests. Traditional occupations include chiefs and herbalists, craftspeople such as goldsmiths, weavers, and basket-makers, farmers, fishermen, beggars, and palm-wine tappers. For women, traditional occupations also include the large number of so-called petty traders, women who deal in small objects such as candy or cigarettes from small stands outside their homes or along sidewalks. Both male and female traders with any kind of fixed overhead (that is, rented stalls or shops, use of a vehicle or other form of capital investment, or employment of others) were scored separately. One could argue that any trader, petty or otherwise, is involved today in the cash economy and should have been scored as such, and this argument may be correct. However, the designation petty trader has traditional status, and it is therefore designated as a traditional occupation in this analysis.

For men, the managerial category mainly includes non-salaried private businessmen such as contractors and transport operators. Only one woman was classified as managerial and has been omitted from the scoring. One might have wished to see more information about particular occupational groups such as Professionals but this number was small, and professionals have been grouped with salaried workers. In the retrospective surveys, many numbers in the occupational categories were too small to be scored.

In the material on fertility of wives by occupation of husbands (Table 2), again a kind of hump-backed fertility pattern emerges, with traditional occupations lowest and a step-by-step rise in fertility with increasing exposure to the forces of modernization up to the Managerial level, at which point there is a fertility decline. Since persons scored as Managers had generally lower levels of education, it is particularly interesting that the same kind of pattern appears with occupation as with education, implying that initial exposure to modernization forces is associated with higher fertility and that this effect is more closely tied to the factor of modernization than with the factor of education itself.

**Table 2**  
**Fertility of Wife, by Occupation of Husband,**  
**Lagos Prospective Sample**

Age Group	Traditional		Unskilled (modern sector)		Skilled and semi-skilled (modern sector)		Salaried and professional (modern sector)		Managerial (modern sector)	
	No.	Age-specific birth rates	No.	Age-specific birth rates	No.	Age-specific birth rates	No.	Age-specific birth rates	No.	Age-specific birth rates
15-17 (x2)	1	0.000	13	0.484	9	0.438	4	0.292	1	0.000
18-22 (x4)	27	0.497	99	0.402	98	0.411	73	0.503	7	0.453
23-27 (x5)	43	0.263	126	0.251	115	0.299	97	0.425	13	0.273
28-32 (x5)	54	0.175	109	0.268	94	0.348	87	0.246	13	0.273
33-37 (x5)	19	0.115	55	0.257	48	0.244	48	0.136	16	0.216
38-49 (x12)	29	0.041	62	0.051	43	0.129	42	0.073	12	0.087
Total fertility rates	(N= 173)	5.245	(N= 464)	7.068	(N= 407)	8.523	(N= 351)	7.507	(N= 62)	6.666

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Also interesting is the high fertility of the unemployed. This seemingly inconsistent finding is, in fact, entirely consistent in the theoretical model to be presented later, relating fertility, insecurity, and the modern African synthesis.

For wives, the pattern follows the step-by-step rise with exposure to modernization forces up to the Salaried and Professional group which has the highest fertility. For all women married and unmarried, the results are heavily affected by marital status, those categories containing a large proportion of women unmarried at the time of the prospective survey with apprentice, student, unskilled, unemployed in particular, having lower fertilities.

None of the occupational scores are statistically significant, except for traders with fixed overhead, which do have some significance for wives and all other women. That this group should have especially high fertility also fits in with the theoretical model to be presented.

The cumulative fertility rate curves by occupation of women are not given, because of problems with small numbers in the 15-17 age group in so many cells. No matter how this problem is handled, whether by ignoring this age group entirely, including only those categories with 10 or more respondents, or including all cells small or not, the same pattern is found: that is, housewife or traditional groups lowest, various modern groups much higher.

That the housewife category has low fertility may seem unlikely to any reader, just as does the high fertility of wives of the unemployed. Low fertility among housewives contradicts the accepted theory that women in modern occupations should have lower fertility because of the problems of caring for small children while the mother is away at work. All of these apparent irrationalities and contradictions are dealt with in the theoretical model to be presented later on.

#### **Fertility and Social Status**

Estimating social status apart from educational level or occupational type is difficult in any society. Sometimes levels of family income, or style of life, are assessed, but, in Africa today it is difficult to place a quantitative value on family income. With respect to cash income, most families have at least one member engaged in either petty or large-scale trading, with the result that small or large sums are continually changing hands and nobody knows what the actual cash income may be. There are also various forms of traditional wealth and status, such as chieftaincy titles, or possession of particular objects such as cattle or fine houses.

In these circumstances, it was decided to set up a scale of household possessions thought to be an index of social status. These were as follows:

- a) None of the listed possessions; b) some form of permanent flooring in the

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home, as opposed to a simple dirt floor; c) radio or rediffusion (individually owned by the household, as opposed to a set shared with several households or in the hallway of a building with rental units); d) electric fan; e) glassed windows, as opposed to wooden shutters; f) refrigerator; g) television; h) telephone; and i) air-conditioner.

Some other possessions, such as an automobile, were not listed because of a need to restrict the data to objects that could be seen in the home.

Most of these objects are associated with modern technology, so that the list is a scale of modernization rather than social status, or at least a scale involving some combination of cash wealth and modernization. The results are shown in Table 3. Once again the same hump-backed fertility pattern appears, with a step-by-step rise from zero up to three possessions, after which there is a step-by-step fall. Results again are not statistically significant, but the pattern is consistent with other data presented.

#### Fertility and Age at First Marriage

Obviously, if the majority of the more educated respondents in the Lagos and other Nigerian samples have increasing fertility, the relation between fertility and age at first marriage is complex, and later marriage may be related to higher fertility. Inspection of our data runs suggests this is the case and that young people who are marrying later have shorter pregnancy intervals during their early years of marriage and higher completed fertility. The catch-up effect appears in many of our data runs, and is most pronounced in the middle years of childbearing, or presumably in the years shortly after the delayed marriage has taken place.\*

#### Summation of Socioeconomic Data

The data on education, occupation, and social status present similar effects, implying rising fertility with increasing exposure to the forces of modernization, up to an advanced level after which there is an apparent decline.

#### MODERN MEDICINE, TRADITIONAL MEDICINE, AND FERTILITY

In 1966, a massive international effort was mounted in West Africa to eradicate smallpox. The goal was to immunize every person in twenty West African countries. One of the initial organizational meetings was held in Lagos. In welcoming the staff of international technical assistance experts who were taking part in the program, the chief preventive medical officer of

\*In another recent publication, Morgan (1975b) developed a paradigm to show how completed fertility could be higher in spite of later age of marriage, because of the shortened pregnancy interval which has been recorded in several Nigerian surveys, particularly in urban areas.

**Table 3**  
**Fertility by Household Possessions Scale,**  
**Lagos Prospective Sample**

Age Group	Zero-one possessions		Two possessions		Three possessions		Four possessions		Five-plus possessions	
	No.	Age-specific birth rate	No.	Age-specific birth rate	No.	Age-specific birth rate	No.	Age-specific birth rate	No.	Age-specific birth rate
15-17 (x3)	133	0.096	56	0.043	28	0.420	17	0.000	28	0.000
18-22 (x5)	309	0.306	116	0.297	77	0.330	36	0.314	27	0.170
23-27 (x5)	298	0.271	89	0.273	74	0.306	21	0.336	24	0.353
28-32 (x5)	317	0.244	108	0.239	33	0.278	18	0.195	19	0.168
33-37 (x5)	164	0.124	50	0.236	27	0.217	13	0.080	29	0.182
38-49 (12)	248	0.058	63	0.101	37	0.060	10	0.200	22	0.000
Total fertility rates	(N= 1,469)	5.709	(N= 482)	5.859	(N= 276)	7.635	(N= 115)	7.025	(N= 149)	4.365

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the Federal Ministry of Health, the late Dr. G. A. Ademola, expressed the hope that smallpox would be eradicated from this vast area of Africa (a hope that has, with minor exceptions, been realized), but he also issued a note of warning. The majority of West Africans, Dr. Ademola said, attribute disease to supernatural rather than to physiological causes, and hence might not consider it important to be immunized. "Even in Lagos," Dr. Ademola said, "you will still find persons who believe in witchcraft."

Dr. Ademola's statement about witchcraft was more accurate than expected. After the meeting, he asked the staff of the Lagos Family Health Project to survey the population of Lagos to determine how many persons believed in immunization and how many persons would take part in the immunization program. An elaborate interview schedule was set up, and two separate subsamples of husbands from one set of households and of wives from another set of households were drawn from among respondents in the larger prospective fertility survey. The interviews lasted sixty to ninety minutes each, with seventeen questions in one part designed to elicit beliefs about the causes of smallpox. Three sets of beliefs about smallpox emerged:

- 1) Persons who identified smallpox as a communicable disease;
- 2) persons who identified smallpox as a condition caused by a certain spirit, but a condition which could be averted by avoiding persons who were ill—in other words, a combination of witchcraft beliefs and avoidance beliefs;
- 3) persons who identified smallpox as a condition caused by a certain spirit, but who also said that the way to avoid the condition was to go to the infected person's room and "greet the spirit." (There was, in fact, a prevalent belief in some areas that the spirit must be appeased in this manner, such persons expressing not only witchcraft beliefs but also a belief in what modern medical officers would consider the most unwise practice of having direct contact with the infected person.)

The smallpox spirit, many respondents explained, might travel about at random and attack some unwary victim more or less by chance. Or the spirit might be sent by an enemy specifically to attack one. In the case of a chance attack, the possibility of recovery was much greater than where an attack was directed by one's enemy. In the latter instance, many respondents explained, smallpox was invariably fatal.

The majority of respondents said they did not think vaccination would prevent smallpox. Yet, roughly 90 percent said they would take part in the vaccination program if it were held. The research team at first considered these two sets of responses to be inconsistent, but they proved to be entirely consistent. After the vaccination program was completed in Lagos, two

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separate evaluation teams reported that between 89 and 91 percent of the population had been immunized. When reinterviewed later, the majority of respondents confirmed that they had been vaccinated, but they did not consider vaccination to have any effect on smallpox. Why, then, had they come to be immunized? The respondents said that vaccination was good and also gave one power.

Which of these persons would have higher or lower fertility in the prospective study which followed? If persons having initial exposure to modernization forces such as Western-type education or employment in the cash economy also have initially higher fertility, persons expressing modern beliefs about smallpox also should have the higher fertility. This in fact proved to be the case. The results are anomalous in regards to transition theory. But the patterns are consistent for the separate subsamples of husbands and of wives.

Just as the socioeconomic data show unexpected relationships between modernization and fertility, so also do the medical data show a general connection between initial exposure to modern medicine, and higher overall fertility. Disconcertingly, this relationship holds whether one considers those who attend maternal and child health clinics, pediatric outpatient clinics, or family planning clinics. In considering such relationships, it is possible to postulate a variety of causal connections. One might say, for example, that high parity women are most likely to want contraception and to attend family planning clinics, or women with many children are most likely to have sick children and to attend pediatric clinics. In this section of the paper, the objective is to present first such data as we have available from the Lagos surveys, and to speculate afterwards on the possible causal relationships.

#### **Contraception and Fertility**

Data on contraceptive practice in Lagos are available from three KAP surveys: 1) Morgan's 1968 survey of women ages 15-49 and males ages 20-plus, married and unmarried, in two random subsamples of the larger Lagos sample (N=1,565); 2) a survey of women with small children who had been using the experimental Gbaja Street Pediatric Out-Patient Clinic in Surulere for at least one year (N=300); and 3) a survey of women with small children who had been using a Federal Ministry of Health pediatric outpatient clinic in Surulere\* for at least one year (N=315). The latter two surveys were conducted by Dr. John Wellman, a former graduate student at Johns Hopkins University.

The Gbaja Street Clinic has been operated by the University of Lagos

\*Surulere is a high population density Lagos suburb about ten city blocks from Lagos University Teaching Hospital.

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College of Medicine since 1967, as an experimental clinic in which nurses give primary care with emphasis on comprehensive care and preventive techniques. The Ministry of Health clinic, operated by two physicians, is one of two large pediatric out-patient clinics open daily in Lagos, and is adjacent to the Gbaja Clinic. Because of the experimental nature of the Gbaja Clinic and because the nurses use procedures normally reserved for physicians, admission to the Gbaja clinic is closely controlled by the Ministry.

To facilitate the research at the Gbaja Clinic, the established admission procedure was as follows:

- 1) Patients formed lines at the Ministry of Health clinic according to time of arrival in the morning, sometimes as early as 6:00 a.m.
- 2) About 8:30 a.m., a nurse from the Gbaja Clinic selected every third person in line at the Ministry Clinic, explained the experimental nature of the Gbaja Clinic, and offered the person approached the option of transferring to the Gbaja Clinic.
- 3) Apparently, most persons approached accepted this option. Once enrolled, families remained at Gbaja, with mothers encouraged to bring siblings and newborn babies in addition to the first child enrolled.

With only a few exceptions, this procedure made it impossible for a member of the general public to attend the Gbaja clinic. From the random selection process, however, one would expect Gbaja patients to be representative of women attending any pediatric outpatient clinic in Lagos. At the time of Dr. Wellman's survey, only women who had been bringing their children to one or the other of the two clinics for at least one year were sampled. Examining his two samples showed a slight bias at the Gbaja clinic in favor of slightly older, slightly better educated women who were Christians and members of the Yoruba tribe, vis a vis the ministry sample and the general public. Neither Dr. Wellman nor Dr. Morgan were connected with the Gbaja clinic during 1967-1970, but it is known that the nurse in charge of selecting the Gbaja patients was a well-educated Yoruba Christian woman. Some selection bias may have occurred. Hence, analysis of variance has been introduced where necessary to compensate for such bias.

Patients at both clinics received health education lectures on topics including family planning. Greater emphasis was placed on health education at Gbaja, where the head nurse gave a half-hour talk to patients at the beginning of each day on a variety of topics including nutrition, immunization and family planning. Two young women were also employed to give additional talks on family planning to patients at both clinics. Family planning services were offered at both clinics, but in a nearby domiciliary midwifery unit operated by the Lagos City Council.

The principal difference between the two clinics, in the view of the Institute of Child Health staff which operated the Gbaja clinic, was the greater

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organization and service offered at Gbaja. Gbaja had fewer patients, and, on most days, four nurses were available to give each patient some personal attention. By contrast, the ministry clinic was a scene of daily chaos, patients engaging in physical combat at times to maintain their places in line, and the two overworked physicians finding only a few moments for each patient. A question arises as to whether contraceptive advice and service are better dispensed under one set of circumstances, or under the other.

In the KAP surveys, respondents were asked about each contraceptive method individually and the interviewers did not distinguish between supposedly modern or traditional methods. In the analysis reported upon, the condom, diaphragm, pill, IUD, jelly or foam, and rhythm method are categorized as modern; abstinence, withdrawal, abortion, surgery of any kind, and methods employed by native doctors are categorized as traditional. Abortion and surgery might have been classified as either modern or traditional but so few persons claimed to have used these methods that the results would not have been changed much either way. Native doctors' methods include spermicides and charms, an example of the former having been tested and found to be effective at Lagos Teaching Hospital. Respondents were asked to report on methods used either by themselves or their partners, so that women might report use of the condom and so on. The most prevalent traditional method used was abstinence prescribed by custom for periods of two to three years after childbirth (59.2 percent of females and 46.4 percent of males claiming to have used this method). The most commonly used modern method was the condom (17.8 percent of males and 6.2 percent of females) followed by rhythm (7.4 percent of males and 7.1 percent of females).

Only females with children were taken from the Lagos sample, to be matched against mothers in the two clinic samples. The results show increased contraceptive use with increased education for all six of the modern methods, with the sole exception of one cell in the IUD table in which there was only one respondent. This pattern also appeared for such traditional methods as withdrawal and abortion.

Other traditional methods (abstinence and native doctors' methods), on the other hand, show no apparent trend. The implication is that modern contraceptive methods are little used in present-day Lagos, except by the more educated minority; whereas one traditional method, postpartum abstinence, continues to be used by persons at all educational levels.\*

Comparing the two clinics against the Lagos sample, it is interesting that mothers who take their children to pediatric clinics are better educated. Since Gbaja patients are in theory selected at random from the ministry clinic (every

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\*Surgery also follows the traditional pattern, but apparently is unfamiliar as a contraceptive measure to the majority of respondents; it was reported used by only one respondent.

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third person in line), the still higher educational level of Gbaja patients may be the result of chance or selection bias. The only important difference in contraceptive use is the much higher resort to modern methods at Gbaja. In use of modern methods, the ministry clinic and the general public seem about equal; and with respect to traditional methods, all three samples appear about the same. The much higher use of modern methods at Gbaja can be attributed almost entirely to greater use of the pill and IUD (9.4 percent and 8.8 percent of Gbaja patients respectively, compared to figures of 3.5 percent and 3.2 percent for the ministry clinic and 4.1 percent and 2.2 percent for the general public). Use of traditional abstinence was reported by 75.1 percent at Gbaja, 78.3 percent at the Ministry clinic, and 70.6 percent of the general public.

What is the effect of contraceptive behavior on actual fertility? Unfortunately, it is not possible to answer the question using the two clinic samples, because the data are retrospective. It is not appropriate to match respondents' cumulative fertilities over many previous years against their currently expressed contraceptive practices. For the Lagos KAP sample, however, we do have current fertility measured over the survey year, and it is reasonable to match current fertility against currently expressed contraceptive practice. For the Lagos sample, we also have KAP data on a separate sample of males, so that the fertilities of four groups can be assessed:

- 1) Females who say they or their mates are practicing some form of modern contraception,
- 2) females who say they or their mates are practicing some form of traditional contraception,
- 3) males who say they or their mates are practicing some form of modern contraception (the fertility of the wives being assessed),
- 4) males who say they or their mates are practicing some form of traditional contraception (the fertility of the wives being assessed).

Using the indirect standardization model, three of the above groups have higher fertilities than the age and marital status corrected norms predicted for them. Only males who claim they or their mates are practicing modern contraception have wives with lowered fertility.

Female partners who reported the couple used either modern contraception (N=48) or traditional contraception (N=352) had higher than predicted fertilities based on the age and marital status corrected norms derived from the full Lagos sample of about 2,000 women. Where male partners said the couple was using modern contraception (N=74), the couple had lower fertility; where males claimed traditional contraception (N=230), fertility was higher.

While these differences are in general insignificant statistically, it is significant that in three cases they are opposite to the expected direction. The following observations are pertinent:

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1) A large number of persons in Lagos claim to be practicing traditional contraception, at all educational levels, but this practice is not associated with lower fertility, and in fact, appears related to increased fertility. Perhaps those with higher fertility, therefore, practice contraception. On the other hand, practice of traditional contraception may paradoxically cause fertility to increase, as evidenced by the unexpectedly high fertility of these persons. Although these data are for Lagos, fertility in other parts of Nigeria may not be lowered by the use of traditional contraception either.

2) The data suggest that the decision to practice modern contraception must be entered into by the male as well as by the female partner to be effective.

At family planning clinics in Lagos and elsewhere, most nurses feel that the majority of women come without their husbands' knowledge or consent and the data indicate that contraception in such circumstances is not effective. To be effective, contraception must be a joint endeavor. Hence, fertility limitation programs of governments and international agencies should be aimed more directly at males or possibly at the married or cohabiting couple, not at women alone. For many such programs in the world this will require a major shift in emphasis.

### **Perceived Child Survival Chances, Ideal Family Size, and Fertility**

Perceived child-survival chances are higher at Gbaja (79.0 percent of mothers saying they think a person is likely to have more surviving children now "than in our father's time or in our grandfather's time"), as compared with about equal lower levels of optimism in the other two samples (58.4 percent and 60.0 percent). With respect to ideal family size, the mean numbers reported in the three samples are given in Table 4. To what extent are these differences in perceptions due to the quality of medical advice and attention offered at the Gbaja clinic? How much does clinic quality affect desired family size norms?

Also, to what extent are these differences due to the somewhat higher educational levels of women at Gbaja? To research these questions, several analyses of variance were made and several rather crude scales of knowledge and optimism were constructed (see Table 5). Results suggest that lower expressed ideal family size is an effect of the clinic itself, and that optimism about child survival chances is an effect of both clinic and education (see Table 6). Knowledge and use of modern methods of contraception is largely an effect of education, though with some clinic effect (in the wrong direction, see methodological note appended to Table 7). Knowledge and use of traditional contraceptive methods does not seem to be affected by either clinic or

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**Table 4**  
Reported Ideal Number of Children, Three Lagos Samples<sup>a</sup>

Sample	Mean ideal no. of sons	Mean ideal no. of daughters	Mean ideal no. of children	Sum of ideal sons & daughters
Gbaja	2.184	1.927	3.748	4.111
Ministry	2.387	1.979	3.989	4.366
Lagos Sample	2.641	2.074	4.273	4.715

<sup>a</sup>If range of numbers such as "three or four" was given by respondent, the average of the range was taken. Answers such as "as many as God gives" have been excluded. Respondents were asked about ideal numbers of sons, daughters, and of all children separately and no attempt was made to reconcile total sons and daughters to equal total children, the replies being scored above as they were given to the interviewers.

**Table 5**  
Perceived Child Survival Chances by Education, Three Lagos Samples<sup>\*</sup>

Education		Gbaja clinic	Ministry clinic	Lagos met. area	Row marginals
No schooling	mean	2.701	2.375	2.413	2.497
	effect no.	0.041	-0.072	0.030	-0.229
		134.000	136.000	358.000	
Primary only	mean	2.871	2.648	2.551	2.690
	effect no.	0.018	0.008	-0.026	-0.036
		93.000	122.000	138.000	
Some secondary	mean	2.983	2.679	2.706	2.789
	effect no.	0.030	-0.060	0.030	0.064
		59.000	53.000	51.000	
Secondary-plus	mean	3.000	3.000	2.778	2.926
	effect no.	-0.089	0.124	-0.035	0.201
		11.000	2.000	9.000	
Column marginals	mean	2.889	2.675	2.612	2.725
	effect	0.163	-0.050	-0.113	

<sup>\*</sup>Means are of scores according to crude scale of optimism in response to question, "Do you think a person is likely to have more surviving children now, or fewer surviving children now, than in our father's time or in our grandfather's time?" ("more now" = three points; "undecided, etc." = two points; "fewer now" = one point).

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**Table 6**  
**Ideal Number of Children by Education,**  
**Three Lagos Samples\***

Education		Gbaja clinic	Ministry clinic	Lagos met. area	Row marginals
No schooling	mean	3.771	4.083	4.424	4.093
	effect	-0.101	0.033	0.068	0.205
	no.	105.000	108.000	217.000	
Primary only	mean	3.866	3.991	4.170	4.009
	effect	0.077	0.025	-0.102	0.121
	no.	82.000	108.000	112.000	
Some secondary	mean	3.577	3.804	3.898	3.760
	effect	0.038	0.087	-0.125	-0.128
	no.	52.000	51.000	49.000	
Secondary-plus	mean	3.455	3.500	4.111	3.689
	effect	-0.014	-0.146	0.159	-0.199
	no.	11.000	2.000	9.000	
Column marginals	mean	3.667	3.844	4.151	3.887
	effect	-0.220	-0.043	0.263	

\*Means shown are of actual values expressed by respondents who gave numerical replies. If a range of numbers was given, i.e., "five to six" or similar, the average value was taken. Respondents giving answers such as "as many as God gives" or similar are excluded. It has been the practice in many KAP reports to use medians rather than means and to count such replies as "above the median;" however, our survey shows such respondents to have relatively low fertility.

Wording of the question asked was as follows: "For a man (woman) living in Nigeria today, if that person is fortunate and could have any number of children he (she) wants, what would be the best number of children to have?"

education. Unfortunately, the scales are crude and the results suggestive only.

The fertility levels of males and females by different methods of contraception demonstrate rather forcefully that for this Lagos sample, the traditional spacing of children or abstinence in its various forms, fails to limit fertility. Respondents claiming various forms of abstinence have higher than expected fertilities at significant or near significant levels.

For the few respondents who use modern methods, it appears that the diaphragm is effective and the pill is not. Perhaps the oft-quoted stories of women in traditional society who have problems in taking the pill on a daily

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Table 7  
 Knowledge and Use of Modern Contraceptive Methods,  
 by Education, Three Lagos Samples\*

Education		Gbaja clinic	Ministry clinic	Lagos met. area	Row marginals
None	mean	1.560	1.287	1.483	1.443
	effect	0.142	-0.089	-0.053	-0.572
	no.	134.000	136.000	358.000	
Primary	mean	1.957	1.615	1.935	1.836
	effect	0.147	-0.153	0.006	-0.179
	no.	93.000	122.000	138.000	
Some secondary	mean	2.169	1.887	2.235	2.097
	effect	0.097	-0.143	0.045	0.082
	no.	59.000	53.000	51.000	
Secondary-plus	mean	2.273	3.000	2.778	2.684
	effect	-0.386	0.384	0.001	0.669
	no.	11.000	2.000	9.000	
Column marginals	mean effect	1.990 -0.025	1.947 -0.068	2.108 0.093	2.015

\*Respondents scored according to crude scale of knowledge-and-use, i.e., "heard of" = one point; "has used" = two points; "using now" = three points. Modern methods include diaphragm, condom, pill, IUD, jelly or foam, and rhythm method.

The slightly higher apparent level of knowledge-and-use in the Lagos sample may result from one of the few methodological differences between the Wellman survey at the two clinics and the Morgan survey in the city sample, the latter interviewers showing respondents examples of the first three methods listed. This increased the probability of correct identification, but also the chance of over-reporting of identification. The interviewers were coached to be alert for such a possibility, and Wellman did not use the approach at all. The IUD was not shown to respondents in the Lagos survey, a result of a decision by the medical staff that this would frighten respondents.

schedule have some validity. An effort should be made to obtain more information on these important questions.

Another question concerns the possible relation of these differences to fertility. Examining birth history data from the three samples, including reported live births, surviving children, and deceased children according to sex of the child, it appears that in the Lagos sample, approximately equal numbers of males and females were reported born (1.98 and 1.91, respectively); equal numbers were reported still surviving at the time of the retro-

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spective survey (1.45 and 1.41, respectively); and equal numbers were reported as having died (0.53 and 0.50, respectively). The combined figure for all children ever born per mother was 3.90, for surviving children, 2.89, and for dead children 1.04. If the average mother has passed through half her childbearing period at the time of the survey, then at the end of childbearing an average of 7.80 children will have been born, 5.72 of whom will have survived and 2.08 of whom will have died. In view of the fact that these women all have had at least one child, these retrospective figures are higher than for a sample of women generally.

Turning to data for the two clinics, the figures are quite different. Reported number of males born is greater than females born by 12-15 percent, and reported number of male child deaths exceeds reported female child deaths by an astonishing 120 percent in both samples. Other data suggest higher fertility, lower infant mortality, and a greater number of surviving children at the Gbaja Clinic. One possible explanation is that mothers more vividly remember what happens to male children, and underreport what happens to female children. A better explanation may be that mothers with male children, and especially sick male children, are more likely to go to clinics in a last-ditch effort to save the child's life than may be the case with a sick female child. There is anecdotal evidence that this occurs. Many female respondents said that it was the child's father who provided the money for transport to clinics, for clinic fees and medicines, and so on. Many mothers even said it was the child's father who shopped for the food the child ate. Bringing only male children to clinics may reflect the father's wishes more than the mother's.

Why was the fertility of the Gbaja mothers higher than that of the government clinic mothers? At first glance, no explanation presents itself except, possibly, the slightly higher educational levels of the Gbaja mothers, or that mothers with sicker children have come to prefer Gbaja and manage to gain admission to Gbaja. (Mothers with sicker children have higher fertility, as noted before). Neither of these explanations seems satisfactory, however, and an alternative explanation will be offered presently.

Attendance at the Gbaja clinic could not have had a great impact on cumulative fertility at the time of the survey in 1970, since the clinic did not open until late 1967 and the sample was chosen only from mothers in attendance more than one year. Mothers in the sample could only have been in attendance at Gbaja from 12 months to a possible 27 months.

One of the questions asked of the Lagos KAP respondents was, "Out of every ten babies born today, how many do you think will survive to be adults?"

Based on the prospective data, the mothers most optimistic about child survival chances have lower fertility; based on retrospective data the most pessimistic mothers have lower fertility. It seems reasonable that the pro-

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spective data reflect most accurately the relationship between current fertility behavior and currently held beliefs, whereas for the retrospective data, mothers who have lost the most children over their lifetimes will tend toward pessimism and also will give the least accurate reports. This would account for the dip in the retrospective curve among the more pessimistic group.

In summarizing the material on perceived child survival chances, the contribution of the Lagos surveys has been principally methodological, emphasizing the wide-ranging complexities involved in trying to establish any firm relationship between improved child care and reduced fertility. For the short-run, Lagos research data show that, along with other modernization factors, fertility is rising with initial attendance at modern pediatric and family planning clinics.

### Fertility and Other Measures of Medical Behavior

In addition to the KAP surveys, several parallel medical surveys were completed in other subsamples of the main Lagos group. In August 1969 (the year following the prospective survey), Morgan and a pediatrician from the Institute of Child Health, Dr. W. O. Gbajumo, examined the nutritional status of a random sample of children ages 0-5 in homes in the sample areas. Among the mothers of these children, a number had been followed through the prospective survey (N = 298). The children were examined and weighed in the homes, and a nurse subsequently scored each child according to a set of weight-for-age profiles as developed by Dr. David Morley in Western Nigeria. The children were scored as belonging in percentile ranges 0-25, 26-50, 51-75, and 76-100. Morley developed separate profiles for male and female children, during his work which spanned many years at the Wesley Guild Hospital, Ilesha, about 160 miles northeast of Lagos. The Lagos children could thus be classified according to a recognized nutritional standard for this part of Nigeria. Each mother was scored according to the nutritional status of her children, and the child's nutritional status was matched against the mother's fertility.\*

About half the mothers had one child in the 0-5 age group which we studied, about half had two, and less than a dozen had three. To classify mothers according to some form of nutritional-status-of-children measure, we developed a scale (unfortunately, a rather crude scale), as follows:

- 1) At least one child in the 0-25th percentile range (low nutritional status)

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\*Morley's weight-for-age profiles are widely available in Lagos. See also Morley (1968, 1973). Pediatricians consider a child's weight-for-age profile to be the best single indicator of good health and nutritional care. The writer is indebted to the late Margaret Gbajumo for her painstaking work in converting the children's weights to the Morley percentiles.

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2) no child in the 0-25th percentile range, some intermediate (25th-75th percentile)

3) all children in the 76th-100th percentile range (high nutritional status).

The results show that children of lower nutritional status are members of large families to an unusual extent with the higher fertility level of mothers of the most badly nourished children being significant at the .01 level.

Also in August 1969, research was carried out on the use of native and traditional medicines in Lagos homes. This survey was directed by Dr. Biola Mabadeje, a staff member of the University of Lagos College of Medicine. For another subsample drawn from Morgan's original Lagos prospective sample, fertility was matched against use of modern and traditional medicines: Women who use no medicine at all or native medicine only have the lowest fertility; women who use only modern medicine have higher fertility; and women who use both have the highest fertility.

From the point of view of child care, the most interesting feature of Mabadeje's survey was the reported use of a group of native medicines for children, collectively called *agbo*. These are prepared by older women in the households from leaves, barks, roots, and other ingredients purchased in the local market according to prescriptions provided by native doctors, or sometimes according to prescriptions handed down in the family, and are regarded as a medicine to give children when they are ill, or as a safeguard against illness. Some physicians at Lagos Teaching Hospital regard *agbo* as potentially harmful to a child's health, but results of the survey show that mothers who use *agbo* have slightly lower than expected fertility, and also healthier children.

Although insignificant statistically, the results are the reverse of the expected direction indicated by demographic transition theory, that is, more educated mothers use modern medicine, take children to clinics, and have lower fertility. The use of *agbo* is an important factor in traditional society, reflecting continued adherence to traditional values and also concern about the child's wellbeing. Considerable effort and expense are involved in preparing and maintaining *agbo* in the household, including purchase of a relatively costly *agbo* pot for each child and payment of the native doctor's fees, which rival those charged by U.S. doctors for a regular office visit. As with use of traditional contraception, use of *agbo* by present-day Lagos mothers is not confined to any specific educational category.

These various relationships between child care, health, and fertility may at first seem inconsistent with demographic transition theory; but there does exist an adequate explanation for the apparent anomaly. According to the socioeconomic data, couples observing the norms of traditional African society have high fertility; couples having initial exposure to modernizing forces such as Western-type education and employment in the cash economy

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have still higher fertility; while those few couples who have had extensive exposure to modernizing forces have lower fertility.

One can thus construct the following picture. Couples who have particular difficulty with sick children or who have lost any children may start attending Western-type pediatric clinics, but just as with attendance at Western-type schools or employment in the cash economy, this represents a challenge to traditional norms and exposure to modernization. Throughout the data presented in this paper, this form of exposure is associated at least initially with increasing fertility, that is to say with fertility at levels still higher than those prescribed by traditional society. Women with healthier children, on the other hand, who do not need the services of Western-type clinics, continue using native medicine and at the same time have lower fertility (fertility at the somewhat lower levels prescribed by traditional society).

It may be that the Gbaja Street Clinic is regarded as exceptionally modern, so that mothers attend this clinic or the adjacent government pediatric clinic only when they have very sick children (or at least very sick male children), and when all other avenues of medical care have failed. Once in attendance, mothers continue to come to the Gbaja Clinic with their children, to respond to the intensive health education campaigns, to express lower family size preferences, but also to have higher overall fertility.

We will explore the possible reasons for transitional status and higher fertility in the next section relating modernization forces, insecurity, and the modern African synthesis.

## FERTILITY, INSECURITY, AND THE MODERN AFRICAN SYNTHESIS

In interpreting the apparent rising birth rate in Nigeria, the explanations so far adduced in the various studies and surveys are simply not borne out by the facts.

Most frequently cited as a factor in the rising birth rate is the gradual disappearance of the lactation taboo. Olusanya (1969b), one of the first demographers to explore this interpretation extensively, writes: "The most rigid form of the lactation taboo among the riverine peoples of Nigeria is found among the Yoruba of Western Nigeria. A three-year period of suckling a baby is prescribed by custom without any provisos." But, he continues, with the inroads made by the appearance of powdered milks and bottlefeeding, women learn that breastmilk is not contaminated by a new pregnancy and, in addition, that they have the option of weaning the child earlier by bottlefeeding. Consequently, the interval between pregnancies is decreased and fertility is higher.

Olusanya (1969b) cites a second factor for increased fertility—the "comparative freedom from diseases which had previously been responsible for a

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high incidence of pregnancy wastage and sterility" (See also papers in Caldwell and Okonjo 1968).

But the data do not support the hypothesis that better health of mothers leads to higher fertility since, as we have shown, mothers with sicker children have higher fertility. The drug and medication survey demonstrated that adult women using both native and modern medications have higher fertility than women using no medicines at all.

While it may be true that the decline in the lactation taboo and the introduction of modern medicine are factors at work in Nigeria today, neither is given strong support as a causal link in the rise in Nigerian fertility. Educated as well as uneducated couples continue to practice traditional abstinence in almost equal proportions, and it is couples practicing traditional abstinence who have the highest fertility, significant above the Lagos norm at the .05 level. If the tradition is upheld in metropolitan Lagos, then it almost certainly is being practiced in rural Nigeria. And if those at all educational levels who continue to practice traditional abstinence after the birth of a child, nevertheless have higher fertility, then the impact of bottlefeeding upon fertility is not substantial and cannot explain fertility increases.

If we want to interpret what we have called the hump-backed fertility pattern which is resulting in higher fertility for the entire population, then we must look for causes more deeply rooted in the social system.

One theoretical model that presents a comprehensive explanatory framework for interpreting the complex Nigerian fertility data is based on the reference group interpretation and individual stress. The term "reference group" was first used by Herbert Hyman (1942) and has been given its fullest elaboration in Merton and Rossi (1949). The concept goes back to the pioneers of the University of Chicago school, including William I. Thomas and his "Polish Peasant in Europe and America" (1919-1927), and to George Herbert Mead (1934, 1956).

Stated briefly, reference group theory subscribes to the following propositions:

- People take their behavior cues from the norms of groups to which they belong.
- While persons are aspiring to membership in a new reference group, they must continue to honor the norms of their present or original reference group.
- Only after they have attained full and unquestioned membership in the new group can they begin to shed the norms of the old. During the transitional period, they must fully honor the norms of the old, in fact may have to overcompensate for their transitional behavior by over-honoring the norms of the old.

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- Persons who too soon shed the norms of the original reference group while still aspiring to, but not yet achieving, membership in the new reference group are in trouble, this trouble being manifested in various ways including acute mental stress and possible mental breakdown.

From the point of the present Lagos research, the theory can be applied as follows: Lagosian Yorubas can be divided into three groups of fertility patterns: 1) A traditional group with continued high fertility characterized by unchallenged allegiance to traditional norms, including no school, traditional occupations, and use of traditional medicine; 2) a transitional group with higher fertility than the traditional group characterized by challenged allegiance (that is, some school, initial involvement in cash economy, and modern medical system) which leads to overallegiance to traditional norms in other areas; and 3) a modern synthesis group with low fertility characterized by membership attained in new reference group (that is, higher schooling, secure involvement in cash economy, and rejection of traditional norms).

This scheme is suggestive only, but it does give us a coherent framework for viewing the fertility patterns shown in our data. If correct, it would explain the step-by-step rise in fertility with such factors as increasing education and social status; at some threshold level of socioeconomic advances, there then occurs a decline in fertility.

The reader outside of Africa cannot imagine the pressures placed upon young men and women in higher levels of education in Nigeria today, by their extended families. These powerful kinship groups may number dozens or even hundreds of persons who have contributed through the years to the promising young person's support and who expect to be paid back. If the relationship between insecurity and fertility holds, then those most insecure in the traditional-to-modern transition should have the highest fertility. The most insecure are those nearing the end of or just completing secondary school, and those who are unemployed in the modern sector. In fact, these two groups do have the highest fertilities recorded in the indirect standardization model (0.124 for wives of males who have completed secondary school; 0.141 for wives of men who are unemployed).

In evaluating these data, one can reach some pessimistic conclusions about uncontrolled population growth as West Africa advances into the modern age. Certainly, the influences of education and modern technology are going to become increasingly pronounced throughout the continent, and our data indicate that for the majority of persons exposed to these modernizing forces, fertility is going to rise. Africa, however, is also experiencing "the modern African synthesis," and our data suggest that for the small percentage of Africans who now are obtaining a foothold in this synthesis, fertility is lower.

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In the concluding section on policy, we will explore the question of fertility, insecurity, and the modern synthesis with reference to several countries in Asia which have achieved both this modern synthesis and lower fertility. Perhaps the experience of these Asian countries—China, Japan, and Taiwan—will provide guidelines to other governments dealing with the question of population growth.

#### **Fertility and Mental Stress**

The stress element has been suggested more often than actually enunciated, perhaps due to the difficulty in defining stress quantitatively. The concept of stress in response to social norms may be traced back to the French sociologist Durkheim's "Le Suicide" and one of the few direct assertions of the relationship is the statement by Lipset and Bendix (1960) that "it is primary-group relations which give individuals the psychic support which 'protects' them against suicide and mental illness."

The relation between transition and stress has been documented in numerous studies in Africa. The Yoruba psychiatrist T. A. Lambo (1962, 1963, 1971) has published a number of papers in which he relates change and the impact of modernizing forces to higher rates of stress and mental breakdown. He also completed a study of health problems and mental breakdown among Nigerian students in Europe (1959). His fellow psychiatrist Raymond Prince (1960, 1962), found a similar pattern of stress among students in Nigerian universities, and Morgan (1965, 1966, 1971) has found relationships between challenged allegiance to tribal norms, and higher rates of suicide and mental breakdown among Nigerian students. In a series of studies among urban and rural Zulus, Scotch (1960, 1961, 1963) has reported relationships between hypertension and various forms of transition and social stress.

Until now, few scholars have tried to relate transition and insecurity to higher fertility, but it is a reasonable proposition. When a society is in flux, traditional norms are challenged, and, as a result, individuals are subject to acute forms of psychological stress and ambivalence. On the one hand, they are motivated to move into new forms of modernity, and, on the other, they cling to and reinforce those traditional forms which remain.

One of the most important of the traditional norms available to families in flux is continued high fertility and preservation of the family name. Project, if you will, the response of the family in flux to typical propaganda in favor of family planning. According to the propaganda, the head of the family in the transitional world is told that "it is in your own rational economic interest, as well as in the interests of world survival, that each family have fewer children." But if the head of the family is suffering the insecurities of social change, acute mental stress, and possible mental breakdown, and if the

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prospect of a larger family brings support and relief, he is apt to reply, "The world will have to solve its own problems. I have troubles of my own. I am going to have more children."

We have suggested that transitional societies are moving toward new syntheses of the traditional and the modern, that individual families caught up in this process recognize either directly or indirectly that this is taking place, that they experience acute insecurity up to the point where they feel they have achieved new forms of stability in the modern synthesis. Until that moment arrives, their response is likely to be that of continued high fertility. The policy recommendation to governments concerned about high population growth rates, then, is to hasten equal access to the modern synthesis for all members of the societies involved; and it is this policy recommendation to which we now turn in the final section.

## DEMOGRAPHIC TRANSITION AND POPULATION POLICY RECOMMENDATIONS

Defining the demographic transition as a fall in mortality rates in a given population, followed by a fall in fertility rates, it is imperative that the time span for this change be shorter in transitional countries than was the case in the present industrial countries, if a population crisis is to be averted.

In light of this situation, governments in the transitional world must seek new approaches to the population problem.

The data suggest that the primary problem which confronts governments is to give poorer people and intermediate level people a sense of having some stake in the future of their countries, along with some sense of decisionmaking power in their own personal futures, rather than the feeling that they are powerless poor people, pawns of larger forces. In short, governments must seek to create a new political and social morality.

This policy recommendation is borne out in the experience of other countries in the transitional world which have undergone, or are going through, the process of change. The examples already given are of one socialist country, China, and two capitalist countries, Japan and Taiwan, which have been in a transitional state and which have achieved markedly lower fertility rates. These examples suggest that reduced fertility is not related to any given political philosophy, but rather to more fundamental forces in the social system itself. In contrast, a number of other countries in Asia, Africa, and Latin America, in which tenant farming, insecure urban employment, and inequalities of wealth and power are to be found, continue to have high fertility rates and high population growth rates.

Since 80 percent of the Nigerian population is engaged in agriculture, special comments are in order about the possible application of this policy

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recommendation to farming. The authors of this paper are a physician and a sociologist, respectively, and the subject matter of our data is the population of Lagos. Nevertheless, we feel that we can make useful comments relating to farming, based on these data.

While neither of us is an agricultural economist, it appears to us that agriculture in large sections of Nigeria today is sick, and that much stronger medicine is required than has been prescribed in either the 1970-1974 or 1975-1980 Development Plans. Studies have shown that in areas of Nigeria, people are disillusioned with farming and are coming to the cities, leaving good farm lands standing vacant, as in parts of Lagos and former Western States. Conversely, studies in other parts of Nigeria show lands so overcrowded and overworked that production is reduced (as in former East Central State); again the surplus population reacts by moving to the cities. Still further studies show that the poorer farmers in many sections of Nigeria in both the north and the south are being forced to sell their lands, in spite of the protection of the traditional land tenure systems, giving rise to special classes of wealthy farmers. The alternative for the poorer farmers who lose out in this process is to go into sharecropping, or, once again, to move to the cities.

Our study data have some direct things to say, and some indirect things to say, about the effects on human fertility of these various forms of deterioration of the agricultural lands. Firstly, the increased migration to cities increases that class of insecure, marginal or unemployed worker shown in our study to have the highest fertility of all. Pressures are mounting on the secondary school graduates as well. Of all Nigerians, these persons probably find it hardest to obtain employment commensurate with their levels of education. The closer one gets to a secondary degree, the greater the level of insecurity, and, in fact, the secondary school graduates in our study have the second highest level of fertility (after the unemployed). For that small group who attain university degrees, on the other hand, security is assured and our data show that its families have declining fertility rates.

The two direct implications for government arising from these data are the ones already mentioned in this report: 1) That government must seek to upgrade the prestige and security of urban workers, and 2) that government must seek to restore the prestige and attractiveness of rural life, so that agriculture will recover and reduce the numbers of migrants to the cities.

How government is to achieve this goal is a subject that goes beyond the data of this present report but some indirect inferences can be drawn. One can speculate that in both the urban and rural sectors, the initial key lies in education. Although there are existing vocational schools and apprentice-training programs in the country, the graduates of these programs must feel themselves different from, and inferior to, the graduates of the regular, that is, Western-based, system. This must be especially true of vocational trainees.

when they compare themselves to other students in secondary schools. Our study has shown that Lagos parents have high educational goals for their children, and other studies in rural populations have shown high educational goals as well. As long as this situation continues, Nigerian parents will try to guide their children into advanced courses in an educational system that is not tailored to the needs of the country, a school system that is actually contributing to the deterioration of agricultural lands and to increasing urban migration, unemployment, and stress.

Nigeria has established its closest ties with the capitalist world but there are some things to be learned from China as well. Two elements of the Chinese educational system which might profitably be borrowed by Nigeria are: 1) In both primary and secondary schools, all pupils should have some training in agriculture, in industrial plants, and in the traditional and modern arts and crafts, in addition to basic courses in reading, writing, mathematics, et cetera; and 2) on completing secondary school, students chosen to go on to university must first spend one or two years in an urban or rural job. These requirements apply to every child, whether urban or rural and whether the child eventually goes on to become a doctor, a farmer, a craftsman, or a lawyer. In other words, even in cities every child must learn the principles of farming and spend some time in agriculture. This was true in traditional Nigerian society, and seems to be an important element of what we have called the modern African synthesis in Nigeria today.\*

We have focused in this report on the factor of security, and a further indirect inference from our data may be that, just as the insecure urban family experiences higher fertility, so does the rural family driven into tenant-farming or other forms of agricultural decline. A most important piece of research would be a longitudinal demographic study of rural fertility in Nigeria, extending over a number of years and building on the Federal Office of Statistics' *Rural Demographic Sample Survey 1965-1966*. Meanwhile, with respect to the demographic transition in Nigeria and based on the Lagos data obtained in this present study, our points may be summarized as follows:

1) Fertility among traditional families is high; fertility among transitional families is higher still; only among the small and economically secure upper class groups are fertility rates declining (groups comprising only 1-2 percent of the urban population at present).

2) The best policy recommendation one can make is that government must try to extend a feeling of security, prestige, and access to opportunity more widely throughout the population. In other words, government must seek to create a new political and social morality.

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\*Such a job training program would be similar to Nigeria's Youth Service Corps, but would come earlier, after secondary school rather than after university.

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3) In education, this means a restructuring of the present Western-based system to prepare intermediate-level manpower for specific and prestigious jobs in industry and agriculture, as well as in the traditional and modern arts and crafts.

4) In agriculture itself, this means a variety of reforms to restore the attraction of rural life, to bring people back to underworked lands, to relieve the pressure on overworked lands, to offset the trend toward sharecropping and tenant farming, and to provide basic services in the rural areas.

5) The experience of other countries, for example, China, Japan, and Taiwan, is that lower fertility rates have accompanied social, labor, and land reforms.

6) The prospect of trying to bring about this wide range of reforms may appear too burdensome for government to contemplate; the alternative, however, would seem to be the perpetuation of a small elite, of a large and increasing number of underutilized and discontented graduates, of continuing urban migration, and of uncontrolled population growth.

### **Methods of Contraception**

After concluding that extensive social and economic reforms may be necessary in Nigeria, it is now appropriate to discuss family planning methods.

In a number of countries, birth rates began to decline at some time in the past two to three decades, after which the demand for improved contraceptive services grew. This was true in Japan and Taiwan; enough data on China are not yet available. In Taiwan, for example, it is known that the birth rate began falling in the 1950s, a decade before the introduction of a formal family planning program in the country.

The present demand for family planning services in Nigeria does not seem great. However, almost all attitude studies in West Africa, including our own, show that parents are worried about the expense of raising large families. Assuming that a demand for contraceptive advice and service does arise in Nigeria in the future, then the following policy recommendations can be made based on the data of this research:

1) Ignorance of modern contraceptive methods must be corrected by education, so as to improve the proficiency of those couples who are using the modern methods. Most of our respondents have only the vaguest understanding of the processes of ovulation and conception, and only about half have heard of any specific modern method of pregnancy limitation. The data suggest that among those couples practicing some form of modern contraception, the pill is the least effective in preventing pregnancies, possibly because of ignorance about the importance of taking the pill daily.

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2) Education will also encourage couples to change from traditional to modern methods. The data suggest that traditional methods are widely practiced in Lagos, but are not effective in reducing fertility. Couples who practice traditional spacing of births, for example, do not have lower fertility levels in the samples studied. With education, interest in and acceptance of modern contraceptive methods increase significantly.

3) The data suggest that modern contraception must be practiced jointly by husband and wife to be effective. Many women attending family planning clinics in Lagos do so without their husbands' knowledge or consent. The data indicate that family planning practiced in this manner may aid childspacing but does not result in reduced overall fertility. If government wishes to promote birth limitation, the recommended policy would be the promotion of advice and service to males and to married couples jointly, rather than to females alone.

4) While only limited information on abortions was obtained in our study, the authors feel that a further policy recommendation, based on the experience in countries such as Japan and China, is that modern contraception is more effective when practiced in conjunction with legalized abortion and that the highly restrictive abortion laws in Nigeria should be changed. Physicians in Nigeria are aware of the high rate of illegal and dangerous abortions performed, and for a number of years have been recommending that abortion laws be modified. The introduction of liberalized abortion policies in many countries has been accompanied by rapidly declining fertility rates.

### Maternal and Child Health Clinics

Family planning services integrated into the overall health care delivery system is the only policy that can be acceptable to the Federal Military Government.

Where family planning services exist at present in Nigeria, they are generally provided in maternal and child health clinics, or in special women's clinics held usually in the evenings. A policy recommendation based on the data of this survey is that the present maternal and child health/family planning clinic concept be broadened to include husbands, and that the role of husbands in family health as well as in family planning must be understood and made more prominent. Maternal and child health clinics must be converted to family health clinics in the fullest meaning of the word.

The data indicate that husbands play a larger role in maternal and child care and family planning than health planners realize. For example, the husband frequently gives the wife the money she needs to buy food for the child or for transportation to the clinic, and quite often the husband buys the child's food

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himself. Government and the Ministry of Health must try to impress upon males the importance of health care and clinic attendance.

Although fertility was higher among patients attending the maternal and child health/family planning clinics studied in this report, the period of study has been too brief to arrive at any firm conclusion on the effect of integrated maternal and child health/family planning services on fertility. More studies are required. Perhaps, for example, the more fertile women are the ones who attend these clinics.

#### **Conclusion: Recommendations for Further Research**

To test the ideas of this policy report further, the following types of research are suggested:

- 1) Studies of the Lagos type among other populations in Nigeria, and particularly among the other two major ethnic groups, the Ibos and Hausas, to see if the policy recommendations of this report can be applied more broadly throughout Nigeria;

- 2) a continuing longitudinal demographic survey in rural Nigeria to see if fertility rates are changing; to see whether the same pattern seen in Lagos is also observed in the rural areas—that is, that fertility is high in families still observing the traditional norms and that fertility is higher still in families in transition, particularly if this transition involves stress and insecurity; and finally, to see if fertility declines with rural security—for example, if fertility declines among farm families who are able to lay away savings or make a profit in the cash economy;

- 3) pilot studies in rural development, including some of the linked educational and agricultural reforms suggested in this report, together with provision of basic services (for example, communications and medical services) in the pilot rural areas. The Institute of Child Health is already active in the latter. One might suggest a complete trial package in one or two distinct political units (that is, in one or two entire states or divisions of states), so that the economic and political as well as the social and medical realities can be tested;

- 4) stress studies in transitional populations, to observe the relation to changing fertility.

In conclusion, we feel that Nigeria has a special place in this type of social development and social research because of the pre-eminence which Nigeria enjoys in Africa and the transitional world. Further analysis of these data on fertility would thus have application and value not only in this portion of West Africa, but in other areas of the transitional world as well.

### ACKNOWLEDGMENTS

Analysis of these data, bringing together material on fertility from a number of projects in medicine and sociology spanning 10 years in Nigeria, has been made possible by a grant from the Interdisciplinary Communications Program, Smithsonian Institution.

The largest block of data analyzed derives from the Lagos Family Health Project, which is continuing in Lagos and a number of other areas of Nigeria under the Institute of Child Health of the University of Lagos. I am grateful to the director of the institute, Professor O. Ransome-Kuti, who made the data available for analysis, gave this writer much needed moral support and able collaboration, and consented to be the principal author of the critical section of this paper dealing with government policy. I am also grateful to the staff of the University of Lagos College of Medicine and Lagos University Teaching Hospital, and to the more than 50 members of this project, who have given their time and effort in holding special clinics, in visiting homes, in conducting or supervising interviews, and in compiling much of the data. The project during most of this research period was a joint activity of the Department of Community Health of the University of Lagos College of Medicine, and the Department of International Health, Johns Hopkins School of Hygiene and Public Health.

I would also like to thank Professor Hilton Salhanick who sponsored the data analysis at the Harvard School of Public Health; Mr. Raymond Neff, Director of the Health Sciences Computing Facility; Dr. Donald C. Olivier who wrestled the data into some of the comprehensible and insightful forms appearing here; and Dr. John C. Snyder who introduced this writer to the field of population science.

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## Rural Development and Demographic Change in Northeastern Tanzania

James E. Kocher

### Abstract

Interviews of adult members of 1,492 households were conducted in a 1973 survey of four rural areas of northeastern Tanzania. Data reveal that considerable social, cultural, health, educational, and economic changes have occurred in all four areas during the past 50 years. Changes were uneven, and where change was greatest there was a rise in the proportion of women who want no more children despite having smaller-than-average families.

This study is an attempt to identify and measure some of the important changes that have occurred and are occurring in four rural areas in northeastern Tanzania and to identify the interactions of these changes with fertility. A century ago, the four study areas were parts of traditional rural African societies. Since then, these societies have undergone social, cultural, and economic disruption, and modernization and development—processes that may lead to the widespread practice of modern contraception and, as a result, widespread and sustained fertility decline.

Some of the assumptions underlying this hypothesis are as follows: A complex chain of causal relationships exists between basic social, cultural, health, educational, and economic characteristics of a society and the fertility of its women. As the socioeconomic milieu of a traditional rural African society begins to change in response to modernizing influences, a host of

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*Note:* ICP social scientist James M. Creager helped prepare this report for publication. Correspondence to Mr. Kocher should be directed to the Harvard Institute for International Development, 1737 Cambridge St., Cambridge, Massachusetts 02138.

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social, cultural, health, educational, and economic changes may start to take place. Over a long period of time, these changes will affect fertility. The direction and magnitude of these initial effects probably cannot be predicted with confidence. However, if modernization continues and increasingly disrupts traditional norms, practices, and values while an ever larger proportion of the society is caught up in this disruptive and modernizing process, the typical woman of childbearing age will eventually decide it is in her best interests and those of her family to limit pregnancies.

## THEORY

The theoretical underpinnings of the analysis in this paper derive from two complementary formulations. One is a conceptualization of fertility as the result of the attempt by couples to have the number of male and female children they want. That is, they attempt to achieve an equilibrium of supply (of surviving children) and demand. This approach draws inspiration, in part, from the work of Easterlin (1975). The second formulation is concerned primarily with identifying the determinants of fertility, postulating that identifiable causal relationships exist between a large set of basic social, cultural, economic, educational, and health characteristics of a society and a much smaller and more specifiable set of intermediate variables which are themselves the direct determinants of fertility.\*

### Equalizing Demand for and Supply of Surviving Children

There is considerable evidence that fertility varies greatly among African rural areas.\*\* We believe that regardless of the level of fertility within a society or for individual women and families, parents in traditional African societies do have goals for family size and composition. The goal may be something as general as "as many as God gives" or something as specific as "four boys and three girls," and may be felt or expressed either in terms of the number of children born or the number of children surviving to adulthood, although the latter is probably of greater importance to most parents. We also believe that many parents in traditional rural African societies feel that they want to have more children than they actually have or are having, and some evidence for this is presented later in the paper.

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\*The concept that intermediate variables are the direct determinants of fertility is similar to that of Davis and Blake (1956).

\*\*For example, analysis of 1967 Census data for Tanzania's 16 rural regions suggests that regional total fertility rates varied from a low of about five to a high of over eight (Egero and Henin 1973). Another study by Henin found that even within a single African tribal and cultural group, fertility differed significantly and the differences were associated with different types of economic and social arrangements or "modes of life" (Henin 1968, 1969).

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The typical woman in a traditional rural African society knows approximately how many children she would eventually like to have. She will continue to want to have children until she reaches or exceeds her goal. A woman's uncertainty or anxiety about possible deaths among her children may cause her to want more births than otherwise as a hedge against an unknown future.

As socioeconomic changes take place, the traditions of a community and its residents change—perhaps toward modernization and development. One probable result will be an increase in the average number and proportion of children surviving to adulthood—the supply. Presumably these changes may also affect the average desired number of surviving children—the demand.

Figures 1A and 1B show two hypothetical groups of women in a transitional society. The diagrams illustrate possible changes in the relative levels of actual and desired numbers of surviving children. Three transitional stages are illustrated. The transition is initiated (Stage 1) by a rise in the average number of surviving children per woman ( $S$ ). This would be, in part, the consequence of improved health conditions and declining infant and early childhood mortality. It could also be, in part, the result of socioeconomic changes that cause an increase in fertility.

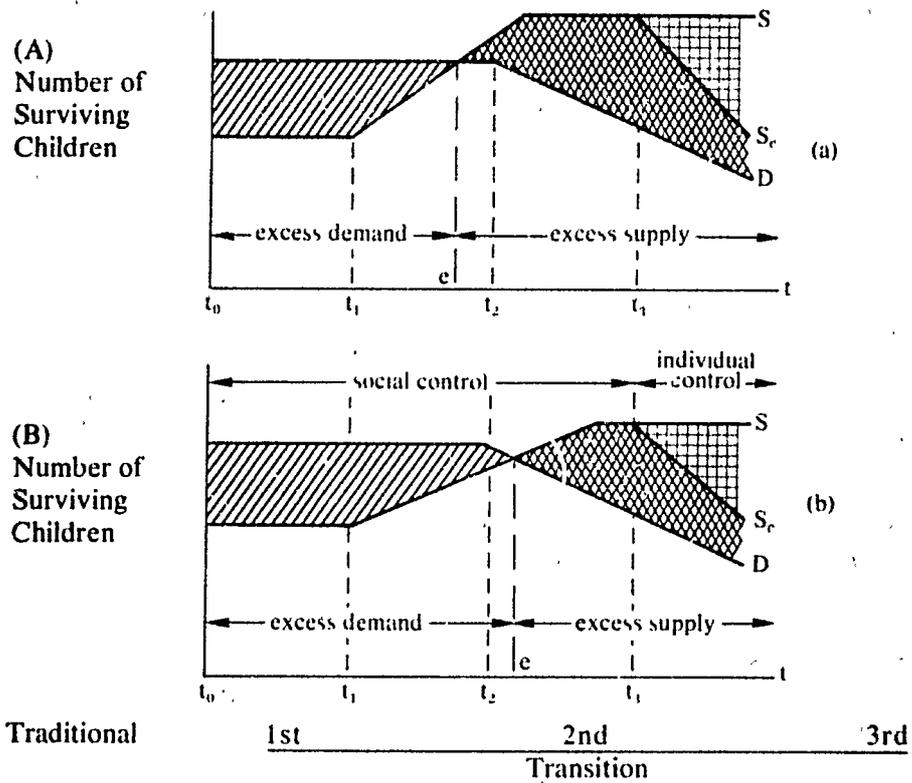
Transition Stage 2 is initiated by a decline in the level of demand ( $D$ ) for surviving children—for example, the desired number of surviving children or desired completed family size.  $D$  would fall because changing conditions alter the mother's or parents' perceptions of the advantages of having the large number of surviving children traditionally desired; the typical woman begins to feel that she would be better off with a somewhat smaller number of children.  $D$  could start to decline, either while it still exceeds  $S$  (as in Figure 1B), or after  $S$  has already surpassed  $D$  (as in Figure 1A). Note, however, that the two figures illustrate the assumption that both in a traditional society and at least in the early part of Stage 1 and perhaps even into Stage 2, the typical woman who has recently completed childbearing does not have as many surviving children as she would like to have;  $D$  exceeds  $S$ . Of course, some fortunate women may have had as many or even more children than they had wanted.

Stage 3 is initiated by a decline in the actual number of surviving children brought about by the deliberate use of modern contraceptives, abortion, or other birth control practices. Line  $S_c$  in Figures 1A and 1B indicates the extent to which the average number of surviving children declines are due to individual fertility control.

At Stage 1, when the average number of surviving children starts to rise, a woman's desire for more children begins to decrease. Eventually, as long as  $D$  remains constant or declines, the actual and desired number of surviving

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**Figure 1**  
**Hypothetical Relative Levels and Trends in Fertility Variables**  
**for a Typical Woman Who has Recently Completed**  
**Childbearing in a Transitional Rural African Society**



D = Desired number of surviving children (demand)  
 S = Number of surviving children (supply) with unregulated fertility  
 $S_c$  = Decline in actual number of surviving children due to deliberate (individual) fertility control

 Deficit fertility—excess of desired number of surviving children over actual number  
 Surplus fertility—excess of actual number of surviving children over desired number  
 Amount of deliberate birth prevention, measured by number of children averted

**Transition Stages**

$t_1$  = beginning of Stage 1: average number of surviving children begins to rise  
 $t_2$  = beginning of Stage 2: desired number of surviving children begins to decline  
 $t_3$  = beginning of Stage 3: beginning of individual practices (contraception, abortion, etc.) to reduce fertility deliberately

Source: Inspired in part by Easterlin (1975) Figure 2(f).

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children will coincide (point e in both Figures 1A and 1B). At this point the representative woman would want to control her pregnancies.

Point e can be located anywhere within Stages 1 and 2. In Figure 1A it is located in Stage 1, while in Figure 1B it is located in Stage 2. It is simply the coincidence of actual and desired numbers of surviving children. The only conditions are that it must come after the average number of surviving children starts to rise (beginning of Stage 1) and before the beginning of the use of modern contraceptives or other individual action on the part of the woman to deliberately regulate fertility (beginning of Stage 3).

To the left of  $t_2$  (beginning of Stage 3), the number of surviving children is not limited by deliberate actions of the woman (or her spouse). The limits are a community's broader socioeconomic conditions. However, to the right of point  $t_3$  the number of children surviving is limited, in part at least, by a woman's deliberate, individual action to regulate her pregnancies. This is the significant change in behavior that identifies Stage 3 in the transition as postulated in Figures 1A and 1B. Hence, in Figures 1A and 1B, the area to the left of  $t_3$  is labeled social control, and the area to the right of  $t_3$  is labeled individual control after Easterlin (1975).

To the left of  $t_3$ , actual fertility (as contrasted to the number of surviving children) may be either falling, unchanged, or rising. As illustrated in Figure 2 and discussed below, some socioeconomic changes affect intermediate variables in such a way as to raise fertility while other changes affect the intermediate variables so as to reduce fertility. For example, the average age at first marriage could be rising and infant and early child mortality rates could be falling. Independently, these two changes would lower fertility. On the other hand, women could be weaning their children earlier (perhaps using store-bought milk) and discontinuing their adherence to post-birth sex taboos. Independently, each change would reduce average birth intervals and increase fertility. Together with other changes discussed below, the net result could be rising, falling, or approximately constant fertility during the period before  $t_3$ —the beginning of deliberate individual fertility control.

The formulation illustrated in Figures 1A and 1B does not differentiate among socioeconomic or other conditions that determine the relative and absolute levels of S and D at any particular point in the transition. For example, economic conditions above do not determine either the number of surviving children a woman wants or the number who actually survive. Nor do they determine changes over time in the number desired and the actual number. However, economic circumstances presumably do play some role in determining levels and trends in D and S. Social, cultural, health, and educational characteristics and changes in these characteristics over time are also important determinants of D and S. In fact, the author believes that in traditional rural societies, and to some extent transitional societies, eco-

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conomic conditions are relatively unimportant determinants of D and S, compared with social, cultural, and health factors. Hypothetically, however, as a rural society changes, socioeconomic trends and interactions become more important in determining levels and trends of both D and S.

### Fertility Determinants

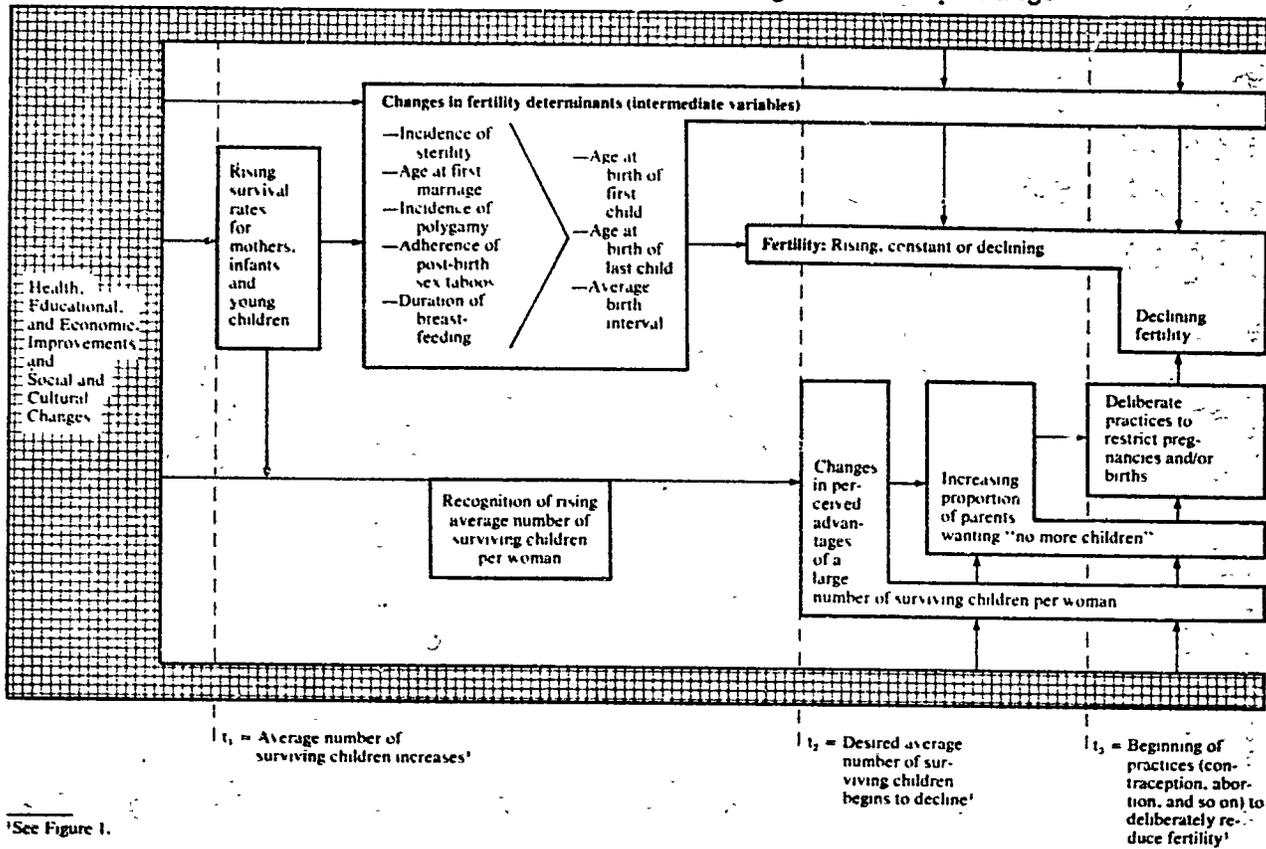
Figure 2 presents a hypothetical model of the causal relationships between basic health, educational, economic, social, and cultural variables as they affect the intermediate variables that are the direct determinants of fertility. The basic variables are left unspecified. Some of the intermediate variables specified are incidence of sterility, age at first marriage, incidence of polygamy, adherence to postpartum sex taboos, and duration of breastfeeding. The interactions of the intermediate variables determine the three basic fertility parameters which are: 1) the woman's age at the birth of her first child, 2) the woman's age at the birth of her last child, and 3) the average interval between births. In this formulation, the basic socioeconomic characteristics of the society have no direct effect on fertility, except through intermediate variables. Hence, changes in the sociocultural milieu and economic, health and educational characteristics of the society would affect intermediate variables that might alter fertility.

For example, women in many African societies have traditionally observed a taboo on sexual intercourse for as long as two years, and sometimes longer, after the birth of a child. Such customs obviously increase the average interval between births, and lower fertility. Within such a framework, the postpartum taboo can be considered a cultural practice that also functions as an intermediate variable in determining fertility. Social, cultural, and economic changes that are difficult to specify may alter the adherence to this particular cultural practice. As a consequence of sociocultural or economic circumstances, some proportion of a population's childbearing women might stop following the taboo altogether, or might observe it for shorter periods of time than in the past. Changing the average birth interval would affect the level of fertility.

Transition Stages  $t_1$ ,  $t_2$  and  $t_3$  from Figure 1 are given along the bottom of the model in Figure 2. The characteristics of each of the three stages that were discussed in conjunction with Figure 1 also apply here. Perhaps the onset of Stage 1 is the result of changes in basic health, education, economic, social, and cultural characteristics that raise survival rates for infants and young children and affect intermediate variables, the net effect on fertility being unknown. One probable effect of these changes is that the average number of surviving children increases, as illustrated earlier in Figure 1.

As illustrated in Figure 2, it is assumed that changes in the basic variables that bring about the onset of Stage 1 will eventually change the traditional

**Figure 2**  
**Model of Hypothesized Transition in Rural Africa and Linkages to Fertility Change**



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attitudes about the advantages of having a large number of surviving children. The beginning of Stage 2 is marked by a decline in the desired average number of surviving children per woman. It is necessary that women recognize that survival rates and the average number of surviving children are increasing. It is not sufficient that they are actually increasing or have increased. Throughout Stage 2, as in Stage 1, fertility may be either rising, constant, or falling. Whatever fertility level women want has essentially nothing to do with fertility, because that is determined by the interaction of the intermediate variables. And, although the intermediate variables determine fertility, they themselves are determined by individual and social characteristics that have nothing to do with how many children a woman would like to have.

This all changes with the onset of Stage 3 because that is the point at which women begin to take deliberate individual action to prevent or terminate pregnancies. A new fertility determinant has been added to the set of intermediate variables. This will not occur until sometime after women feel they are having more surviving children than they want (point e in Figure 1).

In the model presented in Figure 2, the basic societal and individual variables continue to change throughout the three stages of transition. The bottom half of the diagram shows that the basic characteristics also continue to affect attitudes and values about the desired number of surviving children and the advantages of large numbers of surviving children until eventually, beginning at Stage 3, the changes in attitudes and values make women feel strongly enough to act individually to prevent or terminate pregnancies.

Once Stage 3 is reached, the rate at which fertility and the average number of surviving children declines will be determined largely by the success with which women prevent pregnancies or births. This will, in turn, depend on the effectiveness of the means they use, and their skills in using the methods, the costs of using the methods, et cetera. The costs—financial, social, and psychic—of successfully using contraceptives will significantly affect the extent to which actual numbers of surviving children can be reduced.

### The Macro-level

For any given woman in a transitional society, the point at which Stage 3 begins—for example, the time when she first deliberately controls her future fertility—will depend on two important processes in her life. One will be the number of surviving children she has compared to the number she wanted. The second is the set of changes in attitudes, values, and norms in her life and community that are considered the proper roles vis à vis children, family formation, family life, and family size. It is assumed in the model in Figure 2 that both sets of processes are the ultimate outcome of continuing changes in

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basic social, cultural, health, education, and economic characteristics of the woman, her spouse, her family, and her community.

Not all women in the society will reach transition Stages 2 or 3 at the same time. At any given point in time, the actual number of children, compared to the desired number, differs for women of different ages and reproductive histories. But even women of similar ages and fertility and child survivorship experiences will presumably not all reach Stages 2 or 3 at the same time because, even within the same community, they are likely to be the products of somewhat different social, cultural, health, education, and economic experiences. Women's educational levels may differ substantially. Economic circumstances may also differ substantially among the women. Some may be wives of polygamous husbands and among those wives, status will vary. Religious beliefs and commitments may differ. Health experiences of the women and their families may differ. All such conditions affect women's attitudes toward their futures and those of their families, and determine where they will be in the transition process. This is a macro-level view; it is an attempt to understand why women within a single society or community may have different attitudes toward children, fertility, and desire to exercise birth control. When the focus is shifted from a representative woman to the society as a whole, the characteristics of societal changes assume a basic importance. Which women and families are experiencing what changes? How much are various groups within a given community or society participating in the changes?

The distribution of changes within a society is crucial in determining the eventual impact on average fertility. In those societies in which a relatively large proportion of people have reached Stage 3, the reduction in overall fertility will probably be much greater than in a society in which relatively few people have reached Stage 3. The model in Figure 2 implies that if a relatively large proportion of people in a society are to reach Stage 3, that same proportion must have been experiencing profound changes in basic social, cultural, health, educational, and economic conditions throughout Stages 1 and 2.

#### **DESCRIPTION OF THE STUDY AND THE STUDY AREAS**

Data for this study were collected in a two-stage household survey carried out in late 1973 in conjunction with the 1973 National Demographic Survey of Tanzania. Two of the four study areas are located in the district of Lushoto (L-1, L-2); the other two are in the district of Moshi (M-1, M-2). The two districts are about 150 kilometers (90 miles) apart. All four study areas are located in relatively densely settled mountain areas. The two study areas in Lushoto District are in the Western Usambara Mountains; eleva-

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tions in the study areas range from about 1,050-1,525 meters (3,450-5,010 feet). The two study areas in Moshi District are located on the southern slope of Mt. Kilimanjaro at elevations about 1,250-1,860 meters (4,100-6,100 feet).

Each of the four study areas had a total population of about 5,000 at the time of the survey. The rural population of Lushoto District is estimated to have been about 245,000 in mid-1973 and the rural population of Moshi District was about 425,000. The average rural density for Lushoto District was about 70 people per square kilometer, while that of Moshi District was about 98 per square kilometer. This compares to an estimated density of 16 per square kilometer for Tanzania as a whole.

However, the most densely settled parts of the two districts averaged about 250-300 people per square kilometer in Lushoto and about 400 per square kilometer in Moshi. Average densities in the smaller study areas are about 500 to 750 people per square kilometer.

The survey included every second household in each of the Moshi study areas and every third household in the two Lushoto areas. These households accounted for about 1 percent of the estimated total number in each district at the time of the survey. Table 1 gives a detailed breakdown of the numbers of households, ever-married women, never-married women age 12 or older, husbands of currently married women, and surviving children age 7 or older, regardless of current residence, of currently married women included in the survey.

**Table 1**  
**Numbers of Households and Persons**  
**Included in the Survey**

Category	Districts Study Areas	Number of Cases						Grand Total
		Lushoto		Total	Moshi		Total	
		L-1	L-2			M-1		M-2
Households		300	290	590	442	460	902	1492
Ever-married women		312	312	624	505	502	1007	1631
Never-married women age 12 or older		142	128	270	249	325	574	844
Husbands of currently married women		267	260	527	411	432	843	1370
Surviving children age 7 or older (regardless of current residence) of ever-married women		850	867	1717	1400	1651	3051	4768

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### **Tribe**

The southern and western slopes of Mt. Kilimanjaro are situated in Moshi District and are the homeland of the Chagga tribe. The western Usambaras, a mountain range running through Lushoto District, is the homeland of the Sambiaa (or Shambiaa or Shambala) tribe. Substantial numbers of the Pare tribe, whose homeland is the Pare mountains, between Mt. Kilimanjaro and the Western Usambaras, also live in the Western Usambaras. About 92 percent of the population of L-1 and 80 percent in L-2 are Sambiaa; 6 percent in L-1 and 16 percent in L-2 are Pare. More than 99 percent of the populations in both M-1 and M-2 are Chagga.

### **Historical Review**

During the first half of the nineteenth century, the Sambiaa kingdom dominated the surrounding countryside. However, the kingdom disintegrated after the death of King Kimweri ye Nyumbai in about 1862. (Feierman 1974) The Kilimanjaro area was not ruled by a single king or chief during the nineteenth century.

The first Europeans visited these areas in the mid-nineteenth century, but European influence was relatively unimportant until the late 1800s. Europeans—predominantly German—settled and developed the southern slopes of Mt. Kilimanjaro and the Western Usambara Mountains extensively during the early colonial period. Between 1891 and 1911 a railway was constructed from Tanga on the coast, through the Pangani Valley at the foot of the Western Usambaras, to Moshi. By the beginning of World War I, European settlers had established a ring of coffee plantations along the southern slope of Mt. Kilimanjaro and European farms were interspersed throughout much of the Western Usambaras. The defeat of the Germans in World War I and the establishment of British authority brought an end to the rapid expansion of European agricultural holdings in northeastern Tanganyika.

Missionaries introduced coffee in Kilimanjaro in the late 1890s, and the first substantial areas of African-owned coffee were planted in about 1900 (Iliffe 1971). The climate and soils of Kilimanjaro were generally well-suited to coffee, and after about 1925, Chagga cultivation of coffee expanded rapidly (Maro 1974). Early European efforts to grow coffee on a large scale in the Usambaras failed, but in the 1920s the Sambiaa began growing coffee in the Western Usambaras, although coffee production increased more slowly among the Sambiaa than among the Chagga (Iliffe 1971).

World War I also had considerable impact on both the Chagga and the Sambiaa. The German army enlisted large numbers of men from both tribes. Even those who did not fight were affected because of the strategic and

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economic importance of these areas. In 1916, the British captured both areas and established territorial headquarters in Wilhelmstal—renamed Lushoto. They used Moshi as an important administrative center.

### Religion

Along with the European settlement came Christian missionaries. They established the first missions in both areas in the 1890s. In 1910, Christians constituted an estimated 4 percent of the population in the entire Kilimanjaro area. This increased to approximately 80 percent in 1971 (Maro 1974). In the post-World War I period, Christianity expanded much more rapidly in the Kilimanjaro area than in the Western Usambaras. The Moslem religion was originally introduced into the Usambaras from the coastal areas around Tanga and Mombasa, and apparently in the last half of the nineteenth century, the number of followers of Islam among the Sambia increased relatively rapidly (Feierman 1974).

In the four study areas, 82 percent of the population in L-1 and 75 percent in L-2 are Moslems. Only 1 or 2 percent of the population in the Moshi areas are Moslems. Eighteen percent in L-1 and 24 percent in L-2 are Christians, compared to 82 percent in M-1 and 99 percent in M-2. In M-1, 12 percent of the women and 21 percent of their husbands were neither Christians nor Moslems, but claimed to be adherents to traditional beliefs.

### Health Facilities

In addition to their evangelistic activities, the missionaries established schools and constructed hospitals and clinics. As a consequence of these activities, the Kilimanjaro and Western Usambara areas are relatively well endowed with health facilities. In 1972, Lushoto District ranked first and Kilimanjaro District (encompassing the current Moshi and Rombo Districts) was third among the 56 non-island and non-urban-periphery districts in Tanzania in the proportion of population within 10 kilometers of a health facility. Only 1.5 percent of the population in Kilimanjaro District and 0.5 percent of the population in Lushoto District were not within 10 kilometers of a health facility. (Thomas and Mascarenhas 1973)

### Education

Among those people in the four areas born before 1910, a higher proportion of people in the Lushoto areas have formal education than in the Moshi areas. The percentages, however, are very low in all areas. Probably all those with some schooling were educated in mission schools. Nearly all the people born during 1914-1943 who received some formal education would

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also have attended only mission schools. During this period, the proportions of people attending school in the Moshi study areas began to exceed those in the Lushoto areas, particularly among females. Among those born since 1953, educational attainment is definitely higher in the Moshi areas, and the ranking from highest to lowest is M-2, M-1, L-2 and L-1.

#### **Agricultural and Settlement Patterns**

Residents in both areas are predominately small-landholding farmers growing staple foods; most householders keep livestock and produce some crops for market. The most important food crops in Kilimanjaro are bananas, maize, and beans. In the Usambaras, they are bananas, maize, cassava, beans, and sweet potatoes.

Settlement patterns differ substantially between the two areas. Most of the population in Kilimanjaro live in the highlands, and people generally cultivate land immediately surrounding their homes as well as farther down the mountain. For the most part, people do not live in villages but in separate homesteads in the midst of, or immediately adjacent to, their small coffee and banana farms. Historically, farmers grazed livestock in both lowlands and highlands, but in this century increasing land scarcity caused a trend toward conversion of most of the former grazing lands in the highlands to permanent cultivation.

Many people in the Western Usambaras also cultivate land near their homes in the mountains as well as down on the plains. However, in the Usambaras most people live in small villages of about 10 to 50 households rather than in dispersed homesteads as in Kilimanjaro. Typical villages are located along ridge crests, with cultivated areas running down the hill or in nearby valleys. A large proportion of the land cultivated in the highlands is located some distance from the villages. In contrast, most of the cultivation in the Kilimanjaro highlands is located immediately adjacent to individual homes.

In the late nineteenth and early twentieth centuries, European observers described the Western Usambaras as being a densely populated but prosperous area with healthy inhabitants and a flourishing agriculture.

But some observers reported that the general prosperity declined and the well-being of the Sambia deteriorated during the first half of the twentieth century. Iliffe (1971) notes a tendency towards agricultural involution, for example, falling labor and land productivity in the Western Usambaras, and Attems (1968) describes a 70-year process of involution and pauperization despite the development efforts of colonial administrations.

Other reasons often cited as contributing to this deterioration are the increase in population density, the lack of a suitable cash crop that could

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produce income and serve as a catalyst for increasing agricultural productivity, failure to maintain and develop irrigation networks, and poor soil conservation practices.

The Western Usambaras are sometimes contrasted with Kilimanjaro, which is commonly viewed as an area that has experienced considerable prosperity and economic improvement during the twentieth century. Substantial economic growth occurred in Kilimanjaro agriculture during the twentieth century, and particularly in the late 1960s.

However, in Kilimanjaro and the Usambaras, land pressures also increased substantially during this century. The rural population in Kilimanjaro District is estimated to have increased 400-500 percent between 1900 and 1967. Farm size in the highlands fell from an estimated average of about 2.2 hectares per household in 1921 to 0.5 hectares per household in 1967 (Maro 1974).

One response to the rising population density has been more diversification and intensification of agriculture. For example, farmers planted coffee in the interstitial areas among the banana groves, and introduced stall-feeding of cattle on banana leaves and stems and grass brought up from the lowlands. (Maro 1974) Accompanying the increasing land scarcity were fragmentation of land holdings to enable most sons to inherit land, increasing land litigation among kinsmen, and an estimated 700 percent increase in the value of land in the highlands. (Maro 1974)

### Housing

The prevalence of modern and relatively expensive types of housing is one of the best indicators of the extent to which economic improvement and social and cultural changes have permeated these rural areas. In late 1973, 65 percent of all households in L-1, 63 percent in L-2, 25 percent in M-1, and 7 percent in M-2 had only traditional\* forms of housing. Only 2 percent of the households in L-1, 4 percent in L-2, 24 percent in M-1, and 31 percent in M-2 had at least one building with modern walls, a metal or tile roof, and a cement floor. Typically, a household's first housing improvement is the installation of a tin roof on a rectangular house that has a dirt floor and mud and wattle walls. The proportions of households that had at least one building with a good roof, regardless of the other characteristics of that particular building, are 34 percent in L-1 and L-2, 65 in M-1, and 92 in M-2.

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\*Traditional houses in the Western Usambaras are either round or rectangular with grass or banana-leaf roofs and mud and wattle walls. Traditional Chagga structures are conical-shaped with banana-leaved roofs that sweep down to the ground from about 12-foot peaks. Traditional houses in the Kilimanjaro area may also be rectangular with dirt floors, mud and wattle walls, and grass or banana-leaf roofs.

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Percentages with a latrine are 51 percent in L-2 and between 35-37 in the other three areas. Construction and use of latrines has been promoted primarily by missionaries and agricultural officers.

#### **Modern Consumer Goods**

An inquiry into the extent to which people in the study area have acquired modern consumer goods shows that a majority own one or more of the three most common possessions: clothes box, chair, and wood bed. At the other extreme, only a small fraction of the people own one or more of each of the less common—and generally most expensive—items like a clock or a bicycle or car. But, a wide statistical spread appears when one examines the number of people who possess such items as mattresses, tables, and lanterns. Without exception, L-1 has the fewest people owning each item and in many cases the percentage is only about half as high as it is in the other three study areas.

#### **Occupation and Income/Employment**

Among husbands of currently married women, self-employed farmer was the principal occupation of 90 percent in L-1 and between 77 and 79 percent in L-2, M-1, and M-2. Among ever-married women, those who reported themselves to be self-employed farmers ranged from 91 percent in L-2 to 95.5 percent in L-1.

The principal occupation was nonagricultural for 23 percent of the men in M-1, 22 percent in L-2, 20 percent in M-2, and 8 percent in L-1. The relative importance of nonagricultural jobs for men—and to a lesser extent for women—in L-2, M-1 and M-2 as compared to L-1 can be explained by the much greater opportunity for nonfarm employment in the former three study areas. The settlement of Soni, although small, is located at an important junction on the main road running through the Western Usambaras and the only road to Lushoto village, which is the district capital. Soni has several shops, bars, small hotels, and eating establishments. Its residents also include some civil servants, road maintenance workers, and other government employees. Fewer comparable opportunities exist in L-1. Although neither M-1 nor M-2 are located along major transportation lines, there is regular daily bus service from both areas into Moshi town, and numerous residents of both study areas commute daily to work there, a distance of about 15 kilometers from M-1 and 50 kilometers from M-2. Income brought into these rural areas by nonfarm employment helps support local bars, shops, and other service enterprises.

Among men, 90 percent in L-1, 80 percent in L-2, and 87 percent in both M-1 and M-2 report being self-employed and selling produce, for example,

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receiving cash income. Eight percent in L-1, 18 percent in L-2, and 12 percent in both M-1 and M-2 are reported as being primarily wage-earners. Less than 2 percent of the men in each area report receiving no cash income. Among women, between 91 percent in L-2 and 95 percent in L-1 report being self-employed and having sold at least some produce for cash. Between 5-8 percent in each area reported that they were either not working or self-employed but having received no cash income.

### Possession of Agricultural Equipment

In areas L-2, M-1, and M-2, between 20 and 23 percent of the husbands and between 6 and 8 percent of the currently married women held nonfarm jobs. However, it is most likely that even in those households in which one or more people hold nonfarm jobs, the household members produce nearly all their own food.

The agriculturally self-sufficient character of the study areas is reflected in the percentages of households that have at least one of 13 different agricultural tools or pieces of equipment. Between 97 and 100 percent of all householders in all four areas own a hoe; the average number per household ranges from 2.7 to 2.9. Between 95 and 99 percent of all householders own a panga (similar to a machete); axes are present in 89 to 95 percent of all households. L-1 is the area in which the highest proportion of households have each of the tools. This is consistent with the occupation and income/employment data, which show that L-1 is the most agricultural—and probably the most subsistence-oriented—of the four areas.

### Ownership of Livestock

A much higher percentage of households in M-2 report having cattle, goats, and sheep than in the other three areas. Ninety-one percent of all householders in M-2 report owning cattle and 79 percent report owning goats. Even so, the reported average number per household in M-2 is only two goats and two head of cattle. One percent of the householders in L-1 and 2 percent in L-2 have hybrid cattle; 6 percent in M-1 and 15 percent in M-2 report owning hybrid cattle. There are almost no pigs. Over three-quarters of the households in all four areas have either chickens or ducks. There are very few ducks in M-1 and M-2 but a large number in L-1 and L-2. Ducks are more valuable than chickens but the two cannot be differentiated in the data.

The level of livestock ownership might be understated. Ownership of cattle, and to a lesser extent goats and sheep, is often complicated. They may be jointly owned by two or more families; they may be loaned to relatives, clan members, or others under various conditions and time periods. In both districts, they are often grazed in large herds down on the

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plains. Although respondents probably know precisely the extent and content of their livestock holdings, they may have deceived the researchers and underreported their holdings.

#### **Estimated Values of Crops Produced and Sold**

Researchers estimated the monetary values of 13 different crops produced and sold per household in the 12-month period preceding the survey.\* Coffee, tea, wattle, and cardamon are strictly cash crops. The estimated values of these crops produced and sold per household are 388 shillings (shillings 7.14 = \$1 U.S.) in L-1, 349 in L-2, 721 in M-1, and 707 in M-2. However, the estimated value of food crops (maize, beans, millet, cabbage, onions, carrots, peppers, tomatoes and leeks) sold is 93 shillings in L-1, 468 in L-2, 8 in M-1, and 41 in M-2. The estimated total cash value per household of these 13 commodities is 481 shillings in L-1, 817 in L-2, 729 in M-1 and 748 in M-2. Estimated average consumption values of the nine food crops (for example, average values of the quantities reported consumed within the households) were 244 shillings per household in L-1, 237 in L-2, 108 in M-1, and 228 in M-2. The average value of food crops sold is much higher in L-2 than in the other clusters, largely because the government in recent years has made a major effort to encourage and assist farmers in the Western Usambaras to grow and commercially market vegetables, large quantities of which are transported over 400 kilometers to Dar es Salaam. Since the Soni area is located along the main road from the lowlands, residents of L-2 have much easier and cheaper access to outside markets than do those of the Bumbuli area and of most other parts of the Western Usambaras.

The distribution of production and earnings from coffee seems more equal in the Moshi areas than in the Lushoto areas, and L-1 probably has the most unequal earnings distribution of the four areas. For example, although estimated values of crops sold per household are 481 shillings in L-1, 817 in L-2, 729 in M-1 and 748 in M-2, the estimated median shilling values sold per household are 221 in L-1, 395 in L-2, 523 in M-1, and 524 in M-2. That is, in L-1 the median is only 46 percent of the average, and the median in L-2 is only 48 percent of the average. In both Moshi areas, however, medians are over 70 percent of the respective averages. As another indicator of relative inequality, in L-1, an estimated 29 percent of all households reported selling crops valued at less than 10 percent of the average value sold for the area (for example, less than 48 shillings). In L-2, an estimated 23 percent of the

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\*Bananas are excluded from these estimates because most respondents said they were unable to make a good estimate of the quantity of bananas either sold or consumed at home, and because market prices can vary by as much as 1000 percent in a year. Cassava is also excluded because of the difficulty of estimating amounts grown and consumed.

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households sell crops valued at less than 10 percent (82 shillings) of the average. Only 11 percent in M-1 and 9 percent in M-2 are estimated to have sale values of less than 10 percent of their respective area averages. Standard deviations for the estimated values of all crops sold are 1,318 shillings in L-1, 1,418 in L-2, 874 in M-1, and 804 in M-2. Estimates of differentials in values of coffee produced and for the values of all 13 crops together give roughly similar magnitudes for the four areas.

Thus, the data suggest that while there is considerable differentiation in the values of crops sold and produced per household within each area, there is apparently much less variability within the Moshi than the Lushoto areas. In other words, earnings for most of the households in L-2 are probably lower than for most of the households in the Moshi areas. There may be even greater inequality in production and earnings within L-1 than in L-2, implying that production and earnings for the bulk of the households in L-1 are much lower than for the bulk of the households in the other three areas.

Ownership of coffee trees is widespread in all four areas, and the value of coffee produced and sold per household is greater than the value of any other single commodity. In M-1 and M-2, 98 and 99 percent, respectively, of all households reported owning coffee trees; corresponding percentages for L-1 and L-2 are 87 and 93. Most respondents also reported the number of trees they owned, although it was not possible to verify the number given. The average number of trees per household was about 360 in L-1 and M-2, 400 in L-2, and 460 in M-1. The reported number owned by a single household ranged up to 3,000 in L-1, 3,800 in L-2, 4,500 in M-1, and 1,600 in M-2. However, the number of trees owned by members of a household is not an adequate indicator of the value of coffee tree holdings because there can be considerable variation in the yield potential of the trees. Generally, the yield per tree in the Kilimanjaro area may be two to three times as high as that in the Western Usambaras.

Although the reported average number of trees per household ranges only from 360 to 460 in the four areas, the estimated value of coffee production per household is more than twice as high in the Moshi areas as in the Lushoto areas.

### Relative Cattle and Land Holdings

Researchers asked each male respondent how the number of cattle he owned compared with the number owned by his father when the respondent was a boy. The respondent was also asked how the size of his land holdings compared with those of his father. In L-1 and L-2, 76 and 81 percent of the respondents said they owned fewer cattle than their fathers had owned; the percentages in M-1 and M-2 were 82 and 85. Twenty-four and 17 percent in

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L-1 and L-2 and 17 and 13 percent in M-1 and M-2 said they had either about the same number or more cattle than their fathers had owned.

A similar proportion of respondents said their land holdings were smaller than those of their fathers; the percentages were 81 and 85 in L-1 and L-2, and 73 and 80 in M-1 and M-2. In L-1 and L-2, 20 and 13 percent said their land holdings either were about the same or exceeded their fathers' portions. This was the case for 26 and 19 percent in M-1 and M-2.

In L-1, L-2, and M-1, nearly half of all respondents reported that they owned no cattle, while only 11 to 18 percent reported that their fathers had owned no cattle. This suggests that the proportions of residents in these three areas who do not own cattle have increased two-and-one-half to four-and-one-half times during the past generation or two. Of course, as a result of population growth, the absolute number who have no cattle has increased much more. Although there may have been an equivalent proportional increase in the numbers not owning cattle in M-2, only 9 percent of the respondents and 4 percent of the respondents' fathers were reported as owning no cattle.

#### **Summary**

The emerging picture of these four areas is one of considerable social, cultural, health, educational, and economic changes during the past several decades, but the pattern and extent of the various changes have differed significantly among the areas. When the areas are ranked according to indicators of material or economic well-being, L-1 invariably ranks lowest and in most cases M-2 ranks highest.

The most striking differences are in housing quality, where the ranking from best and most expensive to poorest and least expensive is M-2, M-1, L-2, and L-1. M-2 is also well above the others in livestock ownership. The residents of L-1 possess the fewest consumer goods and agricultural equipment and the residents of M-2 are generally the best off, but the differences between M-2, M-1, and L-2 are less striking than they are for housing. However, L-2 is the area with the highest estimated value of crops produced and sold per household. The ranking is L-2, M-2, M-1 and L-1. The sale of food crops—particularly tomatoes and cabbage—accounted for almost 60 percent of the total estimated value of crops sold in L-2, but the sale of vegetables on a substantial scale has come about only during the past few years. The value of nonfood crops sold per household in the Lushoto areas is only about half that of the Moshi areas. Hence, the relatively high average earnings per household in L-2 are undoubtedly recent, while it is likely that average earnings from cash crops in M-1 and M-2 are not much higher—and may very well be lower—than they have been for about the past 25 years.

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Moreover, analysis of evidence concerning crop production and earnings distribution within the areas shows relatively greater inequality in the Lushoto areas than in the Moshi areas and suggests that most residents in the Moshi areas probably produce and earn more from their crops than do most residents in L-2. Most residents of L-1 produce and earn far less than do most residents of the other three areas.

In formal education, the populations' proportional ranking, from highest to lowest, is again M-2, M-1, L-2, L-1, with the differences considerably greater for women than for men. Data presented and analyzed in the next section will also show that the greatest amount of social and cultural change within the four areas has occurred in M-2 and the least amount of change in L-1. The ranking generally seems again to be M-2, M-1, L-2, and L-1.

Social and cultural changes and health, educational, and economic improvements have taken place in all four areas during the twentieth century. But the amounts and rates of change and the extent to which the changes have permeated and transformed the societies appear to differ considerably among the areas. In the next section we will analyze many of these changes and try to identify how they may have affected numbers of surviving children, desired numbers of children, and fertility.

## FINDINGS

### Fertility

Among women ages 20-24, those in M-2 have had, on the average, only about half as many births as women in the other three areas. Women ages 20-24 in M-2 have had an average of less than one birth as compared to the other women's averages of about one-and-one-half births. Among women 25 and older, there are no striking differences in average fertility, although among women ages 25-29, fertility seems to be lowest in M-2.

It will be shown that women ages 20-24 in M-2 were marrying on the average later than women in the other three areas, and were also marrying later than older women in M-2. This is probably the main reason for the different fertility experience for women ages 20-24 in M-2, compared to the other three areas. Other evidence to be presented later also suggests that average birth intervals are probably declining in all four areas, but especially among younger women in M-2. Hence, although an average of the younger women in M-2 are apparently starting childbearing later than women of similar ages in the other three areas or older women in M-2, as time goes on, shorter average birth intervals may cause fertility of these younger women to catch up.

In M-2, fertility of the women of the two age groups 20-24 and 25-29 is lower overall than that of women of the same age groups in the other three areas. Among women ages 30-34, a somewhat higher proportion have had

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five or more births in Moshi than in Lushoto. Otherwise, the differences among the four areas seem to be relatively modest for women 30 and older.

Thus, the fertility data suggest that among women over age 30 there are relatively few differences in fertility experiences among the four areas. Whatever differences do show up point to no clear trends either within or among the areas. However, among women under age 30, and particularly for those ages 20-24, fertility is definitely much lower in M-2 than in the other three areas. There is no real evidence of any trends among younger women in the other three areas, although data to be presented on duration of breastfeeding suggest that average birth intervals—particularly among younger women—may be declining in all three of the other areas—although not as much as in M-2, but less in L-1 than in L-2 and M-1. Data for women ages 20-24 are consistent with this possibility, showing reported average numbers of live births and proportions with more than two live births to be higher in both L-2 and M-1 than in L-1.

#### **The Number of Surviving Children**

The number of surviving children is the number born less those who die. One indicator of the mortality level is female life expectancy at birth. Based on reported age distribution, female life expectancy at birth is in the range of 50 to 55 years in all four study areas. For Tanzania as a whole and for rural Africa generally, these are high values. Survival rates have increased in all four study areas in recent decades, although researchers do not know when they started to increase, how fast, or how much. Female life expectancies probably did not exceed 30-35 years at the turn of the century, and may even have been lower. (As noted in the previous section, the ratio of medical facilities to population in rural areas of Lushoto and Moshi Districts is among the highest in all of Tanzania.)

#### **Age at First Marriage**

Data suggest that average age at first marriage may have been rising in all four areas in recent years; however, the increase has apparently been substantial in M-2 and modest in the other three areas. In M-2, only 34 percent of the women ages 20-24 reported that they had been married before age 20 as compared to about 60 percent in the older three age groups. Between 61 and 70 percent of those 20-24 in the other three areas reported that they had been married by age 20. The apparent modest declines in average marriage age in the other three areas may be real or the result of older women's underestimation of age at first marriage, compared with the estimates of the women who were 20-24 at the time of the survey. The older women in M-2 could have also underestimated their ages at first marriage, but it is most

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unlikely that this accounts for the entire decline from about 60 percent to 34 percent reportedly married by age 20 in M-2.

Among women ages 15-24 at the time of the survey, 50 percent in L-1, 51 percent in L-2, 55 percent in M-1, and 80 percent in M-2 said they had never been married. The proportions never married in age groups 15-19 and 20-24 are much higher in M-2 than in the other three areas. Half the women ages 20-24 in M-2 were single, compared with only about a quarter in the other three areas.\* Otherwise, the marriage patterns appear to be similar among the four areas, except that in the Moshi areas a much higher proportion of women age 60 and above said they were widows than did those of the same age group in the Lushoto areas.

### Incidence of Polygamy

The researcher found only modest differences in the reported incidences of polygamy among husbands age 60 or more and fathers of all ages in the study areas. According to male respondents, between 63 and 75 percent of their fathers were polygamists at some time. Among respondents age 60 or more at the time of the survey, 38 percent in L-1, 47 percent in L-2, 36 percent in M-1, and 42 percent in M-2 were polygamists at the time of the survey.

However, there were substantial differences in the reported incidence of polygamy among the younger respondents. In L-2, the percentages of polygamous respondents were roughly similar for ages 40-49, 50-59, and 60 and over. The incidence of polygamy may have been a little lower among those ages 40-49 in L-1 and among those 40-59 in M-1. The reported incidence of polygamy is much lower for those ages 40-49 and 50-59 in M-2: 12 and 8 percent versus 42 percent among those 60 and older. Moreover, among age groups 20-29 and 30-39, the percentages of polygamous people in M-2 are also much lower than in the other three areas. For these two age groups, 2 and 4 percent were polygamists in M-2, compared to 11 and 12 percent in M-1, 12 and 19 percent in L-1, and 14 and 31 percent in L-2. In fact, it seems apparent that among those under age 60 in M-2, the practice of polygamy has almost disappeared. In M-1, polygamy is still common, although it may be less frequent. In L-1 and L-2 it is impossible to determine yet whether polygamy is becoming less common.

Data on the incidence of polygamy among respondents age 60 and over and on the reported incidence of polygamy among respondents' fathers suggests that, in the past, the frequency of polygamy was similar in all four

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\*In the United States, 28 percent of the women ages 20-24 were single in 1960 and 40 percent of the women ages 20-24 were single in 1975 (U.S. Bureau of the Census 1976).

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areas. At least there is no indication that it was lower in M-2 than in the other three areas. Quite clearly, there is a dramatic decline in the incidence of polygamy in M-2, as compared to the other three areas. The decline also seems relatively recent. It has apparently occurred within the past 25 to 30 years.

Traditionally, material wealth was the main condition that enabled a man to take a second wife. He had to be wealthy enough to provide each wife and her children with a house and enough land to cultivate. But M-2 has been the most prosperous area of the four during the last 20 to 40 years. It has also experienced less settlement density than M-1. Declining or insufficient wealth does not appear to be the reason for the precipitous decline in the incidence of polygamy in M-2. Comparisons of L-1 and L-2 show that, except for ages 50-59, the incidence of polygamy for all age groups of respondents is higher in L-2 than in L-1, and substantially higher for ages 30-39 and 40-49. This difference, however, is consistent with the hypothesis that there is a relationship between wealth and the frequency of polygamy, since the average level of wealth per household in L-2 is apparently higher than in L-1.

Other factors being equal, one expects fertility to be somewhat higher in a monogamous society than in a polygamous society. During the last quarter century or so, fertility may have risen somewhat in the Moshi areas—particularly in M-2—as a result of the decline of polygamy. However, since there appears to be little if any change in the incidence of polygamy in the Lushoto areas, there is no reason to assume that it has caused any change in fertility levels in recent years.

#### **Incidence of Sterility**

The prevalence of sterility can be inferred from the percentage of ever-married women who reported having never given birth. The proportion is very low in all four study areas. Among all women age 30 or more, the percentage ranges from 0.3 percent in L-1 to 1.6 percent in L-2. The percentages are, of course, much higher among those less than age 20, ranging from 23 percent in L-1 to 41 percent in M-1. However, many of these women were only recently married.

These data show that less than 2 percent of the study area women age 30 or over had never been married, and suggest that the prevalence of sterility among couples is extremely low in all four study areas. Among currently married women ages 35 or over, more than 90 percent in all four areas have given birth to at least three children. Altogether, these data suggest that sterility has been relatively low in all four areas, and that there is relatively little prospect of a rise in fertility.

### Average Duration of Breastfeeding

The duration of lactation can be an important determinant of fertility. Breastfeeding prolongs the average interval between the time a woman gives birth and the resumption of ovulation, and hence prolonged breastfeeding increases the average interval between the birth of one child and the next pregnancy. Studies have shown that this ovulation-inhibiting effect can last for up to one and one half to two years (Van Ginneken 1974). In addition, full breastfeeding delays ovulation more than partial breastfeeding in which breast-milk is supplemented with other foods in the baby's diet.

The reported average duration of breastfeeding among women in the study areas was 35 months in L-1, 31 months in L-2, 32 months in M-1, and 30 months in M-2. Standard deviations were 10 months in L-1, 12 months in both L-2 and M-1, and 14 months in M-2. Thus, the differences among the four areas were relatively small, with averages ranging from 30 to 35 months and standard deviations ranging from 10 to 14 months. However, the reported average duration was longest in L-1 and shortest in M-2. The least variation occurred in L-1 and the most in M-2. Evidence discussed earlier shows that L-1 was the area that experienced the least sociocultural, economic, and educational changes, while M-2 was the area that changed most.

Breastfeeding beyond about two years probably has no further effect on the average time at which ovulation resumes. (Van Ginneken 1974) A comparison of all women age 50 or older with those 40-49 and 20-29 shows the following percentages who reported breastfeeding their last baby for more than two years: L-1, 81, 76, and 62 percent respectively; L-2, 75, 66, and 33 percent; M-1, 83, 66, and 29 percent; M-2, 67, 56, and 20 percent. Among all women age 45 or older, not more than 3 percent reported having breastfed for as little as one year in any of the four areas. However, among women ages 20-24, 7 percent in L-1, 11 percent in L-2, 12 percent in M-1, and 40 percent in M-2 reported breastfeeding for one year or less.

Thus, it appears that for about the past 20 years, the average duration of breastfeeding has declined substantially in M-2, somewhat in L-2 and M-1, but little if at all in L-1. Moreover, in M-2 a significant proportion of younger women (about one-third of those ages 20-29) now report breastfeeding for one year or less. This is probably causing ovulation to resume earlier after a birth than has been typical in the past and is probably causing some decline in average birth intervals.

All women who had ever given birth were asked whether they thought women these days are breastfeeding for a longer period of time, shorter period of time, or about the same length of time as compared to the average length of time their mothers breastfed. In all four areas the overwhelming belief is that women these days are breastfeeding for a shorter period of

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time. Eighty-six percent in L-1, 90 percent in L-2, 96 percent in M-1, and 91 percent in M-2 gave this answer. Out of 1,570 respondents, only three answered "longer now." Another 20 respondents (1.3 percent) said they didn't know. The rest thought it was about the same as in the past.

#### **Post-birth Sex Taboos**

Researchers did not ask about the practice of post-birth sex taboos. However, they did ask respondents why they thought that women now breastfeed for a longer or shorter length of time than women did in the past. The most common category of answers is the one that can be loosely interpreted as "Women these days are breastfeeding for a shorter period of time because they resume sexual intercourse with their husbands sooner than in the past and, as a result, they get pregnant sooner." Prolongation of post-birth sexual intercourse by women is traditionally practiced in all four study areas; it is reported to have commonly lasted two years or more in the past. A large proportion of women believe this practice is falling by the wayside. Among those respondents who believe that women are breastfeeding for shorter periods these days, the first or main reason given by 41 percent in L-1 52 percent in L-2, 43 percent in M-1, and 51 percent in M-2 was the one described above. The second most common category had to do with supplementary or bottlefeeding of babies. Even this category of answers masks the assumption that women are engaging in sexual intercourse earlier than in the past. One assumes that women are having sexual intercourse and getting pregnant, either because the previous baby has been weaned, or because mothers are supplementing breastfeeding with other foods.

The analysis and discussion so far in this section have addressed the five intermediate variables listed in the model in Figure 2: Incidence of sterility, age at first marriage, incidence of polygamy, adherence to post-birth sex taboos, and duration of breastfeeding.

The author also made estimates of current mortality conditions. Survival rates have apparently risen considerably over the past few decades. This rise has probably reduced fertility by increasing the average interval between pregnancies and births. However, some other changes in intermediate variables probably had the opposite effect on fertility, at least in the Moshi areas, and particularly in M-2. The greatest amount of change in the intermediate variables listed above occurred in M-2. Age at first marriage had been rising considerably. The effect of this rise was a reduction in average fertility. On the other hand, the incidence of polygamy declined dramatically, and among younger women, the average length of breastfeeding apparently declined and may have been causing an earlier average resumption in ovulation. Evidence also suggests that the traditional postpartum sex

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taboo was being increasingly disregarded. The net effect of these three changes is probably a reduction in the average interval between births in M-2. Similar but apparently less dramatic reductions in the incidence of polygamy, average length of breastfeeding and adherence to postpartum sex taboos also took place in M-1. There were probably some changes in the Lushoto areas, too, with the exception of the incidence of polygamy.

### Type of Prenatal Care

Residents of all four areas had relatively easy access to health care facilities; probably all women lived within no more than a two or three-hour walk from a clinic or hospital. Grouping all women age 15 or more together, 58 percent in L-1, 59 percent in L-2, 57 percent in M-1, and 56 percent in M-2 reported visiting a medical facility at least once for prenatal care during their most recent pregnancies. A comparison of women ages 40-44 with those ages 20-24 gives the following proportions of respondents who reported having made at least one visit to a medical facility for prenatal care: L-1, 57 and 74 percent for ages 40-44 and 20-24, respectively; L-2, 67 and 88 percent; M-1, 59 and 86 percent; M-2, 60 and 97 percent.

The proportions of women attending a health facility for prenatal care has apparently been increasing steadily and is progressively higher among younger women. In all four areas, more than half the women ages 45-49 report not having received modern prenatal care during the last pregnancy. Among women in the next youngest age group, ages 40-44, more than half received modern prenatal care during their last pregnancies. Second, while all four areas were similar in the proportions of women receiving modern prenatal medical care during their last pregnancies, among those under age 35, the highest percentages attending were in M-2 and the lowest were in L-1. However, in both L-1 and L-2 (and particularly in L-2), a high proportion of those receiving modern prenatal care reported having attended a clinic more frequently than once a month.

### Delivery Place

Thirteen percent of all women in L-1, 25 percent in L-2, 47 percent in M-1, and 38 percent in M-2 report having been in a hospital or having had the services of a medically trained midwife during their last deliveries. Among women ages 20-24, the corresponding percentages are 25 in L-1, 36 in L-2, 74 in M-1, and 71 in M-2. One partial explanation for the relatively high proportions in M-1, in particular, is that a sizable Catholic mission hospital was located just across the eastern border of the study area. Although residents of the other three areas also had hospitals close by, none were as conveniently located as in M-1.

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### **Education**

Children in the survey areas are supposed to enroll in the first grade at age 7. But children frequently enter school when they are older; sometimes as old as 12 or 13. The Government of Tanzania provides universal primary education to all children in Tanzania as soon as possible, which would encompass grades 1-7. In 1973 about half of all Tanzanian primary school-age children, approximately ages 7-15, had never been enrolled in school. Data from the study areas show that educational levels are above the national average in all four areas and in M-2 are probably about as high as in any rural area in the country.

Several observations can be made. First, primary education has become almost universal for boys born since 1943 (less than age 30 at the time of the survey) in L-2, M-1, and M-2, although only about 80 percent of the boys born since 1943 in L-2 have received formal education. Girls have fared less well. Among girls ages 20-29, 35 percent in L-1, 42 percent in L-2, 58 percent in M-1, and 72 percent in M-2 have received some formal education. The proportions improved substantially for girls ages 15-19 (born 1954-1958) although a considerably higher proportion of girls than boys in this age group still received no formal education. Proportions of girls ages 15-19 with some formal education were 58 percent in L-1, 74 percent in L-2, 76 percent in M-1, and 90 percent in M-2.

The proportions of boys ages 20-29 who received ninth grade or higher education were 6 percent in L-1, 9 percent in L-2, 13 percent in M-1, and 20 percent in M-2. Corresponding proportions for girls were 0 percent in L-1, 1 percent in L-2, 4 percent in M-1 and 3 percent in M-2. For girls ages 20-29, 7 percent in L-1, 16 percent in L-2, and 31 percent in M-1 and M-2 received five years or more of formal education. For girls ages 15-19, 30 percent in L-1, 38 percent in L-2, 49 percent in M-1, and 55 percent in M-2 received five or more years.

Among respondents ages 30-59 (in school during the period 1925-1960), about 50 percent of the males in L-2 and M-2 and about 40 percent in L-1 and M-1 received some formal education. Percentages of women in these age groups who received some formal education were much lower and ranged from about 5 percent in L-1 to about 20 percent in M-2. The descending order of percentages was M-2, M-1, L-2, and L-1. Among respondents age 60 or older, 23 percent of the men in L-2, 21 percent in M-1, 12 percent in L-1, and 5 percent in M-2 received some formal education. Virtually none of the women over age 60 in all four clusters received any formal education.

Thus, educational levels have been improving gradually in all four areas during the last 50 years, but they have improved most rapidly and covered a higher proportion of the population, particularly among women, in M-2. The least improvement has been in L-1.

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Formal education—particularly of women—has been identified in many studies and development theories as an important contributor to modernization and social and cultural changes that those making the changes, at least, consider superior to traditional norms and practices. Reduction in the average duration of breastfeeding and bottlefeeding or use of other breast milk substitutes may be one such type of nontraditional practice. Monogamy may be another.\* Researchers also identified formal education—again, particularly of women—as an important factor contributing to the attitudes favorable to small families and of receptivity to modern methods of contraception.

The data on educational attainments, particularly for women, suggest that whatever effects educational improvements may be having, the average of actual and desired numbers of surviving children will be greatest in M-2 and least in L-1, and that there was a big gap between M-2 and L-1. L-2 and M-1 were in between, and educational levels in the two were similar in recent years, with the main difference being that a somewhat higher proportion have five or more years of formal education in M-1 than in L-2.

### Education and Religion

Religious differentials associated with educational attainment are striking. Data are not presented for M-2 since 99 percent of the respondents there were Christians.

In the other groups the educational attainment of Christian women and husbands ages 20-39, compares favorably with the overall educational attainment of the same age groups in M-2. Among children ages 10-19, and particularly among those ages 10-14, religious differentials are much less pronounced for boys, although they are still significant for girls. This no doubt reflects the taking over of all primary schools by the government during the 10 years prior to the survey; and religion was no longer a criterion for entrance into what were formerly mission schools. Subsequently, about as high a proportion of non-Christian as Christian boys were enrolled in primary school. The much higher proportions of non-Christian than Christian girls ages 10-19 who never attended primary school reflect greater reluctance

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\*Catholic missions officially recognize only a man's marriage to a first wife. This is an important factor in the low incidence of polygamy in M-2 where 92 percent of both husbands and wives are Catholics. The incidence of polygamy is considerably higher in M-1, even though 86 percent of ever-married women and 76 percent of husbands are Catholic. However, many of the men in this 10 percent difference between women and husbands are probably polygamists whose first wife (and maybe second and third, as well) considers herself a Catholic. But the husband is not a Catholic because he is a polygamist. Hence, he is not considered a Catholic by the Church, his wives or himself. Thus, while 21.4 percent of husbands are reported to follow traditional religious beliefs, only 11.6 percent of the ever-married women do.

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tance by non-Christian parents to allow their daughters to attend school than is the case for Christian parents.

Religious differentials—and the historical pattern by which Christian missions and mission activities spread in the study areas—appear to account for many of the observed educational differentials among and within the study areas. The educational differences that have emerged over the last half century probably account, at least in part, for many of the differentials noted earlier in social and cultural practices and changes, in health practices, and perhaps to some extent in economic changes.

#### **Economic Changes**

During the past half century or so, cash incomes have become increasingly important among householders. The sale of cash crops, primarily coffee, has produced most of the income. Particularly during the 1950s, when coffee prices were relatively high, and in the 1960s, a relatively large proportion of householders in the Moshi areas spent considerable sums of money for improved housing. Some householders also purchased expensive hybrid or European cattle. Householders in the Lushoto areas have also been earning cash incomes for some time, but the sums have averaged considerably less until recently, when the sale of vegetables produced relatively large earnings for some growers, particularly in L-2. At the time of the survey, about 20-25 percent of the households in all areas but L-1 also had one or more members with a non-farm income. In addition to improved housing, of which there has been relatively little to date in the Lushoto areas, cash incomes have enabled householders to purchase modest types of consumer goods and agricultural tools and equipment, many of which are used in the production and processing of cash crops.

Another important set of economic changes has been the increasing scarcity of land, parcelling of it, and rapidly rising land values, caused primarily by steadily increasing population densities and rising incomes. Most residents of the study areas are concerned about this increasing land scarcity, partly because of the greater difficulty and expense of providing an adequate or socially acceptable inheritance for male children.

The net impact of these various economic changes on the intermediate variables discussed in the first part of this chapter is not clear. If anything, the initial effect is to raise fertility. For example, cash incomes may enable women to purchase breast milk substitutes and thus reduce the average length of breastfeeding and interval between births. By enabling people to construct more expensive and modern types of houses and to purchase some modern consumer goods, cash incomes and improved material wellbeing may contribute to aspirations, attitudes, and values that are incompatible with traditional norms and practices. This, in turn, may contribute to rejec-

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tion of such traditional practices as polygamy and postbirth sex taboos. Most fertility studies comparing polygamous with nonpolygamous societies have found fertility to be somewhat lower in polygamous societies. One might expect that one consequence of a reduction in the incidence of polygamy would be a relaxation of the adherence to postpartum sex taboos. Rising economic prosperity might enable young men to acquire enough land to marry earlier, and this could lower the average marriage age of both men and women. On the other hand, rising income and formal educational attainment levels for women could cause the average age at first marriage for women to rise; and this seems to have been the case in M-2 if not yet in the other areas.

On balance, it is not yet possible to say what net effect economic changes have had on intermediate variables, and hence on fertility. Further analysis of this study's data may eventually provide some answers. It does appear that in M-2, age at first marriage has recently risen significantly, thereby delaying the average age at which women first give birth. But it also seems likely that the average interval between births has been decreasing, especially for younger women. Economic gains in M-2 have contributed to both of these changes. But again, the net effect on the average number of births that women will eventually have during their childbearing years is unknown. Economic improvements have probably helped reduce infant and early childhood mortality and hence raised survival rates. Presumably economic improvements, combined with cultural and other changes may be bringing about changes in the way people perceive the advantages of large families. Data presented in the next section may provide some clues as to what proportion of women and husbands, if any, have reached Stage 2 of the transition.

### Desired Number of Surviving Children

In Figure 2, stage 1 of the transition begins at the time when survival rates for infants and young children (and therefore the average number of surviving children per woman) begin to rise. The model presumes that continuing social and cultural changes and health, educational, and economic improvements will eventually cause couples to change their attitudes about the advantages of the number of surviving children, and will eventually cause them to feel that it would be in their best interests to have fewer children. Stage 2 of the transition is marked by the beginning of a decline in the average number of surviving children desired by the representative or typical parent.

This section presents some information on parents' attitudes toward the advantages of both large and small numbers of children, on perceptions of

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changes in survival rates for infants and children, and on characteristics of parents who say they don't want any more children.

#### **Advantages of Large and Small Families**

Parents were asked two questions: 1) Do you think there are any advantages in having a large number of children? and 2) Do you think there are any advantages in having a small number of children? About 60 percent of both fathers and mothers in L-1, L-2, and M-2 thought there were advantages to large families. In M-1, 40 percent of the men and 35 percent of the women thought there were advantages. Between 30 and 40 percent in L-2 and M-2 thought there were advantages to small families. Of women in L-1, only 23 percent thought there were advantages, and 19 percent "didn't know"; 57 and 51 percent respectively of men and women in M-1 thought there were advantages to small families.

If the respondent answered Yes to the question about advantages of a large number of children, interviewers then asked, What are the advantages? Researchers asked a similar follow-up question of respondents who said there were advantages to a small number of children. There was an interesting and consistent difference between the Lushoto areas and the Moshi areas in the types of reasons given, and relatively little difference between the areas within each district. There is a much higher incidence of the reason, "to help with work," in Lushoto than in Moshi. For men and women combined, 67 percent in L-1 and 62 percent in L-2 gave this as their first or only reason, compared to 35 percent in M-1 and 37 percent in M-2. In all four areas, a higher proportion of women than men gave this reason, and it seems to be of less importance for men than for women in Moshi. Twenty-seven percent of the men in M-1 and 32 percent in M-2 gave this reason, compared to 43 percent of the women in M-1 and 42 percent in M-2. This may reflect the fact that in all areas women do considerably more agricultural and household work than men.

It seems to be more important to respondents in Moshi than to those in Lushoto to have children who would care for them in old age. Of those who thought there were advantages to large families, 41 percent in M-1 and 46 percent in M-2 gave this as their principal reason, compared to 22 percent in L-1 and 23 percent in L-2. In all four areas the reason, "to increase the

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\*Prior to asking these two questions, each respondent was asked to indicate the largest number of children that she or he would still consider to be a small family and the smallest number of children that she or he would consider to be a large family. Only 15 to 20 percent in all four areas thought that less than six children could still be a large family. On the other hand, between 35 and 63 percent thought there would have to be at least eight or more children before a family could be considered large.

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family size (or the size of the nation)," was third in relative importance. An average of about 5 percent of the respondents in Lushoto and about 10 percent in Moshi gave this as their principal answer. Interestingly enough, in all four areas, a substantially higher proportion of men than women gave this as their first or only reason. In Moshi the proportion was about twice as many men as women, and in Lushoto more than twice as many men gave a reason in this category. Between 1 and 5 percent of all responses fell into two other categories of reasons, namely, "to provide happiness or prestige," and "in case some of our children die."

### Opinions about Survival Rate Changes

Before women want to take actions to curb fertility (beginning of Stage 3 in the transition models of Figures 1 and 2), they must recognize that infant and childhood survival rates have been rising, and that survival rates have, in fact, risen to the point where women can expect to end up with more children than they want. The concept of recognizing a rising average number of surviving children per woman in helping to change attitudes toward fertility control is incorporated into the lower portion of Figure 2.

Researchers asked respondents, Do you think children these days are more likely to die, less likely to die, or have about the same chance of dying as in the past? Opinions of Lushoto area residents differ greatly from those of Moshi area residents. Only about 26 percent of men and women in L-1 and 30 percent in L-2 thought that fewer children were dying these days than in the past. This compares with more than 80 percent in M-1 and about 65 percent in M-2 who held this opinion. This view was held by about 9 percent more men than women in L-1, L-2, and M-2, and by about 3 percent more men than women in M-1.

When researchers examined responses by age group, they found relatively little difference among men in the proportions holding the various views. Among women in L-1, L-2, and M-1 there seemed to be a tendency for a higher proportion of younger women, to believe that fewer children these days are dying than in the past. No differences based on age are apparent among women in M-2.

These differences in attitudes between Moshi area residents and Lushoto area residents probably do not reflect actual differences in health conditions, differential changes in health conditions in recent decades, or access to health facilities. Access to health facilities in all areas is among the best in the country, and survival rates are among the highest in Tanzania. Researchers asked respondents why they thought children were either more or less likely to die these days than in the past. The reasons given show that the Moshi area residents have more confidence in the efficacy of modern medical services in reducing infant and child mortality than do the Lushoto area

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residents. In the context of the models in Figures 1 and 2, it seems likely that in the Lushoto areas, perceptions of increases in the numbers of surviving children may lag farther behind actual increases in average numbers surviving than they do in the Moshi areas. If this is the case, one would expect that, other things being equal, among mothers and fathers with otherwise similar characteristics, a higher proportion in the Moshi areas than in the Lushoto areas would feel that they didn't want any more children. The Moshi respondents would be more realistic in assessing survival rate improvement.

#### **Parents Who Want No More Children**

Interviewers asked respondents whether or not they wanted more children. Almost without exception, the higher the number of surviving children, the higher the percentage who say they do not want more children. This is the case for both men and women in all four study areas. Generally, for any given number of surviving children, a higher proportion of respondents in Moshi than in Lushoto said they wanted no more children. In most cases, M-I was the area with the highest percentage of respondents who said they wanted no more children. Again, almost without exception, for a given number of surviving children, a higher percentage of women than men said they wanted no more children.

Apparently the biggest difference between the Lushoto and Moshi respondents is among mothers with smaller numbers of surviving children. Among those with four or fewer surviving children, almost twice as many mothers in the Moshi areas as in the Lushoto areas said they wanted no more children.

Comparisons were made between women in the four study areas and women from studies of urban and rural women in six other countries. The other studies were made between 1968 and 1971, and were conducted in India, Korea, Philippines, Taiwan, Thailand, and West Malaysia. In most cases, a smaller proportion of women in each of the four Tanzania study areas want no more children than in the other six studies with the exception of West Malaysia.

As educational attainment rises, in India, the Philippines, and Taiwan, the proportion of women who want no more children generally also rises. In Korea, West Malaysia, and rural Thailand there does not seem to be a significant trend; although in Thailand, as educational attainment rises, there may be some tendency for a decline in the proportion of women wanting no additional children.

In the Tanzania study areas, there were almost no women educated beyond primary school and in the Lushoto areas, few had even primary school education. However, if there is a differential based on education it seems to

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be that as educational level rises, the proportions of women who do not want more children declines. One possible explanation might be that women with primary school education are likely to have married later and, therefore, average fewer children born and surviving than women of the same age who received no formal education—and who probably married and started bearing children earlier. In any case, there is no evidence from the study areas that educated women in Tanzania want to have fewer children than women without any primary schooling.

### Deliberate Birth Prevention

Because the topic was politically sensitive in Tanzania at the time of the survey, it was not possible to question respondents about knowledge of, attitudes toward, or practice of either contraception or abortion. Almost certainly, no modern contraceptives are used in the Lushoto areas because they are not available. Condoms are available in Moshi town and it is possible, although most unlikely, that they have been used in the study areas. The Tanzania Family Planning Association operated a clinic in Moshi town, although almost all of its clients were town residents. In 1973, in conjunction with the Kilimanjaro Christian Medical Center (a joint government- and Lutheran-operated hospital in Moshi town), the Association began using a mobile unit to offer services in areas around Moshi town. There were no known clients in either of the Moshi study areas at the time of the survey.

Thus, while it is not possible to state categorically that no women in the study areas were in Stage 3 of the transition and actively attempting to prevent pregnancies or births, it seems almost certain that no women were using modern contraceptive techniques. Of course, Stage 3 presupposes both knowledge of and access to contraceptive methods, as well as an attitude favorable to using them. It is quite possible that some women were receptive to the idea, but were taking no action, either because they lacked knowledge of or access to methods. Thus, while it seems probable that women were not deliberately controlling fertility in the study areas and thus, by definition, had not yet reached Stage 3 in the transition, there may be some incipient fertility decline in the sense that some women may have receptive attitudes and are only awaiting knowledge of and access to contraceptive methods.

Evidence was presented that some substantial proportion of women—especially Moshi area women with more than five surviving children—have reached the point at which the actual number of surviving children exceeds the desired number. They say they want no more children. These women may be approaching Stage 3, and some may only be awaiting access to modern contraceptives.

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CONCLUSION

The data presented in this paper clearly indicate that many social, cultural, health, educational, and economic changes have taken place in all four study areas since about the beginning of this century. Today none of these four areas can be considered a traditional rural African community. It is equally clear that the types of changes that have occurred, the rates of change, and the extent to which the changes have permeated and transformed the societies in each area have been markedly different.

Table 2 summarizes some of the important changes and differences among the four areas illuminated by this study. Health conditions have improved and mortality has declined dramatically in all four areas. In the context of the theoretical framework on which the study is based, there seems little doubt that most of the women and families in all four areas—particularly in Moshi—have experienced rising survival rates and rising average numbers of surviving children; they have at least moved into Stage 1 of the transition. There is also evidence of some health and mortality differentials. As seen in Table 2, even among women ages 20-24, between 3 and 26 percent in each of the study areas did not receive modern prenatal medical care prior to the birth of their last babies, and about 25 percent in the M-1 and M-2 to 75 percent in L-1 did not have the assistance of a medically trained person during their most recent births.

Although these are no longer traditional areas, there are probably considerable differences among women in these areas, particularly where their health and the health of their children is concerned. As a result, mortality experiences of the women have probably differed considerably. This would have affected not only actual survival among their children, but probably the perceptions of the women concerning the survival prospects for their children. Table 2 summarizes profound differences in perceptions of changes in survival probabilities among parents in the Lushoto and Moshi areas. The table suggests that most of the Moshi area residents—particularly M-1—believe that survival rates have been rising in recent years, as compared to only about a fourth to a third of the residents of the Lushoto area (L-1 and L-2). It seems reasonable to conclude that a relatively large share of the Moshi residents has moved well into Stage 1 of the transition, while a much smaller proportion of the Lushoto residents has done so.

Important cultural and social changes that have taken place include the following: In M-2 and M-1, 99 and 82 percent, respectively, of the adult residents have become Christians as compared to 18 and 24 percent, respectively, in L-1 and L-2. Average age at first marriage in M-2 has risen dramatically in recent years, apparently changing little if at all in the other three areas. This has been associated with the achievement of almost universal

**Table 2**  
**Summary of Selected Characteristics of Study Areas**

Study Areas	Tbce and religion	Survival Rates Female expectation of life at birth (years)	Age of First Marriage		Incidence of Polygamy		Current age group	Duration of Breast-Feeding % reported breast-fed more than 2 years	Prenatal Care % Not visiting health facility before last birth	Delivery Place % of last babies not born in hospital or with medical midwife	Formal Education <sup>1</sup>		
			Years when age 20	% of All women reported married before age 20	Approximate years born	% of Men reported polygamous at least once					Approximate years born	Approximate % with some formal education: men-women	
L-1	92% Sambia 82% Moslem, 18% Christian	53-55	1969-73	61%	1914-33	41%	20-24	56%	26%	75%	1954-58	75%	58%
			1954-68	70%	pre-'10	48%	40-44	71%	43%	89%	1944-53 pre-'14	73% 4%	20% 1%
L-2	80% Sambia 75% Moslem; 24% Christian	50-52	1969-73	70%	1914-33	47%	20-24	33%	12%	64%	1954-58	94%	74%
			1954-68	72%	pre-'10	62%	40-44	73%	33%	79%	1944-53 pre-'14	82% 23%	33% 0
M-1	99% Chagga 82% Christian; 16% Traditional	50-52	1969-73	61%	1914-33	23%	20-24	25%	14%	26%	1954-58	94%	76%
			1954-68	68%	pre-'10	54%	40-44	68%	41%	54%	1944-53 pre-'14	77% 21%	49% 1%
M-2	99% Chagga 99% Christian	53-55	1969-73	34%	1914-33	10%	20-24	16%	3%	29%	1954-58	97%	90%
			1954-68	60%	pre-'10	62%	40-44	45%	40%	58%	1944-53 pre-'14	83% 9%	65% 1%

<sup>1</sup>1954-58, children of respondents; 1944-53 and pre-1914 are respondents themselves.

Study Areas	Housing Quality			Main Occupation % Non-Agricultural	Estimated Shilling Value Per Household of 13 Crops (Previous 12 months) <sup>1</sup>		Current age group	Livebirths Compared with Formal Education				Perception of Mortality Changes <sup>2</sup>		Want No More Children							
	% of all households with at least 1 building with following:				Pro-	Sold		years born	Livebirths			Formal Educ.	Current Age Group	% Who believe children less likely to die these days		No. surviving children	% Who want no more children:				
	Good Roof	Good Floor	Good Walls Roof Floor						Men-	Women	Ave. No. live-			% With 2 or fewer births	% with none		% 5 or more years	Men-	Women	Fathers	Mothers
L-1	34%	5%	2%	8%	4%	725	481	20-24	1949-53	1.3	85%	78%	9%	20-29	27%	23%	0-2	3%	12%		
								25-29	1944-48	3.4	24%	83%	3%				3-4	10%	27%		
								30-34	1939-43	4.6	11%	92%	0				5-6	30%	50%		
L-2	34%	17%	4%	22%	8%	1053	817	20-24	1949-53	1.6	74%	62%	19%	20-29	39%	32%	0-2	2%	9%		
								25-29	1944-48	3.7	26%	71%	10%				3-4	26%	21%		
								30-34	1939-43	4.6	14%	74%	8%				5-6	47%	52%		
M-1	65%	45%	24%	23%	6%	837	729	20-24	1949-53	1.6	76%	43%	33%	20-29	88%	83%	0-2	9%	15%		
								25-29	1944-48	3.2	30%	60%	16%				3-4	24%	47%		
								30-34	1939-43	4.9	13%	64%	12%				5-6	60%	53%		
M-2	92%	52%	31%	20%	7%	976	748	20-24	1949-53	0.8	92%	28%	32%	20-29	76%	66%	0-2	18%	15%		
								25-29	1944-48	3.0	42%	38%	13%				3-4	21%	40%		
								30-34	1939-43	5.0	17%	60%	10%				5-6	42%	55%		
																7+	61%	66%			

<sup>1</sup>Excludes bananas and cassava.

<sup>2</sup>From among the following three categories: 1) less likely, 2) same likelihood, and 3) more likely. Excluded are all "don't know" responses; these ranged from 2 to 7 percent of the total.

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primary education for girls in M-2 while only about 60 to 75 percent of girls ages 15-19 at the time of the survey had received any primary schooling in the other three areas. Nonetheless, this represents a marked increase in recent years in the proportions of girls who have received some schooling, particularly in the Lushoto areas. The high proportion of girls in M-2 who have received some primary school education is a major cause of the recent rise in average age at first marriage. The latter is undoubtedly the principal cause of the apparent recent precipitous decline in average fertility among women under age 30 in M-2, as compared to older cohorts in M-2 and cohorts of all ages in the other three areas. The incidence of polygamy may have declined slightly in the Lushoto areas; it has probably declined substantially in M-1, and it has declined dramatically in M-2. Average length of breastfeeding has apparently declined somewhat in L-1 in recent years, while declining substantially in the other three areas—particularly among younger cohorts of women. Among younger women, average duration of lactation seems to be shortest in M-2. Only 16 percent of women ages 20-24 in M-2 report breastfeeding for more than two years as compared to 56 percent of the same age group in L-1.

The net effect of these cultural and social changes on fertility is unclear. It seems certain that women in M-2 are, on the average, starting to bear children considerably later than in the past. But it also appears that average birth intervals—particularly among younger women—are declining in M-2, so that while women are delaying childbearing, once they start bearing children they are also having more frequent births. There is little evidence of a rising average age at first childbirth among women in the other three areas, although it is possible that average birth intervals may be declining.

Economic improvements have been taking place in all four areas. The first quantum jump in incomes probably occurred at least 20 years ago in the Moshi areas, but average household incomes in the Moshi areas may not have risen much in recent years. Average incomes have risen substantially in L-2 in the last few years; average cash incomes are still considerably lower in L-1 than in the other three areas. The cash incomes of the past 20 years have enabled a sizable majority of households in the Moshi areas—particularly M-2—to purchase improved housing. Only a much smaller proportion of households in the Lushoto areas—and particularly L-1—have acquired improved types of housing.

It is not possible to determine what proportion of the mothers and fathers, if any, are in Stage 2 of the transition, although it appears that a sizable proportion of younger women in the Moshi areas have reached Stage 2. Respondents' attitudes show that only about half as many respondents in the Moshi areas as in the Lushoto areas value large numbers of children for the work they provide. In comparison to the Lushoto respondents, the role of

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children as sources of old age security is much more important to Moshi residents than their role as workers. This observation suggests that Moshi parents are finding that the direct economic benefits of children, while they are still children, are less important than in the past. If so, this may imply that parents in Moshi are starting to feel that large numbers of children are less valuable than in the past. Some parents may now want a smaller number of children than typical parents did in the past, but this is speculation; there is no direct evidence of such a trend.

There is some evidence, however, that an increasing proportion of parents, particularly mothers, in the Moshi areas may feel that they now have or are likely to end up with more surviving children than they want. That is, they are to the right of point e in the model presented in Figure 1, and are probably in Stage 2 of the transition. Table 2 indicates that more than half of the women in all four areas with five children or more said they didn't want additional children, while of those with three or four children, 47 percent in M-1 and 40 percent in M-2 said they didn't want more, as compared to 27 and 21 percent, respectively, in L-1 and L-2.

In summary, the evidence analyzed in this paper neither confirms the validity of its earlier theoretical formulations nor specifies the absolute or relative importance of various determinants of fertility in the study areas, although considerable evidence is presented showing the changes of various fertility determinants. Moreover, the analysis and findings in this paper do show that the theoretical framework is a useful way of conceptualizing the relationships and approaching the analysis of socioeconomic and fertility change in contemporary rural Africa. It contributes to a better understanding of what is a complex set of relationships. While the analysis in this paper does not unequivocally demonstrate the validity of this theoretical framework, it does not refute it. In fact, there appears to be nothing in these findings that contradicts or is incompatible with the theoretical framework. But this approach is a useful beginning to a somewhat novel formulation of the processes at work in rural socioeconomic and demographic transition; it argues for more work along the lines pursued in this paper. There are, in fact, numerous opportunities for further explorations in both the development of the theory and the analysis of data from this study to test the theory, both as it stands now and as it is further developed. Some of these opportunities are in the areas of measuring economic levels and changes in the study areas.

An intriguing and related line of investigation would attempt to identify and characterize more completely those individuals and groups within the study areas that are most advanced in the transition process. Some of the analysis in this paper suggests that the most rapid and profound changes seem to be taking place among younger cohorts, particularly women. It may be possible to identify more precisely the more progressive individuals

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among these younger cohorts in terms of their social, cultural, educational, and economic characteristics, and to attempt a better determination of the accuracy of the theoretical model as a predictor of these persons' behavior.

In short, the theory and analysis presented here are interesting and encouraging but far from finished. It is hoped that the work represented by this paper will stimulate further efforts on the part of the author and others to develop and elaborate the theoretical framework and to utilize and analyze data from these study areas and elsewhere to enhance our understanding of the complex process of transition in rural Africa.

## ACKNOWLEDGMENTS

Although I take sole responsibility for the shortcomings of this paper, many people and institutions made significant contributions, some of which were critical to the success of this undertaking.

I am indebted to the Interdisciplinary Communications Program of the Smithsonian Institution for providing funds during the period October 1975-May 1976 which permitted me to carry out most of the data processing and analyses reported in this paper. The Population Council also provided a grant which, together with supplementary funds from the Bureau of Resource Assessment and Land Use Planning at the University of Dar es Salaam enabled me to carry out the field work. The field work and part of the data processing were carried out in conjunction with the 1973 National Demographic Survey of Tanzania. The NDS was a joint undertaking by BRALUP and the Bureau of Statistics of the Government of Tanzania. My appreciation goes to the staff of the Bureau of Statistics for their cooperation and assistance.

Numerous colleagues and friends in Tanzania and elsewhere gave valuable assistance at various stages of the work, particularly Professor A. C. Mascarenhas, Director of BRALUP, Mr. J. J. Mpogolo, Commissioner of Statistics, and Professor R. A. Henin, Dr. Douglas Ewbank, Mr. Tom Zalla, Mr. Ian Thomas, Mr. E. K. Sekatawa, and Mr. S. Jiwani, all of the University of Dar es Salaam. Drs. Lee Bean, Carl Eicher, Donald Heisel, Paul Schultz, Frederic Shorter and George Simmons all made helpful suggestions at various stages of the work. I am grateful to the members of the interviewer teams for their diligence and hard work and for the friendships we formed.

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## Socioeconomic Fertility Determinants in Costa Rica 1963-1973

Manuel J. Carvajal  
David T. Geithman

### Abstract

An economic model of fertility is used to help explain the decline in fertility in Costa Rica between 1963 and 1973. Data are provided by both Costa Rican censuses and a mid-1960s CELADE fertility survey. A major finding of the study is that while income and fertility are negatively related between social classes, the relationship is positive within a given social class.

Costa Rica's discovery by Columbus on his fourth and final voyage to the New World was quickly followed by Spanish conquest of the region during the first half of the sixteenth century. When the Conquistadores arrived, the country was inhabited by approximately 35,000 Indians clustered in small centers. Through conquest and colonization, by the last quarter of the eighteenth century, most of the indigenous population disappeared, and the total number of inhabitants just about returned to pre-conquest levels.

Population growth proceeded at a moderate pace throughout the first half of the nineteenth century but increased dramatically thereafter. The rate reached 2.5 percent during the second half of the nineteenth century, dropped back to 2.1 percent in the first half of the twentieth century, but jumped

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*Note:* ICP Social Scientist David N. Holmes, Jr. helped prepare this report for publication. Correspondence should be directed to Dr. Carvajal at the University of Florida, Center for Latin American Studies, Linton E. Grinter Hall, Gainesville, Florida 32611.

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suddenly to 4.0 percent between 1950 and 1963. Between 1963 and 1973, however, the annual rate of growth sharply declined to 3.4 percent. The almost continuous rise in the rate of population growth between 1920 and 1955 was attributable mainly to a sharp and sustained decline in the death rate. (Figure 1) Since 1955, however, the birth rate also began declining reaching by 1970 a century low of 3.28 percent.

No matter how mesmerizing, or frightening, macropopulation trends and projections may be for a country or the world, they offer little or no theoretical behavioral explanation for population growth. Moreover, population models are sometimes constructed which are supported neither by history nor theory consistent with the behavior of people from day to day. This study is based on the proposition that people do not breed randomly, uncontrollably, or irrationally. Instead, human fertility adjusts itself to key environmental conditions, and fertility changes are responses to changing environmental conditions. In general, a fertility pattern is explained by the extent to which having and raising a child is compatible with other parental values and intents, and a fertility decline is interpreted through the operation of various socioeconomic changes and pressures that motivate parents to want fewer children.

In the present study, an economic model of fertility that centers on the concept of parental demand for children is used to help explain the steep decline in fertility that Costa Rica experienced between 1963 and 1973, although the relevance of the theory and empirical findings is not confined to that decade alone. To empirically test the demand-for-children approach to fertility, the choice of locale is excellent: Costa Rica in the last ten years or so has experienced some of the factors that have been associated with fertility decline (high rates of economic growth, rising levels of female participation in the labor force, increasing urbanization, and an improving quality of housing for the population) along with the dramatic lowering of fertility rates. During the 1963-1973 decade alone, the fertility ratio\* plunged by almost one-third from 1,140 in 1963—one of the highest levels in the world at that time—to 818. With its consistently low mortality rates Costa Rica seems to be approaching the last stage of demographic transition.

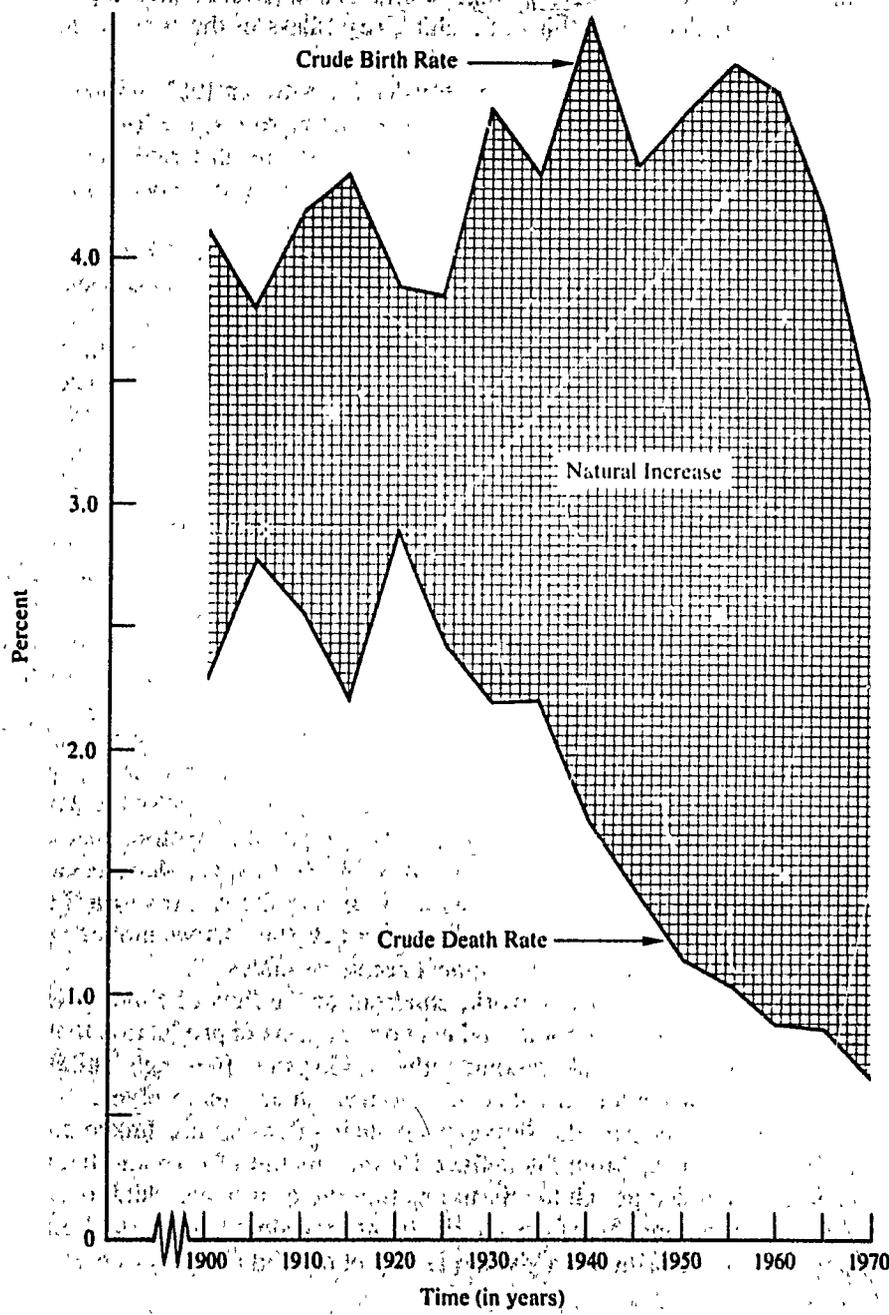
The dramatic change in Costa Rican reproductive behavior in recent years demonstrates the population's immense potential for voluntary adjustment at the level of the individual household. Some interesting comparative international insights emerge. For example, unlike Asian fertility declines in which older women led the transition to lower reproduction, the younger women are the leaders in Costa Rica.

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\*Number of children less than 5 years of age per 1000 women in the prime reproductive ages, 20-49.

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**Figure 1**



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- In 1973, younger women (ages 20-29) had fewer children than younger women had ten years earlier. Younger women have reduced their reproductive activity by about one-third of a child, regardless of the socioeconomic group to which they belong.

- Among younger women, the fertility decline between 1963 and 1973 was greatest for members of the higher socioeconomic groups; the lower socioeconomic groups have been slower in reducing their fertility rates, implying that fertility differentials have increased among the various socioeconomic groups over the ten-year period.

- Almost all older women (35-49) record more children in 1973 ages 0-15 years and living with them, than in 1963. Only in the two highest socioeconomic categories is this pattern partly reversed.

- The age bracket of women 30-34 seems to be a transitional one when interpreting fertility change during the decade: In the four lowest socioeconomic groups, fertility was up slightly in this age bracket over the decade, while for the three highest socioeconomic classes fertility was down slightly.

The microeconomic theoretical framework, elaborated in the next section, to analyze the determinants of fertility in Costa Rica, conceptualizes the individual household as a small multi-product firm. This conceptual household is endowed with time and a rate for converting time into money (the wage rate). The model recognizes two broad categories of service flows from which the household derives utility: Commodity services and child services adjusted for quality. Through the application of inputs purchased in the market and time inputs provided by family members, these service flows are produced and consumed within the household. Maximization of household utility from both categories of service flows is subject to income and price constraints. Fertility determinants are viewed in terms of factors which lift the income constraint, inducing an income effect, and factors that alter relative prices, creating a substitution effect. Relative price changes can be seen as stemming from changes in mode or style of living, urban-rural location, employment conditions in the labor market, the socioeconomic status of women in society, and other socioeconomic variables.

Within this analytical framework, children, or the flow of child services, are regarded as consumer goods and economic agents of production that can contribute to the household income either during the offspring's childhood or in the future when the parents can no longer support themselves.

The satisfactions parents derive from their offspring are linked to the "quality" of their children, as defined by the amount of time and financial resources expended per child. Assuming that the quality per child in a society is variant, parents may face a tradeoff between simply more children and higher quality offspring for a given quantity of desired child services.

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Couples' tastes and preferences for both family size and consumption goods, however, may be highly influenced by the norms of the SORG (socioeconomic reference group) with which the couple identifies. Such population segments, or SORGs, are hypothesized to possess different representative consumption standards to which group members strive to adhere; to maintain status within the group, certain consumption levels must be maintained. Such pressures to consume status goods can be expected to force the family to curtail expenditures elsewhere. In effect, expenditures on children tend to be constrained by the residual. Higher income couples within a particular SORG will have more discretionary income after meeting the minimum expenditure requirements, and hence are expected to desire larger families. This positive relationship between income and family size, however, might not hold across socioeconomic groups. If consumption standards rose faster than average income as one moved up the hierarchy of SORGs, then discretionary income would shrink, with negative effects on desired fertility. A key empirical question, then, is whether or not average family size declines with increasing socioeconomic status; if a negative relationship is apparent, does it continue to hold when relative prices are controlled?

In summary, the theoretical focus of this study treats the process of family-size decisionmaking as operating under three constraints simultaneously; 1) income and 2) relative price constraints, and 3) a status constraint. The status constraint relates to membership in a particular socioeconomic group and to the related pressures that come with such membership to consume status-conferring goods and services.

To test the demand-for-children model of fertility, the 1963 and 1973 Census data were organized into seven SORGs, as well as into six age brackets to control for variation due to age. The analysis of income and price effects on fertility was therefore conducted among households that possess a relatively similar socioeconomic status. Moreover, the SORG approach utilized in the tests helped standardize for child quality by virtue of grouping families according to similar occupational and educational backgrounds. Multiple regressions are run with the child-woman ratio as the dependent variable and family income, female participation in the labor force, presence of the extended family, urban-rural location of the household, participation in the social security system, sanitation facilities in the household, and home ownership as the independent variables.

SORGs turn out to be good predictors of family size. Lower status households consistently have higher measured fertility than higher status families in every age grouping in both 1963 and 1973. Since family income is shown to rise regularly with SORG status, the data seem to confirm the usual finding

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of a negative relationship between fertility and income. However, when other variables are controlled, the regressions for each individual SORG show statistically significant positive coefficients for the income variable. There are also statistically significant positive associations by SORG-age group between measured fertility and social security membership, improved toilet facilities in the home, and dwelling ownership. Important statistically significant negative associations by SORG-age group emerge between measured fertility and female labor force participation, size of extended family in the home, and household location in an urban environment.

To further test the validity of the SORG concept, regressions are run for the whole sample using the same variables without the prior SORG classification. Strikingly, the income variable loses its previous statistical significance, which offers strong circumstantial evidence that the SORG model is a more valid specification.

Additional empirical analysis is provided by a mid-1960's CELADE fertility survey for the capital city of San José. The CELADE survey provides specific, detailed information on fertility experience, contraceptive knowledge and usage, and female attitudes along several dimensions relevant to fertility analysis that is not available in the 1963 and 1973 censuses. Analysis of the CELADE data helps explain the results from the censuses analysis presented later. The survey data show that as we move from lower-status to higher-status SORGs, women tend to know more about contraceptives, contraceptive usage increases, women are more aware of the advantages of family planning, the rate of female labor force participation goes up, women become less traditional in lifestyle, and women more commonly assumed female roles that tend to be competitive with having and rearing children.

In the final section of the study, a broad summary of the empirical findings and the policy conclusions is presented. Since the empirical results help substantiate the demand-for-children theoretical framework by showing that fertility varies systematically with variation in household environment, broadly defined to include economic and social pressures, population policies can be designed based on these relationships. In general, public policies can be created that 1) alter the mix of explicit economic incentives and disincentives to encourage a smaller desired family size, and 2) help alter existing sociocultural institutions and opportunities, which indirectly can be expected to alter the balance of economic incentives and disincentives to have children.

A major policy recommendation is to encourage female participation in the labor force outside the home. Any legislation and/or common unofficial practices to discourage women from entering certain employment areas, or that penalize her economically in any other way should be eliminated. Some very tentative evidence is offered that suggests the existence of labor market

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entry barriers for women or concealed unemployment which prevents from working some women who want to work.

Income differences among SORGs, of course, would tend to be equalized by a major effort to redistribute income in Costa Rica. But income subsidies to the poorest echelons of the high fertility (and low income) SORGs could have the unintended side-effect of increasing fertility. Providing additional income without at the same time altering the relative price or status constraints on fertility could induce these couples to have larger families. Fertility reduction campaigns aimed at the poorest members of society as well as at the more affluent style-setting families within each SORG might be a productive counter-measure. Altering group and individual standards pertaining to consumption aspirations as well as ideal family size should be the objectives of such fertility reduction campaigns.

#### THEORETICAL FRAMEWORK OF FERTILITY ANALYSIS

Human fertility determination can be seen through one or more of three general types of analytical concepts. There are, first, factors bearing on the potential output of children,  $C_n$ , or the number of surviving children parents are capable of having with no deliberate fertility limitation; second, factors dealing with parental demand for children,  $C_d$ , or the number of surviving children parents would want if fertility regulation were costless; and third, factors surrounding the costs of fertility regulation, both psychic and objective costs, or the time and money required to learn about and use specific birth control techniques. (Easterlin 1975) In this section we seek to summarize briefly existing theory as it bears on the concepts of the potential output of children and parental demand for children.

The first concept—the potential output of children—depends upon the average effective span of female reproduction,  $R$ ; the probability of survival of a live birth to the age of maturity,  $P$ ; and the average natural spacing of live births of ever married women during the period  $R$ , or  $S_n$ .  $S_n$  is basically a measure of fecundity. Thus, as Tabbarah (1971) summarizes the potential output of children,

$$C_n = \frac{RP}{S_n}$$

The  $C_n$  concept pertains to very low real income situations, in which material living conditions are the relevant check on procreation and survival of children to maturity. In particular, natural birth spacing has been found to vary widely among populations. (Tabbarah 1971) The primary reasons for variations in natural birth spacing appear to stem from prevailing nutritional, sanitary, health, and medical service standards. Of special interest is the fact that natural birth spacing is relatively low in more developed regions and

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higher in more primitive areas, which is consistent with the nutritional, sanitation, health, and medical service differentials between richer and poorer regions. Tabbarah (1971) presents probable ranges for the maximum number of children that an average couple can expect to survive to maturity, that is, ( $C_n$ ). Due largely to regional variations in both natural birth spacing ( $S_n$ ) and child survival probabilities ( $P$ ),  $C_n$  varies from a low of 1.5-5.0 in Black Africa, to 2.0-7.0 in North Africa and Asia, to 4.5-8.5 in Korea and Taiwan, to 7.5-12.0 in Western Europe and North America.

The  $C_n$  function attempts to capture the basic relationship between alternative levels of nonchild goods consumption by parents and number of children. Easterlin (1975) presents the logic of this function, for which no claim to realism is made other than its general form:

Below some minimum level of parents' consumption, natural fertility would be zero. Starvation conditions, for example, would drastically lower frequency of intercourse and heighten the likelihood of spontaneous abortion if conception did occur. As the parents' living conditions rose from low levels, natural fertility would progressively increase, although the increments would become gradually less until a point were reached at which further living level changes left natural fertility unaffected. (p. 59)

### Parental Demand for Children

The potential output of children function affects the production side of fertility determination. Alternatively, family size determination can be examined through the analytical concept of parental demand for children,  $C_d$ . The simplest possible statement of the parental demand for children concept is:

$$C_d = \frac{RP}{S_d},$$

where  $S_d$  is desired child spacing, or the average spacing of live births necessary for parents to achieve their desired completed family size. Clearly, when  $C_d > C_n$ , for example, when couples generally desire a larger number of children than they can possibly achieve, the relevant check on fertility is the natural birth spacing interval. Changes in fertility will be determined mainly by changes in the natural spacing interval and a change in

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parental demand for children will have no significant effect on average fertility (or actual birth spacing) since the desired number cannot be achieved. Tabbarah (1971) suggests that in Black Africa, fertility is of the type where  $C_d > C_n$  (5.0-15.0 for  $C_d$ , 1.5-5.0 for  $C_n$ ); thus, average family size in Black Africa may be termed a biological phenomenon, since natural spacing is determined largely through biological influences.

Natural birth spacing tends to rise with improvements in nutritional, sanitation, health, and medical service standards, and improvements in these services usually accompany economic development. Thus, beyond some threshold real income level, where  $C_n$  has risen to exceed  $C_d$ , the previous situation is reversed and actual birth spacing will tend to equal  $S_d$ , not  $S_n$ . Now the relevant fertility check is no longer provided by the severity of the family environment but by parental desires for children. Changes in actual fertility will be determined mainly by changes in desired childspacing, and further changes in the natural spacing interval will have no significant effect on average fertility.

Under conditions of  $C_n > C_d$ , fertility can be said to be largely a socioeconomic rather than a biological phenomenon since  $S_d$  is principally determined by social, economic, and psychological factors. (Tabbarah 1971) Of course, couples who seek to achieve fewer children than their maximum potential number of children (or a desired birth spacing interval larger than the natural spacing interval) can do so only by practicing family planning.

The microeconomic theory of fertility associated with the early work of Becker (1960) and Mincer (1963) and subsequently extended by Ben-Porath (1973) and Willis (1973) is essentially an elaboration of the concept of human capital. Central to later development of the model, which has been termed the "new theory of consumer behavior" or the "new home economics," was its extension to deal with evaluating parental time. (Becker 1965)

In this approach, the total time of the adult members of the family is allocated partly to household activity and partly to economic activity outside the home, for example, formal employment that yields wages and market goods. Given specified money prices of the inputs necessary to household production—the prices of goods purchased in the market, plus the wages of employed adult men and women—these input prices will determine factor proportions in household and outside-the-home economic activities. The household's full income is equal to the total time of the husband and wife (both market and household) multiplied by their money wage rates, plus any nonlabor family income.

The full price of production and consumption of both commodity and child services is the value of purchased goods plus the value of parents' time used per unit. (Gardner 1972) Accordingly the proper relative price of child services is partly determined by the value of the time parents allocate to the

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care and enjoyment of their children, as well as by the market prices of all purchased commodities and the time required to consume them. The proper or full relative price of child services can even entail an adjustment to the value of the parents' own human capital investments. This adjustment would occur, for example, if time spent in childrearing affected the rates of investment and depreciation in the parents' human capital. Any reduction in the value of this capital resulting from time spent with children, as Michael and Lazear (1971) show, should be considered a part of child cost.

The impact of alterations in family environment on changes in desired quantity of child services can be viewed as dependent on the extent to which 1) the full income constraint is lifted, inducing an income effect, and 2) relative prices are altered, creating a substitution effect. (Ben-Porath 1973) Changing relative prices can occur, for example, because of changes in lifestyle, urban-rural location, conditions in the labor market, and the socio-economic status of women in society. Enhanced employment opportunities for women are particularly important. In the new home economics model, a rise in the wife's market wage rate has two effects. First, if child services are more intense in the wife's time than are purchased commodity services, a higher wife's wage will increase the full price of children relative to commodity services; this increase creates a substitution effect, which may reduce desired child services depending on the relative intensity of child services in the time of the wife. The second effect of a higher wife's wage is to increase the household's full income, creating an income effect that increases the demand for quantity of child services assuming the latter are not inferior goods, those whose demand decreases as income rises.

If commodity services are substantially less intense in the wife's time than are child services, a change in the wife's market wage will create a negative substitution effect on desired child services that will be opposite to and possibly outweigh the positive income effect. Thus, the relative intensity of the wife's time in child services compared to other commodity services is a crucial determinant of whether the wife's wage, or her labor force participation, and desired child services move in the opposite or same direction. A variety of social and market characteristics help determine the relative intensities in the wife's time. Some of the main factors that affect the relative input of the wife's time in alternative activities include: 1) Ability to substitute purchased inputs for wife's time in childrearing relative to other activities, 2) extent to which the rearing of younger children can be taken over by older children and/or adult relatives, as is suggested by membership in an extended family, and 3) the compatibility of a particular female occupation with childrearing. (McCabe and Rosenzweig 1974)

Parents, of course, derive utility from children by enjoying them as consumption goods; some findings indicate that children are the primary source

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of satisfaction in the marriages of many couples. (Luckey and Bain 1970) The household produces these child services by expending parental time and market goods, thus maintaining the child and affecting the child's quality. A given level of child services can be produced from various combinations of number and quality of children. In other words, additional child services can be generated either extensively, by having more children, or intensively, by devoting additional resources to existing children and thereby raising child quality. It is common to assume, as Becker and Lewis (1973) and Keeley (1975) note, that number of children and child quality are inversely related in the production of child services.

The quality-of-child argument involves one of the greatest subtleties of the model. We are primarily interested in the demand for number of children, which is a variable input in the child services production function, (Snyder 1974) but the model itself refers only to the desired quantity of child services. For example, the theory predicts that the quantity of child services should be positively related to income (unless children are an inferior good), not that the number of children should be positively related to income. Because of the presumed inverse relationship between number and quality of children, the theory suggests that if the income elasticity of demand for quality per child is greater than the income elasticity of demand for quantity of children (and both elasticities are positive), then higher-income families face a higher price of quantity relative to quality. The result is "that even though the true elasticity of quantity is positive, the measured elasticity may be negative." (Keeley 1975) Thus, the simple number of children could be a poor proxy for the quantity of child services unless other attributes of quality per child are held constant. Specifically, child quality can be affected by inputs of parents' time as well as by the socioeconomic environment in which children develop. Only if quality per child in a society were constant or could not be affected by the family, would the theory necessarily predict a positive partial relationship between income and number of children. (Keeley 1975)

The motives for having children include the direct satisfactions children are expected to provide through parents' enjoying them as consumption goods, and the indirect satisfactions they may render. Children can increase the parents' long-run utility by adding to household earnings. In viewing children as economic agents of production, the increase in household earnings may accrue either during the offspring's childhood or at some time in the future after the child has grown up. Increased family earnings can result from numerous forms of child labor performed in the market or at home, as well as from subsidies, tax exemptions, and other economic gains that parents might realize. (Geithman and Carvajal 1975) A child's worth as a current factor of production depends partly upon the economic sector in which

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the parents are employed, for example, farming or small business ownership. This aspect of the demand for child services is emphasized to explain fertility patterns among rural farm families. (Gardner 1972) The general state of child labor legislation and government programs to provide aid to families with dependent children also could be expected to influence the value of a child in this regard.

Future child-based economic benefits arise from the parents' securing economic support from their offspring when they no longer can furnish their own means of support. In other words, having and rearing children can be a method of investing for one's old age. Pursuing this investment approach to fertility, Chernichovsky (1975) develops a model particularly suited for developing economies or certain sectors of these economies that lack organized capital markets and institutions which facilitate low-cost intertemporal transfers of consumption opportunities. In such an environment, the parents' economic opportunities may be evened out over their life cycle by having children. In so doing, parents choose to forgo current consumption opportunities, which then are transformed into services from children at the time of retirement.

Chernichovsky (1975) theorizes, therefore, that an increase in anticipated parental income during retirement would reduce fertility, as would the development of external institutions that secure income for old age. Using survey data of two Indian villages, he finds that parents whose old age income is apt to be more secure tend to have fewer children, or at least fewer adult children living with them. The data also suggest a negative relationship between children and accumulation of financial assets. He reasons that decreased child mortality would increase the expected return per child to the parents; this effect should increase the number of births if the price elasticity of demand for future consumption is greater than one. The empirical evidence, on the other hand, shows an inelastic demand for surviving children, which implies that parents replace children who have died.

Several other studies also find a positive association between a population's mortality rate and its fertility level. (Friedlander and Silver 1967, Newcombe and Rhynas 1962, Weintraub 1962) This relationship apparently stems from parents compensating for child loss through death with additional births to achieve a desired number of survivors. Thus, a lower infant and child mortality level would be linked with lower fertility because fewer births are required to attain a desired family size with a higher child survivor rate. In the context of such a family-size goal model, Schultz (1969) also adds the complications of uncertainties associated with other dimensions of the family formation process, notably premature parent death, dissolution of a parental union, and the probability of remarriage. These factors can combine to produce an increase in the desired number of births.

### **New Home Economics**

A review of the parental choice models of human fertility that fall under the heading of the new home economics reveals three general elements present in all of them: The full income of the household, the full price of children and nonchild goods and services, and the preference map of the household. Several theorists, economists, and sociologists alike, have responded to the question of the effect that socioeconomic status has on the preference map of the household. These attempts have in common an explicit recognition that sociocultural norms affect individual preferences for children and nonchild goods. (Duesenberry 1960, Easterlin 1969)

Usually an individual household will adhere to one or another of the general society's socioeconomic subgroups in the sense that this group will help design or formulate achievable common standards in consumption for group members; to a greater or lesser degree, these prescriptions are respected and adopted by group adherents. We denote these consumption standard-setting collectivities SORGs (socioeconomic reference groups).

Leibenstein (1974) is correct in stating that the determination of a household's membership in a socioeconomic reference class is a matter of broad cultural and historical elements, as well as the socioeconomic present. For practical purposes, the main commonalities among the members of a reference group can be assumed to refer primarily to two types of variables: 1) A shared occupational background, and 2) similarities in past educational experience; to these, the occupational and educational backgrounds of the parents and parents-in-law of group members might be added.

The new home economics approach holds that every couple considers itself totally free to choose any combination it wishes of number of children, expenditures on child services, and expenditures on nonchild goods and services. But given their educational level, occupation, and perhaps a few other factors, the couple might, in fact, act as though it possesses a narrow range of meaningful choice over 1) expenditures on some nonchild goods, and 2) expenditures per child, for example, the quality of its children. The existence of such taste-shaping factors as the consumption standards of the couple's SORG might transform the consumption of certain goods and expenditures on child quality from the category of purely voluntary activities to almost obligatory behavior. Certain nonchild goods and child-quality standards can be termed target goods in the sense that the achievement of targeted minimum levels of consumption of these goods can involve increasing marginal utility up to the targeted standards set by the couple's SORG.

Each socioeconomic reference group can be viewed as possessing a different representative household income; the actual incomes of the households belonging to each SORG will vary, so that the representative house-

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hold income is an average about which there can be a substantial amount of household dispersion. As we move from lower to higher SORGs, the level of expenditures of the representative household on target goods may grow more important. This growth in importance of target goods can be due, in part, to the need in higher status households to spend more on target commitments so as to avoid possible doubts concerning status membership. (Leibenstein 1974) Moreover, a rising level of representative household expenditures on target goods can occur because individual members of higher status families have the capacity to demand more in terms of commitments from the family budget to express status; as we ascend from lower- to higher-status SORG, "it is possible for household members to make proportionately higher claims since the bare necessities of life can now be achieved by increasingly lower proportions of income." (p. 473)

Furthermore, a similar process could operate within a given SORG between demographically similar household members. Interhousehold competition and emulation can result in:

pressure on those who control household finance to treat similarly placed household members no worse than they appear to be treated in competing households. Such a process creates an upward drift in commitments to family members as household incomes rise . . . This can result in claimants making demands for greater commitments to them from household resources until the sum of the increases in all commitments exhausts the increase in income. (Leibenstein 1974 p. 473)

Thus, both 1) between lower- and higher-status SORG, and 2) within a given SORG, as household income rises, the income elasticity of expenditures on target goods could be greater than unity, while the income elasticity of expenditures on all other goods and on number of children would be less than unity.

#### Summary

It is possible now to summarize the preceding theoretical analysis, as it bears on what Easterlin (1969) has called "the puzzle of the true nature of the income-fertility relation [which] has plagued and perplexed fertility research down through the years . . ." (p. 141). In the most primitive economies and among the lowest socioeconomic classes of other developing countries barely emerging from premodern conditions, the demand-for-children approach is largely inapplicable. Deliberate fertility control is essential to a couple's family planning effort in achieving a desired family-size objective, yet numerous KAP (Knowledge-Attitude-Practice) surveys on family planning indicate that in these societies and socioeconomic classes,

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little or no conscious fertility control is practiced. (Easterlin 1975) On the contrary, primary constraints on family size are the medical, health, sanitation, and nutritional conditions of the populations. As these constraints are eased, family size can be expected to increase. Since the status of a population's food, health, medical, and sanitation conditions can be anticipated to vary positively with income, any rise in income should be associated with an increase in number of children per family.

The new home economics model of demand for children normally anticipates a positive effect of a change of income on the quantity of child services consumed in the household when full prices (shadow prices) are considered. With strong negative price effects of children (and the assumption of constant tastes), measured income elasticity on quantity may be negative.

A variant of the demand-for-children approach stresses the importance of group influences in determining the consumption choices of families that see themselves as members of the social group involved. (Leibenstein 1975) It will be recalled that each socioeconomic reference group establishes minimum consumption levels for some important classes of status goods and services and that increased consumption of these status goods up to the targeted levels can entail increasing marginal utility of expenditures on these goods. Furthermore, if the representative households of higher-status SORGs did desire fewer children than those of lower-status SORGs due to the effects of increasing marginal utility of expenditures on status target goods, it would be improper to describe children as inferior goods; the negative income-child relationship would not be occurring under conditions of constant tastes but due to a changing preference map as income rose. The actual income-child relationship, of course, will depend on the relative importance of the target good effect as we ascend the socioeconomic class ladder.

Empirically, the price effects of children should be controlled when estimating the income elasticities for children. Under these conditions, as we move from lower to higher status SORGs, a trend of declining income elasticities for children would indicate substantial taste effects; although the budget constraint is being eased (in absolute terms), taste effects are dominating the income effect. On the other hand, a trend of positive and rising income elasticities for children would point toward the importance of lifting the budget constraint; although taste effects may exist, the income effect is dominant.

Within a single SORG, this model generally predicts a positive income-child relationship with households possessing an income level above (below) that of the representative household desiring more (less) children than the representative household. The income elasticity for children, however, could be substantially less than unity if there were an upward drift in com-

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commitments to family members to express status as household income rose. In the extreme case, a negative income elasticity for children might even result from very strong taste and/or price effects. Again, it would be important to eliminate price effects from empirical calculations of income elasticity for children so as to separate taste from price effects.

In the following section these controlled empirical tests for the underlying fertility-income relationship are conducted within the limitations posed by available Costa Rican data. A least-squares empirical model of household demand for children is presented based on the Costa Rican Population censuses of 1963 and 1973. The model interprets household fertility in each year as a linear function not only of family income but of six additional independent variables that are related to the preceding theoretical discussion. Four empirical variables are utilized as proxies for the full price of children; these variables are female participation in the labor force, the family structure, urban-rural location of the household, and membership in the Costa Rican social security system. A fifth variable, dwelling ownership, is introduced as a proxy for non-human household wealth. Finally, the type of household toilet facilities in use is included as a proxy for both fecundity and parental uncertainty about achieving a desired completed family size.

While the income and relative price effects on fertility are tested directly through the use of the seven independent variables in the empirical model, the role of socioeconomic group membership is tested indirectly by means of dividing the total population sample into seven socioeconomic reference groups. The importance of the status-good effect on fertility can then be gauged from observing the pattern of empirical results across SORGs.

Finally, the theoretical model itself is strictly addressed to the desired quantity of child services, not to the number of children *per se*. And, as noted above, a simple measurement of number of children could be a rather poor proxy for the quantity of child services demanded unless other attributes of child quality are controlled. The SORG-approach employed in the empirical tests in the following chapter helps standardize for child quality by grouping families according to relatively similar socioeconomic backgrounds, which are empirically established on the basis of the husband's occupation and level of educational achievement.

## EMPIRICAL ANALYSIS OF SOCIOECONOMIC FERTILITY DETERMINANTS

The central conclusion of parental choice models of human fertility is that the quantity of child services demanded is constrained by available resources and relative prices. Thus, the effects of changes in family environment on desired quantity of child services is viewed as depending on the degree to which the full income constraint is altered, inducing an income

effect, and relative prices are changed, creating a substitution effect. Recent empirical investigations demonstrate that economic variables account for a significant share of cross-sectional variation in aggregate and individual fertility.

The theoretical discussion in the previous section also suggests that parental free choice in fertility decisionmaking may be additionally constrained by sociocultural properties that help condition individual behavior. Couples' tastes and preferences for desired family size can be influenced by the norms of the socioeconomic group with which the couple identifies. As discussed, certain consumption levels must be maintained to retain status within the group. In effect, the group establishes minimum expenditure levels on commitment or target goods to express status; these expenditures have first claim on family income, and expenditures on number of children are constrained by the residual.

The focus of the present study, therefore, is to regard parental fertility decisionmaking as operating simultaneously under three constraints: Economically orthodox income and relative price constraints, plus pressures associated with socioeconomic group membership to consume status-conferring goods and services, and thereby to reduce expenditures on numbers of children. This section attempts to develop an empirical model of demand for children that views the fertility problem in terms of these three constraints. The specific manner in which we can integrate the three constraints on fertility into the empirical model is to divide the total population into numerous socioeconomic reference groups. The analysis of income and price effects on fertility is then conducted among families that possess a similar socioeconomic background or status. It will be recalled that a SORG should be viewed as a somewhat homogeneous subset of the population characterized by a representative pattern of consumption and a representative household income; the actual incomes of the households belonging to the SORG will vary, so that the representative household income is an average around which there can, and probably will be, a substantial amount of dispersion.

### **SORGS**

The family observation units used in the empirical tests include every married woman (either legally or consensually) in Costa Rica between the ages of 20 and 49 whose husband is a salary- or wage earner, her spouse, and her sons and daughters aged 0 to 15 years, all living in the same household as recorded by the Population Censuses of 1963 and 1973. Every woman is classified into one and only one of seven SORGs according to her husband's occupational grouping and level of formal education.

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To develop the seven SORGs, seven groupings of occupational categories are constructed from the 1963 and 1973 Population Censuses, ranging from highest to lowest occupational status. Since there are 7 occupational groupings and 17 possible years of formal schooling, a total of 119 possible combinations exist. Each combination is assigned to one and only one SORG in a tradeoff manner; that is, within certain limits, households characterized by a higher occupational status but a lower educational level share the same SORG with households featuring lower occupational status but higher education. For example, households in occupational grouping three, with zero years of formal schooling, are classified as belonging to the same SORG as households in occupational grouping seven with nine years of formal schooling.

Households in each SORG are further separated according to wife's age into six five-year age groups ranging from 20-24 to 45-49. The total number of households that meet the criteria for inclusion amounts to 61,957 for 1963 (23.7 percent of all Costa Rican salary-and-wage earners and 15.7 percent of the total Costa Rican labor force) and 131,033 for 1973 (35.6 percent of all salary-and-wage earners and 25.4 percent of total labor force). These observation units are dispersed among the 42 possible classifications (seven SORGs times six age groups). Both distributions of households are similar to the extent that, first, the number of household observations generally decreases as we move from lower to higher SORGs; and, second, the number of observations in the 25-29 age group is slightly higher than in the 20-24 group, but the number decreases steadily in all subsequent age groups.

Although the 1973 census questionnaire included measures of fertility, unfortunately no direct questions on fertility were recorded in the 1963 Census. Since a comparable fertility indicator is essential to evaluate fertility changes during the decade, the number of children aged 0 to 15 years living with their mother at the time of the census is used as a fertility indicator common to 1963 and 1973. This number, of course, records only the number of surviving children and, consequently, is not independent of fetal, infant, or child mortality. Furthermore, this indicator has a downward bias since it fails to include children possibly living with other relatives.

The trends for 1963 and 1973 indicate that in moving from lower-status to higher-status SORGs, fertility decreases steadily for every age group. Within each SORG, fertility increases when moving from lower to higher age groups, reaches a peak in the 30-34 age group for 1963 and 35-39 for 1973, and declines in subsequent age groups. It is noteworthy that, although the overall average number per family of children aged 0 to 15 living with their mother is approximately the same for both years (3.30 for 1963 and 3.37 for 1973), the composition of the averages has changed considerably by SORG and age group over the decade. The fertility decline experienced in Costa

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Rica between 1963 and 1973 is centered in the lower average number of children recorded within the two youngest age groups; all women ages 20-29 recorded fewer children in 1973 than similarly aged women in 1963. Regardless of socioeconomic class to which they belong, generally younger women have lowered their reproductive activities by a third of a child or more. However, among women 20-29, the fertility decline was greater for members of the highest SORGs; with the lower SORGs slower in reducing their fertility rates, fertility differentials increased among the various SORGs during the ten-year period. At the other extreme, among older women 35-49 almost all socioeconomic classes recorded more children in 1973 than in 1963, the pattern being partly broken only in the two highest SORGs. Finally, the range of middle aged women 30-34 seems to be a transitional one when viewing the fertility decline over the decade; in the four lowest SORGs, fertility rose slightly over the ten years while for the three highest SORGs, fertility declined slightly.

Of course, the fertility indicator employed here is quite different from a measure of cumulative fertility—for example, total number of live births a woman has experienced, or total number of surviving children. Clearly, the former is a measure of recent fertility (within the last 15 years), and is subject to the characteristic that as children age past 15 years they disappear from the fertility indicator. Thus, we record lower fertility in Table 1 for women past age group 30-34 in 1963 and 35-39 in 1973 simply because some children have aged sufficiently (for example, past 15 years) to drop out of the fertility measure.

Unlike the 1963 census, the 1973 census included a useful explicit measure of cumulative fertility, and the total number of surviving children in the family. As would be expected, the average number of children 0 to 15 years living with their mother in 1973 and the average number of surviving children are almost identical for the first two age groups; but beginning with the 30-34 age group the latter fertility measure grows increasingly larger than the former measure. However, the central trend across SORGs remains the same regardless of which measure is used; the higher the SORG, the lower the average fertility level. Also significantly, the number of children aged 0-15 years living with their mother bears approximately a constant relationship to the number of recorded surviving children regardless of SORG; in other words, in moving from lower to higher SORG, the number of children ages 0 to 15 living with their mother as a percentage of the number of surviving children in the family fluctuates very little. Consequently, the use of number of children aged 0-15 living with their mother rather than number of surviving children as a fertility indicator appears to introduce no systematic bias into the analysis of the effects of socioeconomic status on fertility.

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A systematic bias across socioeconomic classes does exist when comparing, on the one hand, number of children 0-15 years of age living with their mother or number of surviving children and, on the other hand, number of live births as fertility indicators. The bias is due to a systematic variation between frequency of infant and child death and socioeconomic status. Utilizing the availability of data on number of live births and number of surviving children in the 1973 Census, the average number of child deaths per woman by SORG and age group have been calculated. These indexes show a definite inverse relationship with SORG status; that is, in general, the higher the SORG status, the lower the average number of child deaths per women within every age group. As already noted, this limitation must be kept in mind when interpreting the estimates of the parameters in the empirical model later in this section where the fertility indicator is specified in terms of surviving number of children.

Obviously it is difficult to discuss socioeconomic trends simultaneously across SORGs and by various age groups, since the trends may be opposing. Thus, there is a need to statistically separate the effects of changes across age groups while not considering changes across SORGs, and vice versa. To test for inter-SORG and inter-age group statistical differences simultaneously, the (RCBD) Randomized Complete Block Design has been applied throughout this section. The RCBD statistical model is used when two sources of variation exist, in this case SORG status and age group, so that each SORG appears once in each age group and each age group contains all SORGs. The linear additive model of this design is as follows:

$$X_{ij} = \mu + \alpha_i + \delta_j + \epsilon_{ij}$$

where  $X_{ij}$  refers to the number of children 0-15 years of age in the  $i$ th SORG and the  $j$ th age group,  $\mu$  is the overall parameter mean,  $\alpha_i$  is the deviation of the  $i$ th SORG mean from the overall mean,  $\delta_j$  is the deviation of the  $j$ th age group mean from the overall mean,  $\epsilon_{ij}$  is the stochastic component or statistical error term of the  $X_{ij}$ th observation,  $i = 1, \dots, 7$ , and  $j = 1, \dots, 6$ .

The design for the RCBD is presented in Table 1 and its analysis of variance table (ANOVA) is presented in Table 2. The values of  $F_s$  and  $F_a$  in the ANOVA tables indicate whether or not differences among SORGs and age groups, respectively, are statistically significant. ANOVA tables are not included in the text because of space limitation.

The percentage contribution of SORG status and age bracket to fertility variation can be estimated from two additional ratios that are developed from the ANOVA tables. These ratios,  $R_s$ , the ratio of sum of squares among SORGs to total sum of squares in the model, and  $R_a$ , the ratio of sum of squares among age groups to total sum of squares in the model, represent the

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**Table 1**  
**Design of the Randomized Complete Block Design (RCBD)**

Age Group	SORG							Total
	1	2	3	4	5	6	7	
20 - 24	X <sub>11</sub>	X <sub>21</sub>	X <sub>31</sub>	X <sub>41</sub>	X <sub>51</sub>	X <sub>61</sub>	X <sub>71</sub>	X <sub>.1</sub>
25 - 29	X <sub>12</sub>	X <sub>22</sub>	X <sub>32</sub>	X <sub>42</sub>	X <sub>52</sub>	X <sub>62</sub>	X <sub>72</sub>	X <sub>.2</sub>
30 - 34	X <sub>13</sub>	X <sub>23</sub>	X <sub>33</sub>	X <sub>43</sub>	X <sub>53</sub>	X <sub>63</sub>	X <sub>73</sub>	X <sub>.3</sub>
35 - 39	X <sub>14</sub>	X <sub>24</sub>	X <sub>34</sub>	X <sub>44</sub>	X <sub>54</sub>	X <sub>64</sub>	X <sub>74</sub>	X <sub>.4</sub>
40 - 44	X <sub>15</sub>	X <sub>25</sub>	X <sub>35</sub>	X <sub>45</sub>	X <sub>55</sub>	X <sub>65</sub>	X <sub>75</sub>	X <sub>.5</sub>
45 - 49	X <sub>16</sub>	X <sub>26</sub>	X <sub>36</sub>	X <sub>46</sub>	X <sub>56</sub>	X <sub>66</sub>	X <sub>76</sub>	X <sub>.6</sub>
Total	X <sub>.1</sub>	X <sub>.2</sub>	X <sub>.3</sub>	X <sub>.4</sub>	X <sub>.5</sub>	X <sub>.6</sub>	X <sub>.7</sub>	X <sub>..</sub>

$$X_{i.} = \sum_{j=1}^6 X_{ij} \text{ for each } j = 1, \dots, 6;$$

$$X_{.j} = \sum_{i=1}^7 X_{ij} \text{ for each } i = 1, \dots, 7; \text{ and}$$

$$X_{..} = \sum_{i=1}^7 \sum_{j=1}^6 X_{ij}.$$

percentage of total variation in the model attributable to SORG and age grouping, respectively. For example, approximately 32 percent of the fertility variation reported for 1963 is attributable to SORG differentials and 67 percent attributable to age group differentials; by 1973 the percentage contributions had changed to 41 percent due to SORG differentials and only 57 percent due to age group differentials.

**Key Variables**

In this section we discuss and test for statistically significant differentials among the households recorded in the 1963 and 1973 Census for several key variables postulated to be important to household fertility decisionmaking. These variables are family income, female participation in the labor force, the presence of the extended family, urban-rural location of the household, participation in the social security system, sanitation facilities in the household, and dwelling ownership. Variation in each of these variables is expected to explain a share of the cross-sectional variation in household fertility recorded in the 1963 and 1973 Census, presumably through its effect on

**Table 2**  
**Analysis of variance table (ANOVA) for the Randomized Complete Block Design**

Source of Variation	Degrees of Freedom	Sum of Squares	Mean Square	F
SORG	6	$SSS = \sum_{i=1}^7 \frac{(X_i)^2}{6} - \frac{(X_{..})^2}{42}$	$MMS = \frac{SSS}{6}$	$F_s = \frac{SSS}{MSE}$
Age Group	5	$SSA = \sum_{j=1}^6 \frac{(X_{.j})^2}{7} - \frac{(X_{..})^2}{42}$	$MSA = \frac{SSA}{5}$	$F_d = \frac{MSA}{MSE}$
Error	30	$SSE = \sum_{i=1}^7 \sum_{j=1}^6 X_{ij}^2 - \sum_{i=1}^7 \frac{(X_i)^2}{6} - \sum_{j=1}^6 \frac{(X_{.j})^2}{7} + \frac{(X_{..})^2}{42}$	$MSE = \frac{SSE}{30}$	
Total	41	$TSS = \sum_{i=1}^7 \sum_{j=1}^6 X_{ij}^2 - \frac{(X_{..})^2}{42}$		

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desired quantity of child services. Each variable is intended to relate to either the income or relative price constraint on fertility.

*Family income.* Unfortunately, the 1963 and 1973 Census report only salary and wage income, which is the reason for including in the present study only the families of salary- or-wage earners. The measure of family income used here is the sum of the husband's current money income plus the wife's income, if she received any. It can be argued that observed income at one point in time generally may not be a proper representation of the type of income relevant to household fertility decisionmaking. (Easterlin 1969) As Schultz (1969) points out, children tend to represent a long-term irreversible commitment, and unless parents view their current income change in some sense as permanent, they may not respond to a current variation with adjustments in their desired completed family size. There is good evidence for Costa Rica, however, that the long-term income stream is a function of education, occupation, and age, (Carvajal and Geithman 1975) all three of which are adjusted for in the empirical model tested later in this section. This seems to suggest that, under these circumstances, current income should provide a useful proxy for permanent income.

Average family income (husband's plus wife's earnings) steadily rises from lower to higher SORGs. For example, average family income in 1963 across SORGs ranges from 206 colones to 1,969 colones. By 1973, the range across SORGs narrows slightly. From lowest to highest SORGs the values are 462 colones and 3,831 colones. Average family income also rises between ages 20-29, reaches a peak between ages 30-39, and then declines in the higher age groups although the differences are much smaller across age groups than across SORGs. Judging from the two census samples, the average wage-and-salary income doubled between 1963 and 1973; the price index rose by approximately 40 percent during the same period, (census of Costa Rica 1973) which implies that, on average, purchasing power increased by 60 percent. The greatest gains in real income are registered by the lowest income brackets (SORGs 1 and 2), followed by the higher-status SORGs, which implies that the middle class (SORGs 4 and 5) lost ground relative to the other two groups. It also is clear that younger households experienced larger gains in income than did older households.

In general, the husband's contribution to family money income vastly exceeds the wife's; on average for all SORGs and age brackets, the wife's income represented only 7.5 and 10.7 percent of total family income in 1963 and 1973, respectively. Statistically significant differences, however, exist by SORG and age grouping in both years, although three-quarters or more of the total variation is accounted for by SORG classification. The wife's percentage contribution to family income increases with SORG status until SORGs 4-5 and declines thereafter. The wife's percentage contribution to

income also increases with age, reaching a peak between age 25-34 and declining with subsequent age groups. This seems to imply that the role of married women in the labor force is becoming more important as a source of family income, but important differences among SORGs and age brackets exist.

*Female labor force participation.* An economic model of fertility must include as part of the full price of children the time value parents devote to their children, as well as the market prices of purchased commodities related to child-raising. Thus, female participation in the labor force is used in this study as a proxy for the opportunity cost of the wife's time in bearing and rearing children.

The pattern of female participation in the labor force is similar in both 1963 and 1973, the participation rate increasing as the SORG increases. For example, the participation rates ranged from 2.3 percent to 29.2 percent across SORGs in 1963 and 4.8 percent to 34.6 percent across SORGs in 1973. The participation rate also rises as age increases up to the 30-34 age group, but declines in older age brackets. But the differences across ages are much narrower than across SORGs which suggest that the SORG classification is vastly more important in determining female participation than the age group classification, although the age group gains influence in 1973 relative to 1963. For all SORGs and age brackets together, the overall female participation rate increased only slightly over the decade (from 8.3 percent in 1963 to 10.3 percent in 1973). Such increase in the participation rate, however, was heavily concentrated among higher SORG wives and, to some extent, among younger wives. These changes seem to imply the emergence of a trend for younger and better-educated married women to engage more in market economic activity relative to older and less-educated women. It is interesting to observe that these same groups also experienced the highest drop in fertility between 1963 and 1973.

*Non-nuclear family.* Female participation in the labor force is one variable that helps measure the full price of children by serving as a proxy for the opportunity cost of the wife's time. In the nuclear family structure, in particular, a higher women's opportunity cost in terms of foregone earnings due to bearing and rearing children could be expected to lessen fertility, in effect because children are more expensive commodities when their presence lowers the wife's earnings. But the degree of incompatibility between the wife working and also having children could be mitigated in the extended family structure by the presence of older relatives, whose time may substitute for the time demanded from the mother by her children. In the extended-family system the full cost of having and raising a child, rather than being confined to its parents, can be distributed among members of the broader family group. Thus, it can be hypothesized that, other things being equal, the

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greater the amount of assistance from one's kinship system in reducing the parents' time costs of children, the weaker will be the incentive to prevent or postpone pregnancy. (Goldberg 1960) However, the presence of additional, nonnuclear family members in the household can also constitute a drain on household income, especially if these persons are not income earners themselves and not contributing toward household expenses. This suggests a possible negative income effect on the household fertility level.

Nonnuclear family members are defined as members of the household other than household head, wife, and their children. The number of nonnuclear family members as a percentage of total household members can serve as a measure of the extended-family system. An analysis of this variable shows little change between 1963 and 1973 by SORG and age group. There exists a statistically significant trend for this percentage indicator to increase as SORG status increases in both years. It must be kept in mind, however, that households in higher status SORGs often hire the services of maids and other servants who live in the house and are counted in the non-nuclear family. Thus, the statistic for nonnuclear family members may be somewhat inflated for higher SORGs by the presence of servants. The ANOVA table shows that differentials among age groups, although relatively small, are statistically significant.

*Urban-rural location.* The motives for having children include not the only direct satisfactions children are expected to provide by virtue of parents enjoying them as consumption goods, but also indirect satisfactions they can render through their potential value as factors of production. Specifically, having and rearing offspring may promise tangible, market-realizable returns to parents because of the child's present or future contribution to real family income. Conditions in rural areas, even in rural nonfarm households, generally are more propitious for child labor than in urban areas. In rural areas the family is the basic institution to which all other institutions are subordinated. In rural households, employment, education, and provision for old age often are provided directly by the family itself, whereas in urban centers specialized impersonal institutions such as the labor market, schools, and the social security system take the place of the family in performing many functions fulfilled by the family in rural areas. (Goode 1964) This specialization and reliance on nonfamily, modern institutions tends to reduce the economic benefit of children as investment goods in cities relative to the countryside. Thus, other things being equal, a negative association is expected between urbanization and family size.

The overall urban-rural composition of the population is identical for both years—about one-third of all households being urban. Among the higher SORGs and older age brackets, however, there is a marked trend toward more urbanization; the data show that the level of urbanization varies from

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12.7 percent to 67.8 percent across SORGs in 1963 and from 11.9 percent to 81 percent across SORGs in 1973. The vast majority of the variation in urban-rural location (98-99 percent) is attributable to SORG differentials. Thus, it is higher SORG status rather than older age that best explains the urbanization trend.

*Social security system participation.* Children can also contribute to their parents' long-term income flow even after they have grown up. Thus, children can be analyzed as a source of parental economic sustenance when the aged parents can no longer support themselves. In this view, children constitute a form of social security for the parents and, other things being equal, households that are not members of a governmental social security program could be expected to compensate for this lack by having a larger family size. This reasoning suggests a negative relationship between fertility and household participation in the social security program. The social security program in Costa Rica, however, is an all-inclusive one which provides maternity and sickness benefits as well as disability and retirement benefits. A program of this nature, therefore, can be a pronatalist subsidy to couples to the extent that parents do not have to pay for maternity or medical services for their offspring. Therefore, the expected long-term negative effect of a social security system on fertility could be outweighed by a short-term positive one.

An analysis of household participation rates in the social security program by SORG and age group reveals that the rate of participation increases from lower to higher SORG, reaches a peak at SORG 5, and then declines for SORGs 6 and 7. For example, the average participation rates for SORGs 1, 5, and 7 in 1963/1973 were 0.242/0.348, 0.727/0.840, and 0.620/0.831 respectively. Although this pattern existed in both 1963 and 1973, it is more apparent in 1963. Age group differentials in participation rates are not statistically significant for either 1963 or 1973. For all SORGs and age brackets taken together, the participation rate increased from 46 percent of all households in the sample to 51 percent over the decade; but the largest gains in participation rates were recorded in the higher-status SORGs. Whether this trend constituted a strengthening negative or positive influence on fertility must depend on which price effect is dominant: Couples replacing the need to have children with a modern, impersonal form of old age protection or parents using the social security system to subsidize the full costs of having and rearing children.

*Household sanitation facilities.* Another factor influencing fertility is the level of sanitation in the household. The theoretical effects of better sanitation facilities operate in two directions. On the one hand, better sanitation facilities could stimulate higher fertility levels both by lengthening the span of the woman's reproductive years (through hastening menarche and delay-

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ing menopause) and by lowering the level of ill health, which impairs a couple's physiological capacity to reproduce. On the other hand, a negative association between better sanitation and fertility can be postulated due in part to a reduction in parents' uncertainty about having the number of children they want—that is, better sanitation facilities, and a consequent lower mortality level (especially infant and child mortality) may be linked with lower fertility because fewer births are required to attain a desired completed family size. Moreover, it can also be argued that the presence of better household toilet facilities makes possible a more efficient use of contraceptive techniques; Stycos (1965), for example, has pointed out that a lack of adequate sanitation conditions is seen by some observers as a limiting factor in the effective use of birth control methods. This reasoning clearly suggests the existence of a negative relationship in the household between fertility and quality of sanitation facilities.

The level of sanitation in the household can be evaluated through a proxy that measures whether or not the dwelling is connected to a sewer system or a septic tank. As would be expected, the quality of sanitation facilities in the household increases uninterruptedly with rising SORG status ranging from around 20 percent to over 40 percent across SORGs in 1973. But no clear trend by age group is discernible, although the differences among age groups are statistically significant. Overall, an impressive improvement in the dwelling infrastructure occurred in the ten-year period insofar as the percentage of all dwellings connected to a sewer system or a septic tank rose sharply from 28 percent in 1963 to 41 percent in 1973.

*Dwelling ownership.* Finally, an economic analysis of fertility must include non-human wealth effects on fertility. Provided that children are not inferior goods, an exogenous increase in the household's stock of non-human wealth can be expected to shift unambiguously rightward the family demand-for-children schedule (Schultz 1973). The empirical indicator used in this study refers to ownership of the family dwelling as a proxy for the household's stock of non-human wealth. The percentage of self-owned dwellings increases notably as age increases, which is plausible since households in older age groups have had more opportunity over time to accumulate wealth. For example, around a third of the youngest households owned their own home while around 45 percent of the older couples did. The analysis of variance indicates that the age group classification accounts for around 70 percent of the variation while the SORG classification only accounts for 26 percent, although SORG class is also highly significant statistically; of course, there is a higher incidence of home ownership among the higher SORGs than the lower SORGs. The percentage of ownership for all SORGs and age brackets taken together rose slightly from 44 percent in 1963 to 48 percent in 1973, with the higher-status SORGs registering the largest gains.

## Demand for Children

The main question this study addresses is how household fertility in Costa Rica responds to variations in families' socioeconomic environments that systematically affect income, relative price, and status constraints on fertility. In this is presented least-squares estimates of an empirical model of household demand for children which is constructed within the limitations of the data of the 1963 and 1973 Costa Rican Population Censuses. The model interprets individual household fertility in 1963 and 1973 as a linear function of seven independent variables, each of which has been discussed in the preceding section of this chapter: Household income, female participation in the labor force, family structure, household location, membership in the social security system, household sanitation, and a wealth proxy. That is,

$$C_{hijk} = B_{0hij} + B_{1hij} Y_{hijk} + B_{2hij} L_{hijk} + B_{3hij} E_{hijk} + B_{4hij} U_{hijk} + B_{5hij} S_{hijk} + B_{6hij} T_{hijk} + B_{7hij} D_{hijk} + V_{hijk}$$

where

- $C_{hijk}$  is the number of children aged 0 to 15 living with their mother in the  $k$ th household, the  $j$ th SORG, the  $i$ th age group, and the  $h$ th year.
- $Y_{hijk}$  is the sum of the husband's and wife's monthly salary-and-wage income in the  $k$ th household, the  $j$ th SORG, the  $i$ th age group, and the  $h$ th year.
- $L_{hijk}$  is a dummy variable for female participation in the labor force, assigned a value of 1 if the  $k$ th wife of the  $j$ th SORG in the  $i$ th age group was a member of the labor force in the  $h$ th year, a value of 0 otherwise.
- $E_{hijk}$  is the ratio of nonnuclear family members to total members in the  $k$ th household, the  $j$ th SORG, the  $i$ th age group, and the  $h$ th year.
- $U_{hijk}$  is a dummy variable for urban location, assigned a value of 1 if the  $k$ th household of the  $j$ th SORG in the  $i$ th age group was located in an urban area in the  $h$ th year, a value of 0 otherwise.
- $S_{hijk}$  is a dummy variable for the household head's participation in the social security system, assigned a value of 1 if the  $k$ th head of the  $j$ th SORG in the  $i$ th age group was a member of the social security system in the  $h$ th year, a value of 0 otherwise.
- $T_{hijk}$  is a dummy variable for household sanitation, assigned a value of 1 if the  $k$ th household of the  $j$ th SORG in the  $i$ th age group was connected to a sewer system or a septic tank in the  $h$ th year, a value of 0 otherwise.
- $D_{hijk}$  is a dummy variable for wealth, assigned a value of 1 if the dwelling of the  $k$ th household of the  $j$ th SORG in the  $i$ th age group was owned by the household head in the  $h$ th year, a value of 0 otherwise.
- $V_{hijk}$  is a normally, independently distributed stochastic disturbance term for the  $k$ th household of the  $j$ th SORG in the  $i$ th age group in the  $h$ th year.
- $B_{0hij}, \dots, B_{7hij}$  are the least-squares coefficients to be estimated for the  $j$ th SORG in the  $i$ th age group in the  $h$ th year.

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and where

$k = 1, \dots, K_{hi}$  where  $K_{hi}$  is the sample size of the  $j$ th SORG in the  $i$ th age group in the  $h$ th year.  
 $j = 1, \dots, 7$  for the seven SORGs.  
 $i = 1, \dots, 6$  for the six age groups.  
 $h = 1963, 1973$ .

It can be seen that the 61,957 households for 1963 and 131,033 households for 1973 included in the study are grouped according to both their socioeconomic reference group and wife's age to show how these two classifications influence the effects of each of the seven independent variables on fertility. It is assumed that all of the independent variables in the model are predetermined; that is the values of the coefficients in the regressions do not depend upon the fertility level. Regression results are reported in Tables 3 and 5 only for mothers ages 20-24, 25-29, 30-34. Results for the older women exhibit the same general patterns with slightly lower explanatory levels.

*Family income.* As can be seen in Tables 3 to 5, with only two exceptions, all regression coefficients for family income ( $Y_{hijk}$ ) are significantly different from zero, at least at the 0.10 level for both 1963 and 1973. In general, the levels of statistical significance were higher in 1973 than in 1963. The positive sign of the income variable indicates that income does act as a constraint on household fertility so that, provided other variables are statistically controlled, income and fertility appear to rise and fall together. Within a given socioeconomic reference group, as household income increases, parents can afford having and raising more children without having to seriously reduce consumption of other goods and services customary for households in that SORG; on the other hand, families with a level of income below their SORG's income average seem to reduce their family size in order to maintain the consumption patterns common to the SORG.

Of course, the value of the least-squares coefficients themselves depend on the variable's unit of measurement and the range of the variable; as such they are not strictly comparable among SORGs and age groups, nor are they comparable with the coefficients of other variables. A unit of standardization is needed, and such a unit is provided by the elasticity of the variable evaluated at the mean of the variable. As is well known, elasticity in general can be defined as the ratio of a percentage change in the dependent variable to the corresponding percentage change in the independent variable as the percentage change in the independent variable approaches zero. Specifically, income elasticity of fertility refers to the limit of the ratio of the percentage change in fertility to an infinitesimal change in income. These income elasticities (see Table 6) show, for example, that in 1963 a 10 percent in-

**Table 3**  
**Regressions on Number of Children, Ages 0-15, and Living with their Mothers ( $C_{ijk}$ ), in 1963 and 1973, for Mothers, Ages 20-24, by Socioeconomic Reference Group (with Standard Errors and Levels of Significance)**

SORG Number	Family Income $Y_{ijk}$	Female Labor Force Participation $L_{ijk}$	Non-nuclear Family to Total Household Size $E_{ijk}$	Urban Location $U_{ijk}$	Social Security Membership $S_{ijk}$	Toilet Availability $T_{ijk}$	Dwelling Ownership $D_{ijk}$	R <sup>2</sup>	F ratio
1963									
1	0.00132** (0.00028)	-0.4664** (0.25042)	-2.6719** (0.14642)	-0.12032 (0.08778)	0.13168** (0.04567)	0.13624** (0.01332)	0.05549 (0.30839)	0.507	488.404**
2	0.00120** (0.00018)	-0.51649** (0.16274)	-1.91911** (0.16191)	-0.17206** (0.04629)	0.10715** (0.04567)	0.34239** (0.05447)	0.14372** (0.03863)	0.493	473.755**
3	0.00090** (0.00018)	-0.55897** (0.11723)	-1.54825** (0.17245)	-0.18553** (0.05980)	-0.04412 (0.04412)	0.04776 (0.04776)	0.38152** (0.05032)	0.446	253.110**
4	0.00076** (0.00016)	-0.61148** (0.10853)	-0.82687** (0.18769)	-0.25172** (0.07211)	0.05566 (0.03482)	0.50732** (0.07611)	0.36442** (0.05976)	0.421	150.635**
5	0.00048** (0.00024)	-0.79830** (0.15844)	-0.55461 (0.37452)	-0.31400* (0.16227)	0.03166 (0.02218)	0.65735** (0.09373)	0.43421** (0.10932)	0.392	41.678**
6	0.00036* (0.00020)	-0.85766** (0.16429)	-0.52095 (0.35922)	-0.35967** (0.10326)	-0.24043* (0.12860)	0.71953** (0.10332)	0.23323* (0.12039)	0.365	35.854**
7	0.00028* (0.00014)	-0.87747** (0.13670)	-0.54180* (0.31313)	-0.48138** (0.14303)	-0.29088* (0.12428)	0.77889** (0.09822)	0.19387 (0.12941)	0.352	21.046**

1973

1	0.00098** (0.00009)	-0.45794** (0.09974)	-1.84651** (0.18269)	-0.15914** (0.02266)	0.28131 (0.23073)	0.17286** (0.02703)	0.02283** (0.01304)	0.378	675.417**
2	0.00091** (0.00015)	-0.48936** (0.11582)	-1.62167** (0.15119)	-0.18170** (0.05439)	0.34033** (0.26352)	0.29235** (0.04106)	0.02898* (0.01157)	0.362	595.313**
3	0.00080** (0.00006)	-0.54812** (0.13463)	-1.03195** (0.10677)	-0.18820** (0.03857)	0.25855* (0.12224)	0.29142** (0.06701)	0.19392** (0.02670)	0.358	239.321**
4	0.00054** (0.00014)	-0.60189** (0.04766)	-1.03054** (0.07537)	-0.21316** (0.07713)	0.21342* (0.11862)	0.33920** (0.05986)	0.27421** (0.02194)	0.331	149.109**
5	0.00042** (0.00006)	-0.62152** (0.06319)	-0.34543** (0.14759)	-0.32086** (0.06502)	0.15648 (0.09730)	0.41499** (0.06342)	0.28956** (0.02352)	0.305	122.543**
6	0.00035** (0.00010)	-0.74116** (0.05354)	-0.17631** (0.11438)	-0.36216** (0.05684)	0.10420* (0.05035)	0.47421** (0.05992)	0.33989** (0.02078)	0.311	81.881**
7	0.00031** (0.00008)	-0.73209** (0.07463)	-0.17871** (0.10304)	-0.40968** (0.10106)	0.11793 (0.07919)	0.57372** (0.18657)	-0.40635** (0.03004)	0.249	39.465**

\*\* Significant at the .01 level

\* Significant at the .05 level

" Significant at the .10 level

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Table 4

Regressions on Number of Children, Ages 0-15, and Living with their Mothers ( $C_{ijk}$ ), in 1963 and 1973, for Mothers Aged 25-29, by Socioeconomic Reference Group (with Standard Errors and Levels of Significance)

SORG Number	Family Income $Y_{ijk}$	Female Labor Force Participation $L_{ijk}$	Non-nuclear Family to Total Household Size $E_{ijk}$	Urban Location $U_{ijk}$	Social Security Membership $S_{ijk}$	Toilet Availability $T_{ijk}$	Dwelling Ownership $D_{ijk}$	$R^2$	F ratio
1	0.00214** (0.00038)	-0.77129** (0.25234)	-3.45590** (0.22300)	-0.25439** (0.09809)	0.33918** (0.05578)	0.30212** (0.04867)	0.08233** (0.04796)	0.426	380.697**
2	0.00144** (0.00026)	-0.84335** (0.16947)	-2.91166** (0.24423)	-0.27979** (0.06999)	0.11358* (0.04932)	0.53881** (0.06787)	0.27269** (0.04860)	0.398	357.291**
3	0.00126** (0.00022)	-0.89380** (0.12481)	-2.06926** (0.24249)	-0.37824** (0.06941)	0.06623 (0.05546)	0.59967** (0.13695)	0.46269** (0.05908)	0.372	205.220**
4	0.00084** (0.00016)	-0.95136** (0.11160)	-1.84699** (0.24344)	-0.41737** (0.08461)	0.07817 (0.03722)	0.67489** (0.10987)	0.46742** (0.06476)	0.358	150.402**
5	0.00078** (0.00024)	-0.93299** (0.16241)	-1.11935** (0.43704)	-0.62323** (0.18171)	0.04256 (0.03065)	0.57562** (0.12694)	0.50823** (0.11636)	0.350	34.612**
6	0.00070** (0.00018)	-0.00711** (0.16554)	-0.96067* (0.44577)	-0.66097** (0.09248)	-0.19586 (0.12424)	0.76037** (0.18744)	0.43532** (0.12201)	0.339	25.102**
7	0.00056** (0.00012)	-1.02703** (0.13865)	-0.90241* (0.39446)	-0.65087** (0.17567)	-0.30247* (0.12517)	0.84186** (0.18017)	0.38074** (0.11620)	0.337	21.081**

1973

1	0.00130** (0.00012)	-0.57808** (0.11850)	-3.00457** (0.22682)	-0.19492** (0.03078)	0.55836 (0.36020)	0.40582** (0.03586)	0.03678* (0.01487)	0.355	699.183**
2	0.00118** (0.00016)	-0.65466** (0.13466)	-2.37957** (0.16838)	-0.25862** (0.07269)	0.58278 (0.33536)	0.41596** (0.06161)	0.04544* (0.01828)	0.352	513.723**
3	0.00095** (0.00019)	-0.70539** (0.15562)	-2.24792** (0.26263)	-0.37030** (0.05214)	0.46553** (0.16953)	0.52716** (0.08461)	0.27115** (0.03344)	0.329	247.206**
4	0.00078** (0.00015)	-0.73165** (0.05665)	-1.93235** (0.11131)	-0.38269** (0.10028)	0.41488** (0.12385)	0.55605** (0.07921)	0.46486** (0.02831)	0.326	119.991**
5	0.00075** (0.00011)	-0.75104** (0.07910)	-1.14924** (0.20018)	-0.50251** (0.08868)	0.32718* (0.14036)	0.60096** (0.09549)	0.44942** (0.02904)	0.304	111.370**
6	0.00052** (0.00008)	-0.86783** (0.05457)	-0.90246** (0.15081)	-0.58392** (0.06297)	0.11636 (0.14206)	0.63796** (0.07103)	0.50721** (0.02116)	0.315	97.622**
7	0.00050** (0.00006)	-0.90232** (0.06516)	-0.54566** (0.18831)	-0.61902** (0.09559)	0.15665 (0.10800)	0.88750** (0.18635)	0.51000** (0.02693)	0.261	67.708**

\*\* Significant at the .01 level  
 \* Significant at the .05 level  
 " Significant at the .10 level

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**Table 5**  
**Regressions on Number of Children, Ages 0-15, and Living with their Mothers ( $C_{ijk}$ ), in 1963 and 1973, for Mothers, Ages 30-34, by Socioeconomic Reference Group (with Standard Errors and Levels of Significance)**

SORG Number	Family Income $Y_{ijk}$	Female Labor Force Participation $L_{ijk}$	Non-nuclear Family to Total Household Size $E_{ijk}$	Urban Location $U_{ijk}$	Social Security Membership $S_{ijk}$	Toilet Availability $T_{ijk}$	Dwelling Ownership $D_{ijk}$	$R^2$	F ratio
1	0.00120** (0.00034)	-0.76442** (0.21877)	-5.90464** (0.32992)	-0.34276** (0.09849)	0.35959** (0.06488)	0.49325** (0.05757)	0.09014** (0.05257)	0.397	263.439**
2	0.00096** (0.00030)	-0.81048** (0.16460)	-5.50217** (0.30949)	-0.34030** (0.07502)	0.26985** (0.05809)	0.65995** (0.09187)	0.27600** (0.05696)	0.352	250.551**
3	0.00090** (0.00024)	-0.86403** (0.12570)	-4.05714** (0.30499)	-0.45283** (0.07960)	0.18095** (0.06243)	0.68877** (0.16070)	0.50699** (0.06569)	0.353	187.075**
4	0.00078** (0.00016)	-0.89264** (0.12367)	-3.24397** (0.34331)	-0.51216** (0.10030)	0.14790** (0.03383)	0.75296** (0.16502)	0.50520** (0.07356)	0.348	135.442**
5	0.00064** (0.00022)	-0.90467** (0.22434)	-2.84716** (0.67697)	-0.73562** (0.23373)	0.09159** (0.02433)	0.82837** (0.15596)	0.63863** (0.15943)	0.340	29.924**
6	0.00055** (0.00016)	-0.93055** (0.18660)	-2.38420** (0.50688)	-0.78563** (0.13141)	-0.18608** (0.14076)	0.85373** (0.18160)	0.52771** (0.13457)	0.335	23.571**
7	0.00044** (0.00014)	-0.97991** (0.16532)	-1.73899** (0.54124)	-0.82404** (0.21086)	-0.22884** (0.13803)	0.90488** (0.24893)	0.44929** (0.13274)	0.323	17.315**

1973

1	0.00158** (0.00017)	-0.64123** (0.12135)	-4.34875** (0.32478)	-0.24509** (0.04033)	0.69340* (0.38227)	0.45490** (0.04683)	0.05059* (0.03034)	0.346	544.363**
2	0.00141** (0.00023)	-0.69381** (0.16683)	-3.83601** (0.25570)	-0.43991** (0.09666)	0.43011 (0.35677)	0.55424** (0.07480)	0.07211** (0.02412)	0.335	336.511**
3	0.00125** (0.00013)	-0.73647** (0.16054)	-3.55577** (0.41009)	-0.46270** (0.07058)	0.50696* (0.21654)	0.55260** (0.11604)	0.38097** (0.04388)	0.293	179.476**
4	0.00099** (0.00012)	-0.72043** (0.06732)	-2.96531** (0.16332)	-0.48957** (0.11404)	0.44659* (0.20563)	0.68910** (0.09410)	0.46820** (0.03729)	0.286	111.161**
5	0.00088** (0.00010)	-0.77815** (0.10529)	-2.33230** (0.29535)	-0.66888** (0.14057)	0.38485* (0.19039)	0.73986** (0.16511)	0.41787** (0.04186)	0.291	113.530**
6	0.00073** (0.00009)	-0.87299** (0.06946)	-1.93170** (0.22347)	-0.68666** (0.08505)	0.29490* (0.14325)	0.71205** (0.10406)	0.52178** (0.02907)	0.292	68.024**
7	0.00071** (0.00011)	-1.00816** (0.07828)	-1.83083** (0.27798)	-0.71504** (0.14676)	0.26467* (0.14547)	0.93843** (0.38220)	0.50521** (0.03733)	0.294	62.889**

\*\* Significant at the .01 level  
 \* Significant at the .05 level  
 " Significant at the .10 level

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**Table 6**  
**Estimated Values of Income Elasticities of Fertility**  
**for Family Income, 1963 and 1973**

SORG							
Age Group	1	2	3	4	5	6	7
1963							
20 - 24	0.11	0.13	0.17	0.21	0.26	0.25	0.31
25 - 29	0.12	0.11	0.16	0.18	0.32	0.37	0.47
30 - 34	0.05	0.06	0.10	0.14	0.22	0.26	0.29
35 - 39	0.05	0.05	0.09	0.11	0.21	0.21	0.16
40 - 44	0.05	0.06	0.10	0.13	0.26	0.25	0.23
45 - 49	0.06	0.07	0.12	0.17	0.27	0.30 <sup>a</sup>	0.31 <sup>a</sup>
1973							
20 - 24	0.21	0.27	0.34	0.32	0.50	0.60	0.89
25 - 29	0.17	0.21	0.25	0.29	0.62	0.67	1.02
30 - 34	0.17	0.20	0.26	0.28	0.59	0.71	1.12
35 - 39	0.12	0.15	0.17	0.19	0.43	0.37	0.56
40 - 44	0.14	0.14	0.17	0.19	0.33	0.41	0.62
45 - 49	0.14	0.16	0.22	0.20	0.33	0.47	0.67

a = coefficient not statistically significant at .10 level.

crease in income increased fertility for households in SORG 1 and age group 20-24 by approximately 1.1 percent, and for households in SORG 7 and age group 20-24 by 3.1 percent.

An analysis of the estimated income elasticities of fertility reveals that, for each age group in both 1963 and 1973, fertility in higher-status SORGs is more income elastic than fertility in lower-status SORGs. As socioeconomic status increases, households apparently are able to both maintain SORG position status through rising consumption of status goods and have a larger number of children as well. The empirical evidence sharply contradicts the hypothesis that the importance of targeted consumption goods and services rises as SORG status increases in such a way as to either hold constant or reduce the number of children reared in the household. On the other hand, the income elasticities are almost always substantially less than unity. This pattern does indicate that the pressure within a given SORG to consume other, non-child goods and services is great, resulting in the generally weak effect higher income has on increased number of children.

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In the context of these positive but rather low income elasticities, it is important to note that income elasticities in 1973 are noticeably higher than in 1963. Without exception, the elasticity coefficient in every SORG-age group classification in 1973 is larger than in 1963; in fact, the 1973 elasticity coefficient for SORG 7 and age groups 25-29 and 30-34 has surged above unity. This trend suggests that within a given SORG, the pressure to consume other goods and services out of a given income, while often still considerable, is less binding than was this constraint ten years earlier. This accounts for the higher elasticity values in 1973 compared to 1963. Particularly for the highest SORGs, say 5, 6, and 7, the elasticities can no longer be considered low, which was true in 1963.

The income elasticities of fertility follow a less reliable pattern with respect to age group. In general, the highest elasticity values are recorded by the younger age groups. Such a finding is not surprising, since these are the households currently in the process of family formation, and the specification of the dependent variable makes it less meaningful for older populations. For age brackets above, say, 35 years, there is the possibility of recording lower fertility simply because some children may have aged sufficiently (that is for the past 15 years) to drop out of the fertility indicator. Recall that fertility is indicated by the number of children ages 0 to 15 years living with their mother. Thus, in higher age groups there is the distinct possibility of declining fertility due to child aging, together with rising income, creating an artificial negative fertility-income relationship. Apparently this negative relationship is statistically mixed together with an underlying true positive relationship, thereby weakening the size and significance of the latter. Thus, the empirical results presented here probably should be regarded as most accurate for the younger age brackets, say women ages 20-35, the results for older age brackets partly distorted due to the aging of children. Later, the dependent variable is respecified for 1973 only in terms of the cumulative number of surviving children. Of course, the problem of alteration in the dependent variable due to child-aging cannot arise in that alternative specification of the model.

The analysis of variance indicates that 76-81 percent of the total variation in the distribution of the income elasticities across all SORGs and age groupings is accounted for by SORG classification and only 12-15 percent of the total variation by age bracket.

• *Female labor force participation.* The statistically significant negative signs of the coefficients measuring the effect on fertility of female participation in the labor force ( $L_{hjk}$ ) support the hypothesis that, other things being equal, female work experience outside the home acts as a deterrent to fertility due to the higher opportunity costs associated with working wives having children, relative to wives not employed outside the home. The coef-

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ficients presented in Tables 3 to 5 imply, for example, that working wives in 1963 aged 20-24 and belonging to SORG 1 have, on average, 0.47 fewer children than nonworking wives in the same SORG and age group. Only three coefficients are not statistically significant at least at the 0.10 level in 1963, while in 1973 only one is not; all three coefficients are in the 40-49 age bracket (not shown in the tables).

In moving from lower to higher SORG, the effect of female labor force participation on fertility becomes even more pronounced. This trend may be indicative of a preference for higher-quality children in higher status households; in other words, children of higher-status households may be a more time-intensive commodity with respect to the mother's time than children of lower-status households. Thus, a greater perceived incompatibility between having and raising children, on the one hand, and working outside the home, on the other hand, is likely to exist in higher SORG households than in lower SORG households. The negative effect of female participation in the labor force generally is strongest for the 25-29 and 30-34 age groups, which correspond to the years in which most women raise young children. For the younger age groups, 20-34, however, the negative effect appears generally weaker in 1973 compared to 1963. This implies that during the ten-year period, younger women came to perceive childraising and work outside the home as somewhat less incompatible activities.

*Non-nuclear family.* Another variable utilized to measure children-related costs is the ratio of nonnuclear family members to total members in the household ( $E_{huk}$ ), which approximates the incidence and magnitude of the extended-family structure. As shown by the coefficients for this variable in Tables 3 to 5, this is a highly significant variable, particularly for the 30-34 age brackets, in which all coefficients are statistically significant at the 0.01 level. The negative signs of the coefficients indicate that the extended-household structure not only constitutes a greater net drain on family resources than does a nuclear household structure, but this negative influence outweighs any positive effects on fertility that might be associated with lowering the costs of children, especially the costs of child care. The highly significant negative signs may imply that the presence of other relatives and maids in the household are a poor substitute for the mother's time devoted to childraising, particularly in light of the significant and negative coefficients also estimated for female labor force participation. In general, however, the absolute values of the elasticities that can be calculated from the extended-family coefficients are very low, although the variable grows moderately more elastic in higher age groups and for higher-status SORGs. On average, the already-low 1963 elasticities decline even more in 1973. Despite the statistical significance of the coefficients, the low absolute values raise

doubts concerning any major impact on fertility of changes in family structure.

*Urban-rural location.* A third proxy to help estimate the effects on fertility of children-related costs and benefits reflects the urban or rural character of the household ( $U_{hijk}$ ). The statistical estimates of these coefficients, which are presented in Tables 3 to 5 conform to expectations: All coefficients are negative and, with only one exception, statistically significant at a high probability level. They imply that in urban areas children are a more expensive commodity and/or their net rate of return to parents as factors of production is lower than in the countryside. This negative effect of urban residency on fertility generally is more pronounced in moving from lower to higher SORG and from younger to older age group, with the exception of the 45-49 age group (not shown in tables) in which the negative effect of urban location is weaker than in the 40-44 group. Some interesting, systematic 1963-1973 changes took place over the decade. In general, the negative effect of urban location grew weaker among lower-status SORGs but stronger among the top three SORGs. A similar pattern occurred with respect to age groups: Urban location exerted a greater negative pressure on fertility in 1973 than in 1963 among older households, while the opposite was true for younger households.

*Social security system participation.* Another proxy to measure price effects of children records whether or not the household head belongs to the social security system ( $S_{hijk}$ ). Estimated values of the coefficients of this variable can be observed in Tables 3 to 5. Membership in the social security system is hypothesized to have a dual effect on fertility: 1) A negative long-term effect because membership in the system reduces parents' dependence on children for support in their old age, and 2) a positive short-term effect because membership in the Costa Rican social security system subsidizes the medical and health costs of having and raising children. The empirical findings for 1963 show that among lower-status SORGs, membership in the social security system performs primarily as a government subsidy for maternity and children's medical expenses; the lower the SORG, the more important is the positive effect of the subsidy on fertility. For example, for SORG 1 in the 20-24 age group, households whose heads belonged to the social security program in 1963 had, on average, 0.13 children more than households in the same SORG whose heads were not part of the program; however, among households in SORG 5, the fertility differential was reduced to 0.03 children. The positive effect on fertility of the subsidy becomes more important for SORGs 1-5 as the age group increases, reaching a peak in the age bracket 30-39 and declining with subsequent age groups. The 1963 results also show that, for the highest two SORGs, the positive subsidy

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effect of social security membership was replaced by a negative effect, suggesting that membership in the social security system replaced having children as the dominant form of providing for security in old age. This negative replacement effect generally was more intense among the older households in SORGs 6 and 7. In general, the statistical levels of significance for the 1963 coefficients are acceptable, although nine of these coefficients are not significantly different from zero at the 0.10 level; the nonsignificant coefficients are grouped mostly in the younger age groups and higher SORGs.

The results for 1973 also show a declining trend in the absolute sizes of the coefficient values in moving from lower to higher SORGs, but the coefficients generally have a higher positive value than in 1963. Thus, the signs of the coefficients for SORGs 6 and 7 have become positive, whereas in 1963 they were negative. The increased positive values of the coefficients in 1973 may be attributed to the relatively large influx of new social security system participants between 1963 and 1973 who apparently view membership in the program as a subsidy for having and rearing their offspring. With respect to trends by age groups, the 1973 pattern is less definite than in 1963, although age group differentials are statistically significant. The positive effect of social security membership on fertility gains importance with greater age, reaching a maximum in the 35-44 age bracket, and then declines in the 45-49 age group.

*Household sanitation facilities.* The effect of improved household sanitation facilities on family formation is measured with a dummy variable recording availability of toilet facilities in the dwelling ( $T_{hijk}$ ). Estimated values for the coefficients of this variable are reported in Tables 3 to 5. All coefficients in 1963 and 1973 are significantly different from zero at the 0.01 probability level. The positive signs of the coefficients indicate that better sanitation tends to stimulate higher fertility levels. This effect seems to become stronger in moving from lower to higher SORG and from younger to older age groups, until it reaches a maximum in the 40-44 (not shown in tables) age group and declines in the oldest group. In general, the magnitude of the positive effect of better sanitation facilities on fertility declined slightly for 1973 relative to 1963.

*Dwelling ownership.* As a proxy to estimate the effect of wealth on fertility, a dummy variable measuring the incidence of dwelling ownership by the family occupants ( $D_{hijk}$ ) is utilized. The positive signs of the coefficients in Tables 3 to 5 accord with the hypothesis that an increase in the household's stock of non-human wealth shifts its demand for children upwards. This positive effect is increasingly stronger as we progress from younger to older households in both 1963 and 1973. There seem to be some interesting differentials, however, in the nature of the demand shift between 1963 and

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1973. While the positive effect of wealth on fertility in 1963 increased with the status of the SORG, reaching a peak with SORG 5, and then declining in SORGs 6 and 7, the positive effect of wealth in 1973 increased uninterruptedly from lower- to higher-status SORGs. In general, the wealth effect appears to have declined during the ten-year period since, on average, the absolute sizes of the 1973 coefficients are approximately 10 percent smaller in relation to the 1963 coefficients.

*F statistics and coefficients of multiple determination.* The F statistic tests whether or not the effect on fertility of an entire set of variables is statistically significantly different from zero when these variables are taken together. Thus, the F statistic is used to help determine if the empirical model is specified properly. The high statistical significance of the F ratios, as shown in Tables 3 to 5 indicates that the variables treated in this model do have an important effect on fertility in both 1963 and 1973. Although all 84 F statistics are significantly different from zero at the 0.01 probability level, the values of this statistic reveal three definite patterns. First, the value of the F ratio and the SORG status vary inversely; that is, the higher the SORG, the lower the value of the F statistic. Second, the younger the household, the higher the value of the F statistic. This conforms with the point raised earlier that the specification of the dependent variable in this model probably means the model is most accurate for younger age brackets, due to the problem of children aging and dropping out of the fertility indicator. The third pattern shown by the values of the F statistics in this model is that 1973 F ratios are higher than 1963 ratios. These three patterns imply that, although the model seems to be appropriate for all 84 classifications (seven SORGs, six age groups, and two years), it is best specified for younger, lower-status SORG households in 1973.

The coefficient of multiple determination,  $R^2$ , is another indicator of whether or not the model is correctly specified. It measures the percentage of the variation in the dependent variable that is accounted for by variations in the independent variables. The coefficients of multiple determination for 1963 and 1973 shown in Tables 3 to 5 range from 0.323 to 0.507 in 1963, and from 0.249 to 0.378 in 1973. As with the F statistic, the values of these coefficients generally decrease in moving from lower- to higher-status SORGs and from younger to older households. With the  $R^2$ , however, the 1963 values exceed the 1973 values, which implies that a better fit is accomplished for the 1963 data.

### **SURVIVING CHILDREN**

The 1963 Census questionnaire contains no direct questions on fertility, but the 1973 questionnaire does. Specifically, it is possible to estimate the total number of surviving children belonging to each household. Number of

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surviving children is the fertility concept perhaps closest to the demand-for-children theoretical framework used in this study, which is primarily a theory to explain lifetime completed fertility. Thus, it is of some interest to re-test the same basic empirical model for 1973 data only with the dependent variable respecified to include all surviving children.

An alternative empirical model of fertility, referring to number of surviving children and applicable to 1973 data only, can be expressed as follows:

$$G_{ijk} = \gamma_{0ij} + \gamma_{1ij} Y_{ijk} + \gamma_{2ij} L_{ijk} + \gamma_{3ij} E_{ijk} + \gamma_{4ij} U_{ijk} + \gamma_{5ij} S_{ijk} + \gamma_{6ij} T_{ijk} + \gamma_{7ij} D_{ijk} + W_{ijk}$$

where

- $G_{ijk}$  is the number of the surviving children reported by the  $k$ th wife of the  $j$ th SORG in the  $i$ th age group.
- $W_{ijk}$  is a normally, independently distributed stochastic disturbance term for the  $k$ th household of the  $j$ th SORG in the  $i$ th age group.
- $\gamma_{0ij}, \dots, \gamma_{7ij}$  are the least-squares coefficients to be estimated for the  $j$ th SORG in the  $i$ th age group.

The other variables remain as defined earlier.

Due to limitations of space, the estimates of the coefficients for the seven variables in the model, their standard errors and levels of significance, the  $F$  ratios, and coefficients of multiple determination are not presented here. In general, when comparing the results from the two models using alternative fertility indicators for 1973, one can see no appreciable differences in the signs, statistical significance, and general trend of the coefficients and elasticities. There is, however, one major exception to this generalization: As a rule, regardless of the particular effect of an independent variable on fertility, the sizes of the coefficients tend to be larger when using number of surviving children as the dependent variable than when using number of children ages 0 to 15 living with their mother. Of course, the size difference in the coefficients is particularly noticeable for older age groups. The differences find a plausible explanation in the fact that the number of surviving children is an indicator of cumulative fertility, whereas the number of children aged 0 to 15 is an indicator of recent fertility. For the younger age groups, say 20-34 years, the difference is nil because the wife's length of exposure to conception seldom exceeds 15 years. Thus, among younger households, the only important difference between the two indicators lies in those relatively few cases where a child does not live with the mother. Among older women, say those 35 years and older, the length of exposure to

conception generally exceeds 15 years, producing disparities between recent and cumulative fertility and depressing the dependent variable due to the aging of children past 15 years. In general, however, the values of the F statistics and coefficients of multiple determination are larger when the dependent variable is specified in terms of children ages 0 to 15 years living with their mother, rather than in terms of total number of surviving children. These findings clearly suggest that the specification of the empirical model in terms of children aged 0 to 15 years living with their mother is both useful and not radically divergent in practical results from the model specified in terms of number of surviving children.

EFFECTS OF INCOME AND PRICE  
VARIABLES ON FERTILITY

Finally, it is appropriate to put to empirical test the general notion that the pressures to consume status-conferring goods and services associated with socioeconomic group membership are a measureably useful addition to the fertility decisionmaking framework. Since the manner of introducing the status constraint along with the income and relative price constraints has been to divide the total population into numerous SORGs, in this section the attempt is made to empirically test the effects of the income and price variables on fertility without disaggregating the total population by socioeconomic status.

Of course, this alternative empirical model still is consistent with the new home economics approach insofar as it considers, within each age group, both household income and proxies that measure the price of children. Husband's education is added to the multiple regression as one more explanatory variable since it no longer performs its previous function in classifying households into SORGs. The model now can be respecified as follows:

$$C_{hik} = \theta_{0hi} + \theta_{1hi} Y_{hik} + \theta_{2hi} L_{hik} + \theta_{3hi} E_{hik} + \theta_{4hi} U_{hik} + \theta_{5hi} S_{hik} + \theta_{6hi} T_{hik} + \theta_{7hi} D_{hik} + \theta_{8hi} Z_{hik} + X_{hik}$$

where

$C_{hik}$  is the number of children aged 0 to 15 living with their mother in the kth household, the ith age group, and the hth year.

The independent variables remain as defined before but without the j subscript which designated the jth SORG.

$Z_{hik}$  is the number of years of formal education completed by the kth husband of the ith age group in the hth year.

$X_{hik}$	is a normally, independently distributed stochastic disturbance term for the $k$ th household in the $i$ th age group in the $h$ th year.
$\theta_{0hi}, \dots, \theta_{8hi}$	are the least-squares coefficients to be estimated for the $i$ th age group in the $h$ th year.
$k = 1, \dots, K_{hi}$	where $K_{hi}$ is the sample size of the $i$ th age group in the $h$ th year.

Estimates of the coefficients for the eight variables in the respecified empirical model, their standard errors, and levels of significance, the F ratios, and the coefficients of multiple determination are presented in Table 7. The results of this model are most interesting when compared with earlier findings. First, the coefficients of the proxies measuring income, wealth, and membership in the social security system in most cases lose their previous statistical significance. Second, the variables for female participation in the labor force, extended family, and urban-rural location, all retain their earlier negative signs and, generally, their previous levels of statistical significance. The new variable, Z, measuring the husband's level of education also appears negative and highly significant statistically, at least in the younger age brackets.

Another interesting comparison lies in the differences in the F ratios and coefficients of multiple determination. Although the values of the F ratio are statistically significant in the respecified model, generally they are lower than the corresponding values for the equations in which households are classified into socioeconomic reference groups. The values for the coefficients of multiple determination also are lower. Therefore, it appears on the basis of the empirical findings that the inclusion of households status constraints through the classification of heterogeneous populations into relatively homogeneous socioeconomic reference groups adds a valuable refinement which helps explain fertility differentials for the entire population.

### Summary

We have found broad empirical support spanning six age groupings in two different census years for the main hypotheses of the demand approach to explaining cross-sectional variation in household fertility levels. The income, relative price, and status constraints on fertility all prove to play important roles in determining the number of children couples choose to bear and rear. The empirical results on Costa Rican families in 1963 and 1973 yield the following propositions:

1) Lower-status households have larger families, measured by number of children ages 0-15 years living with their mother, than higher-status households in every age grouping. For every SORG, measured fertility rises

Table 7

Regressions on Number of Children, Ages 0-15, and Living with their Mother (C1W+), in 1963 and 1973, by Mothers' Age Group (with Standard Errors and Levels of Significance)

Age Group	Y <sub>1</sub>	L <sub>1</sub>	E <sub>1</sub>	U <sub>1</sub>	S <sub>1</sub>	T <sub>1</sub>	D <sub>1</sub>	Z <sub>1</sub>	R <sup>2</sup>	F <sub>1</sub>
1963										
20 - 24	0.00012 (0.00032)	-0.74323** (0.18940)	-1.84316** (0.24902)	0.19440** (0.07032)	0.07327 (0.05947)	-0.28757** (0.08312)	0.21414 (0.25398)	-0.12431** (0.03160)	0.320	42.613**
25 - 29	-0.00005 (0.00021)	-0.84434** (0.21302)	-2.35541** (0.31434)	-0.27665* (0.12281)	0.18172* (0.09443)	-0.47269** (0.13107)	-0.17415 (0.41824)	-0.15774** (0.03555)	0.284	35.736**
30 - 34	0.00010 (0.00043)	-0.65499** (0.23061)	-4.39741** (0.38371)	-0.44008** (0.12813)	0.21337 (0.17690)	-0.45465** (0.12186)	-0.30711 (0.32694)	-0.12499** (0.02896)	0.225	21.280**
35 - 39	0.00014 (0.00062)	-0.52445* (0.28110)	-4.98732** (0.41069)	-0.61249** (0.14657)	-0.25673** (0.19007)	-0.63921** (0.21573)	0.15362 (0.38640)	-0.10833** (0.02746)	0.164	15.324**
40 - 44	0.00017 (0.00058)	-0.42193* (0.25258)	-4.17201** (0.40994)	-0.68434** (0.15824)	0.22813 (0.17945)	-0.57040* (0.24883)	-0.28418 (0.44011)	-0.07532* (0.03851)	0.129	7.878**
45 - 49	-0.00003 (0.00041)	-0.31389 (0.25122)	-2.37000** (0.29194)	-0.50283* (0.21905)	0.16401 (0.13215)	-0.39261* (0.21108)	0.15917 (0.52408)	-0.04166 (0.03919)	0.101	5.086**
1973										
20 - 24	-0.00001 (0.00028)	-0.62032** (0.12852)	-1.46375** (0.20224)	-0.22379** (0.05583)	0.24949 (0.15318)	-0.41803** (0.15270)	-0.04381 (0.10763)	-0.14564** (0.03028)	0.261	53.110**
25 - 29										
30 - 34	0.00014 (0.00030)	-0.72331** (0.15293)	-3.10492** (0.25874)	-0.40365** (0.11198)	-0.41185 (0.42937)	-0.58912* (0.26387)	-0.00314 (0.07883)	-0.15368** (0.02517)	0.152	36.657**
35 - 39	0.00012 (0.00055)	-0.48439** (0.13982)	-4.41421** (0.35604)	-0.58912** (0.13188)	0.71823* (0.35716)	-0.42866 (0.29934)	0.41267* (0.21832)	-0.11016** (0.02733)	0.119	28.976**
40 - 44	0.00004 (0.00052)	-0.35793** (0.17664)	-4.62396** (0.48913)	-0.63547** (0.14686)	0.63802* (0.49166)	-0.45361 (0.33287)	-0.05398 (0.04726)	-0.09843** (0.02675)	0.093	18.324**
45 - 49	0.00003 (0.00032)	-0.33028* (0.14180)	-3.12418** (0.45330)	-0.39480* (0.18435)	0.32849 (0.40357)	-0.21319 (0.30765)	0.12749 (0.08818)	-0.05128* (0.02439)	0.074	15.746**

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from younger to older age groups, reaches a peak in the 30-39 age groups, and declines thereafter.

2) The Costa Rican fertility decline (measured in terms of number of children ages 0-15 living with their mother) during the 1963-1973 decade was centered within the youngest age groups; the greatest fertility decline occurred for members of the highest SORGs, with families in lower SORGs slower to reduce fertility.

3) Increases in family income, measured as the sum of husband's and wife's wage-and-salary earnings, raise measured fertility levels. The income elasticities of fertility were larger in 1973 than ten years earlier.

4) Increases in the females' participation in the labor force tend to reduce family size. The coefficients are lower in 1973 than 1963 with some exceptions in the highest SORGs.

5) A larger-size extended family, measured as the ratio of nonnuclear family members to total members living in the household, reduces measured fertility. The elasticity values are not great and changed little between 1963 and 1973.

6) Location of the household in an urban environment, other things being equal, tends to diminish family size.

7) Membership by the head of household in the Costa Rican social security system generally raises measured fertility. An exception was a negative association in 1963 for the highest SORGs.

8) Improved levels of household sanitation are associated with higher fertility levels.

9) Family ownership of dwelling place tends to raise family size.

10) Re-specification of the empirical model in terms of number of surviving children rather than number of children ages 0-15 years living with their mother causes no appreciable differences to appear in the signs, level of statistical significance, and general trends of the coefficients and elasticities for the independent variables. An exception to this generalization is that the absolute sizes of the coefficients tend to be higher when using number of surviving children; but the F statistics and R<sup>2</sup>'s tend to be larger when using number of children aged 0-15 years living with their mother.

11) Another alternative specification of the empirical model seeks to test income and price effects on fertility without considering simultaneously the status constraint, which the SORG disaggregations are designed to capture. In this re-specification the income and two price variables lose statistical significance, while three price variables retain their levels of significance. Generally, the F statistics and R<sup>2</sup>'s are lower in the re-specified model than in the original equations, indicating that disaggregation of the population into relatively homogeneous SORGs is a useful empirical refinement. The last proposition may be taken to support the hypothesis that a status constraint

operates in family fertility decisionmaking along with income and price constraints.

#### EMPIRICAL ANALYSIS OF FAMILY PLANNING AND ATTITUDINAL DIFFERENCES

Household fertility varies closely with the status of the socioeconomic reference group to which the couple belongs. That is, for the 1963 and 1973 Census samples, family fertility decreases markedly in moving from households belonging to lower-status SORGs to those belonging to higher-status SORGs. Moreover, the Costa Rican fertility decline during the ten years between the two censuses seems to have been concentrated in the younger age brackets among women, 20-29 years; almost all older women, 35-49 years, recorded more children in 1973 than ten years earlier. These results have been explained in terms of the income, relative price, and status constraints on family-size decisionmaking. All three constraints perform according to the theoretical expectations developed in a previous section, and appear to explain cross-sectional variation in individual household fertility in 1963 and 1973.

In this section, collateral data and empirical tests are discussed that further enrich the explanation of the Costa Rican fertility decline. These data were obtained in a unique and highly detailed fertility survey conducted in the capital city of San José. Thus, specific data on fertility experience, contraceptive knowledge and usage, and female attitudes along several dimensions relevant to fertility analysis are available which are not contained in the two population censuses but which supplement those data sources. To test for statistically significant differences among SORGs and age group classifications, three sets of variables have been selected from the fertility survey information. The first set examines actual family planning behavior; the second set deals with broad cultural attitudes relevant to fertility behavior; and the third set pertains especially to cultural attitudes toward the role of women in Costa Rican society.

#### DATA BASE

The data used in the empirical analysis in this section are obtained from the Urban Fertility Survey conducted in 1965 in San José under the sponsorship of CELADE (United Nations Center for Latin American Demography). Since the survey is limited to the largest metropolitan area in the country, the results must be interpreted with this limitation in mind. The Urban Fertility Survey of San José included a total of 2,132 women. Of these, only 1,309 legally or consensually married are included in this analysis. Single women were not questioned about their use of contraception and, therefore, were excluded from the sample.

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The criteria used to define the socioeconomic reference groups include the husband's occupational category and the joint level of the husband's and wife's formal education. Five occupational groupings are identified in the survey. They are, from highest to lowest occupational status, as follows: Occupational grouping 1) professional, high administrative, and management posts; Occupational grouping 2) higher supervisory or inspection nonmanual occupations; Occupational grouping 3) lower supervisory or inspection nonmanual occupations; Occupational grouping 4) routine nonmanual and specialized manual occupations; and Occupational grouping 5) semi-specialized and nonspecialized manual occupations. Similarly, nine composite groupings of the husband's and wife's level of formal education are identified in the survey. From lowest to highest educational level, these are: Educational grouping 1) low husband, low wife; Educational grouping 2) low husband, intermediate wife; Educational grouping 3) low husband, high wife; Educational grouping 4) intermediate husband, low wife; Educational grouping 5) intermediate husband, intermediate wife; Educational grouping 6) intermediate husband, high wife; Educational grouping 7) high husband, low wife; Educational grouping 8) high husband, intermediate wife; and Educational grouping 9) high husband, high wife. Thus, there are five occupational and nine educational groupings for a total of 45 possible combinations. Each combination is assigned to one and only one SORG in a tradeoff manner; that is, within certain limits, households characterized by a husband's higher occupational status but a lower level of joint educational level share the same SORG with households featuring a lower occupational status but a higher educational level. For example, households in occupational grouping 2 and educational grouping 1 are classified as belonging to the same SORG as households in occupational grouping 5 and educational grouping 9.

Households classified by SORG are further disaggregated according to the wife's age into six five-year age groups ranging from 20-24 to 45-49. The distribution of these households by SORG and age group is fairly even and permits statistical analysis and inference. The statistical model employed is suitable for testing inter-SORG and inter-age group differentials as well as the interaction effect between both sources of variation. The linear additive model of this design is:

$$X_{ijk} = \mu + \alpha_i + \delta_j + \lambda_{ij} + \epsilon_{ijk},$$

where  $X_{ijk}$  is the value of the indicator for the  $k$ th household of the  $i$ th SORG in the  $j$ th age group,  $\mu$  the overall parameter mean,  $\alpha_i$  is the deviation of the  $i$ th SORG mean from the overall mean,  $\delta_j$  is the deviation of the  $j$ th age group mean from the overall mean,  $\lambda_{ij}$  is the SORG-age group interaction effect,  $\epsilon_{ijk}$  is the stochastic component or statistical error term of the  $X_{ijk}$  observa-

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tion, and where  $i = 1, \dots, 5$  and  $j = 1, \dots, 6$ . The values of  $F_s$ ,  $F_a$ , and  $F_i$  shown in subsequent tables indicate whether or not the SORG, age group, or interaction effects, respectively, are statistically significant in explaining variations in the different variables analyzed throughout the remainder of the chapter.

Ten specific variables are analyzed in the following section for statistically significant differences by SORG and age group classification. These variables are an index of knowledge about contraceptives; an index of contraceptive usage; an index of family planning status; an index of traditionalism; the place of geographic origin of the husband and of the wife; the percentage of female participation in the labor force; the percentage of women who believe that women should have the same work opportunities outside the home as men; the percentage of women who feel that female labor should be confined to household chores; and the percentage of women who believe that married women should participate in the labor force.

Before examining the results of these tests, however, we briefly comment upon the past fertility behavior of the 1,309 married women in the survey. For each SORG and age bracket, the average number of surviving children per woman is shown in Table 8. As would be expected, the values of the fertility indicator are partly determined by the mother's age for the obvious reason that older women have been exposed to the possibility of conception for a longer period of time than younger women. More interesting is the unequivocal downward trend in fertility that occurs in moving from lower to higher SORGs. This trend is highly statistically significant for the fertility indicator, but the interaction effect is not. The high level of statistical significance for SORG classification seems to imply that SORGs, and the criteria employed in developing the socioeconomic reference groups can be highly relevant for fertility analysis. The 1973 Census and the 1965 Urban Fertility Survey, two entirely different data sources, show identical fertility trends (fertility decreasing with SORG status, increasing with age, and both sources of variation statistically significant at the .01 level). One interesting difference, however, does appear: the census reports a higher absolute level of fertility than the Urban Fertility Survey in almost every SORG-age cell. Of course, this difference undoubtedly reflects the higher absolute level of fertility prevailing in the rural countryside relative to San José.

#### **FAMILY PLANNING BEHAVIOR**

The Urban Fertility Survey contains responses dealing with several family planning methods. The first is an index of contraceptive knowledge in which a score is given for each method of contraception that the respondent can identify. Furthermore, the weight assigned varies according to the reliability of each method as follows: 1) knows no method, 2) withdrawal, 3) rhythm

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**Table 8**  
Average Number of Surviving Children per Wife,  
By SORG and Age Group\*

Age Group	SORG					Total
	1	2	3	4	5	
20 - 24	2.13 (1.13)	2.05 (1.49)	1.87 (1.26)	1.07 (0.80)	1.50 (1.08)	1.79
25 - 29	3.74 (1.56)	3.47 (1.53)	2.48 (1.49)	3.10 (1.14)	2.25 (1.08)	2.83
30 - 34	4.31 (2.45)	3.75 (2.15)	4.54 (1.45)	3.41 (1.93)	2.91 (1.47)	3.88
35 - 39	5.44 (2.29)	4.36 (3.18)	4.32 (2.41)	3.61 (2.25)	3.54 (2.14)	4.28
40 - 44	5.78 (3.04)	5.35 (3.14)	4.40 (2.96)	4.00 (2.24)	3.76 (2.13)	4.67
45 - 49	5.39 (3.23)	4.89 (3.41)	4.50 (2.55)	2.80 (1.14)	3.22 (1.88)	4.42
Total	4.64	3.97	3.60	3.12	2.78	3.61

ANOVA

Source of Variation	Degrees of Freedom	Sum of Squares	Mean Square	F
SORG	4	404.57	101.14	11.79**
Age Group	5	1,219.23	243.85	28.42**
Interaction	20	48.48	2.42	0.28
Error	1,279	10,979.10		
Total	1,308	12,651.38		

\*Standard deviation in parentheses.

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or douche, 4) chemical jellies, 5) condom, 6) diaphragm, and 7) pill. The resulting index is the sum of the weights, and the score can range from 1 (none of the methods is identified) to 30 (all methods are identified). The estimated values of the index range from an average of 9.7 to 17.5 across SORGs. The variation across age groups is small. The statistically significant differences among SORGs indicate that the level of education, one of the criteria used in the SORG classification, varies positively with knowledge of contraception, thus confirming other researchers' findings along these lines. (Stycos 1970) More education presumably not only enhances the woman's knowledge about the availability of contraception, but might also increase her awareness of the benefits from controlling fertility through contraception. A more educated woman is also more likely to accurately evaluate the advantages and shortcomings of alternative contraceptive techniques, and thus to use more effective contraceptive methods.

Therefore, level of education, knowledge about contraceptives, and actual use of contraceptives are likely to be positively correlated. Accordingly, an index of actual contraceptive use by SORG and age group indicates that the weights are identical to those of the index of contraceptive knowledge described above. Both SORG and age group classifications are highly statistically significant, with women in the higher-status SORGs showing more actual use of contraception than women in the lower-status SORGs. The range in values across SORGs is 3.0 to 6.0. Age group differences are also clearly evident. Women ages 20-39 (average index score 4.8) use more contraception than older women ages 40-49 (average index score 3.3), which implies that family planning practices are becoming more integrated into the Costa Rican lifestyle, at least in the capital city, by permeating the environment of younger women belonging to higher SORGs.

Based on these two contraceptive indices, CELADE has developed a composite index of family planning status. This index measures along a discrete scale of 1 to 10 with the following code: 1, the woman uses a modern method of contraception and takes no chances; 2, the woman uses a modern method of contraception but takes chances; 3, the woman uses a traditional method of family planning and takes no chances; 4, the woman uses a traditional method of family planning but takes chances; 5, the woman now uses no method, but in the past has used a modern method; 6, the woman now uses no method, but in the past has used a traditional method; 7, the woman has never used contraception, but knows about a modern method; 8, the woman has never used contraception, but knows about a traditional method; 9, the woman knows no contraception method, but accepts the principle of family planning; and 10, the woman knows no contraceptive method, and does not accept the principle of family planning. Obviously, the higher the value of the index, the less prone the woman would be to using

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contraception effectively. Estimates on the value of this index by SORG and age group reveals that the values of this index vary inversely with SORG status and positively with age as anticipated. Values range from 5.75 to 4.20 across SORGs and from 4.88 to 6.72 across age groups. Both SORG and age group variations are statistically significant, again indicating that younger, higher-status households are the most effective family planners.

### Cultural Attitudes

In less developed, transitional countries like Costa Rica, traditionalism plays an important role in many aspects of life. Thus, the adoption of means of contraception by couples may conflict with traditional values. Other things being equal, it could be expected that those socioeconomic reference groups in which the use of contraception is more widely practiced are less traditionally oriented than other groups in which contraception is less widespread. The Urban Fertility Survey includes an index of household traditionalism measured along a 1 to 9 discrete scale; lower scores on this scale represent a lower regard for traditional values by the respondent, while higher scores are indicative of more traditionally oriented values. Estimates of this index reveal that traditionalism declines fairly steadily as the status of the SORG increases (values range from 6.02 to 4.44) which conforms to the expectation that SORGs relatively high in use of contraception also should record relatively low traditionalism scores. The age group classification is also statistically significant for the index of traditionalism but, surprisingly, on average, younger households score more traditionally oriented values than older households (range is from 6.06 to 5.22 from younger to older). This finding apparently conflicts with the fact that younger couples practice contraception more commonly than older couples.

Another measure of traditionalism in the Urban Fertility Survey refers to the geographic origin of the household. Other things being equal, the value systems of individuals now living in large metropolitan areas but born and raised in small towns or rural areas might be expected to be more traditionally oriented than the values of individuals born and raised in large cities. As Freedman and Slesinger (1961) point out, attitudes toward contraception and fertility among rural immigrants in an urban population are affected by both the cultural patterns of their farm origins and those at their urban destinations; the degree of adoption of contraception attitudes is expected to develop out of a modification of rural values under the impact of urban living and urban attitudes. Two proxies are used to determine the geographic origin of the household. These are dummy variables that record whether or not the husband and the wife were born in a small village or rural area. These percentages clearly indicate that, both for husbands and wives, birth in a rural area or small village is closely and positively associated with member-

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ship in the lower-status SORGs, the level of statistical significance being 0.01 in both cases. The percentages vary from 31.4 percent to 8.6 percent for husbands and 48.4 percent to 7.4 percent across SORGs. These findings, of course, also support the generalization that rural origin is positively associated with traditionalism and negatively associated with the adoption of family planning practices. With respect to age classification, little in the way of a definite pattern exists, while age group differences lack statistical significance for the wife. The age-SORG interaction effect, however, is significant for both husband and wife.

#### **Role of Women in Society**

This section primarily deals with cultural attitudes regarding the role of women in Costa Rican society. Before examining these findings, the actual patterns of employment outside the home of the 1,309 married women in the Survey are briefly discussed. Female labor force participation is measured by a dummy variable recording whether or not the woman was employed outside the house for 30 hours or more per week. The results show that neither age classification nor the interaction effect is statistically significant in determining female labor force participation. But, on average, the rate of female participation is higher among higher-status SORGs than among lower-status SORGs, inter-SORG differences being statistically significant at the 0.01 level. The range is from 4.4 percent to 16 percent across SORGs. Of course, this pattern implies that female participation rates and use of contraceptives are correlated. To the extent that having and raising children is an activity incompatible with female employment outside the home, (Easterlin 1969) working women tend to be more motivated to engage in family planning than women who do not work outside the home.

These results are entirely consistent with and supportive of the earlier findings from the analysis of the census data. Thus two entirely different data sources reveal identical participation trends: Participation rises very significantly with SORG status, and also peaks in the younger age brackets (30-34, in both censuses, 25-29 years in the survey). One interesting difference between the two analyses, however, is that, for all SORGs and age brackets together, the overall participation rate in the census (8.3 percent in 1963, 10.3 percent in 1973) is lower than in the survey (11.3 percent in 1965). Of course, this difference undoubtedly reflects the higher rate of female participation in work outside the home that is characteristic of urban areas relative to smaller towns and the countryside.

The first cultural attitude toward the role of women in society discussed here deals with responses to the question of whether or not a woman should have the same opportunity to work outside the home as a man. An analysis of the data reveals that relatively more women in higher-status SORGs (84.4

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percent) share this egalitarian belief than women in lower-status SORGs (75.5 percent). This result is not surprising since it was earlier concluded that women in higher SORGs have a higher rate of both labor force participation and family planning than do women in lower SORGs. It is surprising, however, that age group differences are not statistically significant since younger women in developed countries like the United States are often in the forefront of those demanding equality and justice for women. It will be recalled, however, that age group differences in rates of female labor force participation in Costa Rica are not statistically significant, which may be related to the lack of statistical significance for age group differentials in this case.

Another proxy attempting to quantify attitudes toward the role of women in society refers to the belief that female labor should be confined to domestic tasks. Approximately one-third of the women in the survey sample responded affirmatively, with women in lower-status SORGs responding positively far more than women in higher-status SORGs. Differences by age group continue to lack statistical significance. Another proxy measuring responses to the question of whether or not married women should participate in the labor force lacks statistical significance for both SORG and age group classification. However, an interesting point emerges when comparing the pattern of responses with actual female participation rates. In every single SORG-age group classification except one, the percentage of women who believe wives should work outside the home exceeds the percentage of women (wives) who actually work outside the home. Moreover, the values of these differences are generally greater the lower the SORG; the percentage differences are 0.087 for SORG 5, 0.162 for SORG 4, 0.114 for SORG 3, 0.162 for SORG 2, and 0.264 for SORG 1. This trend may imply the existence of either some labor market entry barriers or a degree of concealed unemployment in Costa Rican labor markets that limits the ability of women from actually finding employment. If this interpretation is valid, these difficulties in finding work are greater for women with less education and lower socioeconomic status than for women with more education and higher socioeconomic status. (Carvajal and Geithman 1975)

#### FINDINGS

The empirical analysis of the Urban Fertility Survey data in this chapter shows several clear-cut trends as SORG rises. In moving from lower to higher SORGs, fertility itself steadily declines; women are more informed about and actually use more contraception; they are more aware of the advantages of family planning; the rate of female labor force participation goes up; women become less traditional in life style; and they more commonly advocate female roles that tend to be competitive with the traditional role of having and raising children. As the age of the women increases, use

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of contraception (both past and present) decreases; women seem less aware of the advantages of family planning; and the level of traditionalism declines.

With few exceptions, the SORG-age interaction effect lacks statistical significance. One inconsistency appears when analyzing age group differentials: Although younger women appear to see themselves as more traditionally oriented in life style, their past and present usage of contraception exceeds that of older women. Perhaps this apparent contradiction is explained by a difference of perception of family planning between older and younger women. It may be that the adoption of family planning implies breaking away from traditionalism and conservative thinking for older women, but that among younger women in Costa Rica the use of contraception is simply a commonly accepted fact of life not perceived to be in conflict with other traditional values.

Thus, the empirical findings in this section are, in general, consistent both among themselves and with the results presented previously. One particular value of the findings is that they help explain, in terms of actual family planning differentials, the manner in which women in higher-status SORGs and younger women achieve their lower fertility rates. Moreover, several cultural attitudes that probably encourage the receptivity of women to family planning emerge in the empirical findings. In particular, there are clear SORG and age group differentials dealing with female work experience and attitudes toward work outside the home which tend to conflict with the traditional female role of childbearing and rearing.

#### SUMMARY AND POLICY CONCLUSION

Between 1963 and 1973 Costa Rica experienced a substantial drop in fertility. This fertility decline is analyzed in this study through an economic model of fertility that focuses on the demand-for-children concept. Fertility outcomes are seen as varying systematically with variations in the individual household's environment, broadly conceived to include economic, social, and cultural pressures.

The value of the economic approach to fertility analysis depends upon its ability to explain fertility differentials in terms of changes in resources and scarcities and to go beyond undefended statements about taste differences. (Ben-Porath 1973) An extensive and rigorous empirical analysis is applied in this study to 1963 and 1973 Costa Rican Censuses data to explore the effects on family-size decisionmaking of three constraints simultaneously; these are the income, relative price, and status constraints. The study finds broad empirical support spanning six age groupings across both census years for the main hypotheses of the demand-for-children approach. The income, relative price, and status constraints all seem to play an important function in determining the number of children couples desire.

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According to census data, higher-status households have a smaller family size, measured as the number of children aged 0-15 years living with their mother, than lower-status households in every age grouping. For every SORG (socioeconomic reference group), measured fertility rises from younger to older age groups, reaches a peak in the 30-39 age range, and declines thereafter. The measured fertility decline during the 1963-1973 decade was centered within the youngest age groups; but for all younger women, the decline was greatest for members of the highest-status SORGs.

While the empirical results reveal that fertility in lower-status SORGs exceeds fertility in higher-status SORGs, the censuses also show that income rises as SORG status rises. From this fertility-income relationship, it is clear that, when considering the entire population and not controlling for other variables that capture price effects, fertility tends to decrease as income rises. However, when other variables for price effects are controlled, the regressions show a statistically significant positive coefficient for the income variable. That is, within each SORG, regardless of age bracket, and within each age bracket, regardless of SORG, fertility tends to rise as income rises. Households that earn income above the SORG's average income are able to maintain SORG status through the consumption of target goods and have a larger number of children as well. Thus, the empirical evidence from the 1963 and 1973 censuses contradicts the hypothesis that the importance of status consumption goods increases so dramatically as SORG status rises, as to force higher income families to reduce the number of children reared in the household. However, the income elasticities of fertility are substantially less than unity, which implies that the pressure to consume non-child goods is great. Finally, the income elasticities in 1973 are noticeably higher than in 1963; this indicates that, within a particular SORG, the pressure to consume other goods out of a given income reduced fertility less in 1973 than in 1963.

The empirical findings support the hypothesis that female work experience outside the home acts as a deterrent to fertility, probably through the higher opportunity costs associated with working wives having and raising children, relative to wives not employed outside the home. Children of higher-status households seem to be a more time-intensive commodity, at least with respect to the mother's time, than are children of lower-status households. Thus, as SORG status increases a greater incompatibility exists between having children and working outside the home. The negative effect of female labor force participation on fertility generally is strongest for women in the 25-34 age groups, which correspond to the years in which most women raise young children.

Another proxy used to ascertain the impact on fertility of child-related costs is the ratio of nonnuclear family members to total members in the household, which approximates the incidence and magnitude of the

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extended-family structure. The negative signs of the elasticities of this variable indicate that the extended-household structure constitutes a greater net drain on family resources than does a nuclear-household structure; this influence also outweighs any positive effects of the extended-household structure on fertility that might be associated with lowering the full costs of raising children. The negative sign of the elasticities implies that the presence of the extended family and maids in the household are a poor substitute for the mother's time devoted to the child. The absolute values of the elasticities, however, are very low for 1963 and drop even more in 1973, which raises doubts concerning any major impact on fertility of changes in family structure.

The empirical findings related to geographical place of residence conform to expectations insofar as the estimated values of the coefficients for urban residence are negative. This implies that children in urban areas are a more expensive commodity and/or their net return as a factor of production is lower than in the countryside. This negative effect becomes more pronounced as we progress from lower to higher SORG and from younger to older age group. Some interesting changes over time can be observed; a weaker negative effect of urban location on fertility existed in 1973 relative to 1963 among lower-status and younger households, but a stronger negative effect occurred among higher-status and older households.

The findings also show that, among lower-status SORGs, membership in the social security system in 1963 acted to subsidize maternity and children's medical expenses; the lower the SORG, the more important was the effect of this subsidy in having and rearing children. For the highest SORGs in 1963, however, the positive subsidy effect was replaced by a negative effect of membership: this negative effect indicates that membership in the social security system for these couples was associated with lower fertility probably because these couples rely less on children as a way of "investing" in their old age security. We can describe this aspect of social security membership as a replacement effect, the couple replacing one form of old age protection (having a large number of children) with an alternative form (membership in a public institution). Both the subsidy and replacement effects of membership in the social security system tend to become more powerful as age increases. The social security coefficients in 1973 show a decreasing trend from lower- to higher-status SORG, although the signs for the highest SORGs have become positive. The change from negative to positive sign in the coefficients for the highest SORGs between 1963 and 1973 may be attributed to the relatively large influx of new social security system participants between 1963 and 1973 who apparently used membership in the program partly as a subsidy for having and rearing their offspring.

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The statistically significant positive signs of the coefficients recording availability of sewer or septic tank as toilet facilities support the hypothesis that better sanitation stimulates higher fertility levels. This effect seems to grow stronger as we move from lower to higher SORG and from younger to older age group, but the positive effect weakens slightly in 1973 relative to 1963.

Finally, the positive signs of the dwelling-ownership variable accord with the hypothesis that an increase in the household's stock of nonhuman wealth increases the demand for children. The positive effect of wealth on fertility is greater for higher-status SORGs and older households than for lower-status SORGs and younger households. The positive wealth effect, however, appears to have weakened somewhat in 1973 in relation to 1963.

An alternative statistical model that utilizes the whole population sample without prior classification by SORG is also tested. Strikingly, the income, wealth, and social security variables lose their previous statistical significance, which provides strong circumstantial evidence that the SORG empirical model is a more valid specification. Moreover, the usefulness of the SORG model as a valuable refinement in explaining fertility differentials is also supported by a comparison of the F-ratios and coefficients of multiple determination of the two models.

Census results from 1963 and 1973 are consistent with the findings of a 1965 San José Fertility Survey that provides specific, highly detailed data on fertility experience, contraceptive knowledge and usage, and female attitudes along several dimensions relevant to fertility analysis. As is also shown by the two censuses in moving from lower-status to higher-status SORGs (that is, as employment status and formal educational achievement rise) measured fertility declines and female participation in the labor force increases. In addition, the Survey shows that as socioeconomic status rises, women know about and actually use techniques of contraception more often; women are more aware of the advantages of family planning; women become less traditional in their life styles; and women more commonly advocate female roles that tend to be competitive with the traditional role of having and raising children. The empirical findings also point to some interesting differentials related to age. As the age of the woman increases, both past and present use of contraceptive methods decreases; women seem less aware of the advantages of family planning; and the level of traditionalism declines. An apparent inconsistency appears in that, although younger women see themselves as more traditionally oriented in life style, their past and present use of contraception exceeds that of older women. Perhaps this apparent contradiction is explained by a difference of perception of family planning between older and younger women. It may be that for older women, the adoption of family planning implies moving away from

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traditionalism and conservative thinking; but among younger women the use of contraception may tend to simply be a commonly accepted fact of everyday life which is not felt to be in conflict with other traditional values.

Probably the most important single reason behind economists' renewed interest in population theory, modeling, and empirical testing are the needs to properly formulate population policy and to develop efficacious guidelines for such policy. Lacking precisely formulated microfoundations, the family planning effort in the past all too often has focused on devising mechanical, inexpensive, and morally acceptable measures to prevent pregnancies directly, rather than on seeking an understanding of the fundamental reasons that underlie parental desires to have children. The Costa Rican family planning program probably has played an important role in accelerating the fertility decline experienced in recent years. However, it appears that the decline was already underway when the program was formally established in 1968. In other words, the major factors accounting for the recent fertility decline lay on the demand-for-children side; otherwise the family planning program would not have encountered propitious circumstances for its development and its operation would have been less successful. The provision of family planning clinics and the distribution of birth control devices are clearly insufficient conditions for bringing about a broadscale fertility decline. Apart from the morality of the issue, little in recent historical experience has proven to be more futile than to attempt to distribute contraceptives among people who do not wish to use them and who have no felt need to adopt their use. Couples first must want to reduce family size, and only if they feel themselves better off in some way by having smaller families can they reasonably be expected to do so. Modern family planning and birth control measures primarily make it easier for couples to accomplish this end.

There is, of course, nothing in this view that impugns in the slightest degree the usefulness of programs designed to reduce couples' ignorance about birth control techniques or to provide contraceptives to those who desire to use them. Clearly, however, further research is needed to evaluate the impact of the Costa Rican program and to study the socioeconomic characteristics of its participants. The establishment of SIDESCO (the Costa Rican Service Statistical System) as the centralized unit responsible for data collection on family planning has improved the data base of the program considerably and provides the infrastructure necessary to conduct further research. But if socioeconomic considerations strongly impinge on family size decisionmaking, which is the viewpoint stressed in this study, then policies and family planning programs designed to lower fertility rates can anticipate a higher degree of success only when they strike directly at parents' basic socioeconomic motives for having children.

## DEMOGRAPHIC TRANSITION

One major policy implication of the present analysis of Costa Rican fertility must be that either governmentally limiting or removing individual free choice in the very personal areas of family size determination is neither necessary nor justified; on the contrary, reasonable interpretation of recent past Costa Rican fertility evidence substantiates the assessment that, in a sense, an expansion of individual free choice is appropriate. The Costa Rican society seems to have demonstrated an immense potential to adjust its fertility rate, without significant governmental interference, to emerging situations and changing economic and social priorities at the level of its individual households. Moreover, this trend of declining fertility might be predicted to continue into the future as the country continues on its development path; the analysis seems to suggest that, as development proceeds, a weakening demand for children (coupled with increasing coverage by family planning programs) could lead to further reductions in fertility level, especially among lower-income and lower-education households. Several bases can be offered for this prediction. As the benefits of having children decrease relative to the consumption of goods and services that are competitive with children for a fixed household budget (such as consumer durable goods, entertainment, travel, and so forth), a substitution away from having children toward these alternative goods and services would occur.

Another factor pointing to further fertility reductions is that the economic costs per child could rise in terms of both out-of-pocket expenditures and opportunity costs, in part because of a growing preference by parents for higher-quality children. Insofar as children seem to be a time-intensive commodity, growing female participation in the labor force will act as an increasingly powerful limitation on fertility. Also rapid urbanization, which the country has experienced in recent years, is likely to continue, perhaps even at an accelerated rate; children are notably more expensive to raise in an urban milieu than in rural surroundings, and they are less valuable to their parents as economic agents in an urban setting than in a rural environment where farming without a large amount of free labor (that is, children) often is impossible. Finally, declining levels of mortality are likely to continue, although not so markedly as in the past; hence uncertainties in the family formation process will be further reduced with a consequent reduction in parents' need to compensate for the deaths of children with additional births so as to achieve a desired number of surviving children.

## POPULATION POLICIES, EXPLICIT AND IMPLICIT

The preceding discussion of fertility as a self-regulating phenomenon within the framework of family-size decisionmaking by individual couples does not imply that no role exists for an activist population policy. The Costa Rican government can indirectly affect household demand for chil-

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dren by promoting selective changes in certain features of families' environments. Individual free choice can be respected within a framework of noncoercive government interference. There is considerable difference between governmental regulatory activities, on the one hand, and repressive or prohibitive legislation, on the other. The idea of restrictions, limitations, and guiding influences being placed on individual freedom, in a liberal way, is not unfamiliar in modern political democracies like Costa Rica. (Carvajal and Geithman 1975)

The Costa Rican government can pursue liberal fertility reduction policies in four general areas, all of which fall short of using the coercive power of the state to promulgate repressive fertility legislation. The first two areas are, in capsule form, 1) simple communication with people to influence their fertility behavior—for example, long-term programs in sex and family life education, mass media programs to inform people that family planning is possible and services are available, media campaigns to emphasize the positive virtues of small families; and 2) public provision and support of medical means of contraception, abortion, and family planning programs—for example, expanding formal family planning clinics and hospital postpartum services, upgrading informal and commercial institutions that provide family planning advice and supplies.

Thus far, the Costa Rican public sector has operated only in these two areas of fertility reduction, and has utilized some, but not all, available techniques. These limited activities could be supplemented by aggressive policies to increase the availability of family planning facilities, as well as information about the costs and benefits involved in preventing births through the public schools, agricultural extension agencies, social security system offices, and so forth.

Of course, even when provided without charge, birth control devices and family planning information are not cost-free to their potential users. That is, it may be quite expensive in terms of search costs for couples to seek out and acquire modern contraceptive knowledge and methods that are more reliable or convenient than traditional methods of birth control. These private search costs are probably highest in more traditional and isolated rural environments. For this reason, public efforts to expand the flow of information and contraceptive devices could be concentrated on the most traditional rural areas although it is more costly to do so. Based on the premise that the obstacle represented by privately borne search costs is considerably lower in cities, public efforts in the urban areas probably could be less aggressive than in rural areas. These interpretations cannot be much more than educated guesses at this moment because a detailed cost-benefit study of the provision of family planning services in Costa Rica is needed. Such a study should focus on differentials in the costs and benefits of family planning

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programs in rural versus urban geographic areas. The effects such public programs have on private search costs should be a crucial vector in such a study.

The view emphasized here is that a *sine qua non* of any family planning program is that couples must want to reduce family size. The empirical evidence in this study seems to substantiate the interpretation that the dramatic Costa Rican fertility decline was dominated by factors operating on the side of couples desiring to have fewer children. The remaining two of the four possible areas proposed for a liberal fertility reduction program operate precisely on this demand side of the population equation. Public policy can be designed to 3) alter the mix of explicit economic incentives and disincentives so as to encourage smaller family size and 4) help alter existing sociocultural institutions and opportunities, which, in turn, can be expected to change the balance of economic incentives and disincentives to have children.

With regard to explicit economic incentives, the tax structure could be altered to allow for fewer exemptions and deductions per child born past a certain date, thus increasing the tax burden on parents of future babies (or, more realistically, to reduce the existing tax subsidy to parents). Additionally, a new direct tax for each child born to a couple is a possibility, as is a direct public subsidy to each couple for every childless year. Cash sums could be paid for a vasectomy, as has been proposed in some Asian countries. Higher priorities in public housing schemes for large families encourage larger families and should be abolished.

Other researchers have pointed out that the psychological, social, and economic rewards that children provide may be important when non-familial institutions do not respond to the needs of poor people. This lack of responsiveness of non-familial institutions may lead parents to depend on family and kin as a means of providing economic security in old age, even when these individuals are also under economic stress. This view, of course, emphasizes the need to extend a publicly funded, institutionalized system of social security to the least economically advantaged in society. The findings in this study, however, show a positive relationship between social security participation and fertility. Apparently, membership in Costa Rica's social security system now helps subsidize maternity and child medical expenses. This pronatalist effect should be reversed by eliminating all maternity and pediatric coverage from the social security plan.

Parents also now enjoy subsidization of childrearing costs through publicly funded education for the young. Requiring parents to pay the full costs of educating their children, plus enforcing a requirement for universal compulsory school attendance would help tip the scale of economic incentives toward having fewer children.

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Changes in the broad forms of existing sociocultural institutions and opportunities also can effect the income, price, and status constraints on family fertility decisionmaking, although the effects of new policy initiatives may be more indirect than those discussed above. A major policy recommendation based on the empirical work in this study is the importance of encouraging female labor market participation outside the home. The association between a woman's work experience outside the home and her fertility is a clear and strong negative. Legislation or common practice that tends to bar or discourage women from entering certain employment areas, or that penalizes them with discriminatory wages should be eliminated.

The findings showing a notable discrepancy between the percentage of women who believe women should work outside the home and the percentage of women who actually work outside the home are disturbing; the former percentages are greater than the latter for all SORGs, and the values of the differences are greatest for the lowest socioeconomic groups. These percentage differences may suggest the existence of either some labor market entry barriers for women or a degree of concealed aggregate unemployment in Costa Rican labor markets. The difficulty, of course, is that provisions for increasing female employment opportunities and wages cannot be merely legislated; they must be part of a broader development program in which the overall demand for labor is increased in a way that unemployment and underemployment are reduced for all Costa Ricans, male and female alike. Little comment on the difficulty of establishing such a development-employment program is necessary, for it is the most fundamental problem in all less-developed countries. (Simmons 1976)

Female participation in the labor force also could be encouraged through a program that subsidized older girls and young women to continue their educations and develop career aspirations beyond those pertaining to home-life and family-raising. Moreover, an expansion of career objectives beyond traditional cottage industry or farm work is important; when women's economic activities are confined to cottage industry and farm work, even though performed for wages or outside the home, they tend to be more compatible with childrearing since both activities can be performed at the same time.

Subsidized child daycare centers tend to break down the economic incompatibility between having children and working outside the home; therefore, these probably should not be publicly subsidized. Daycare centers definitely should exist, however, so that mothers can work outside the home; but the cost of placing a child in a center should not be artificially lowered so that the economic incentive to avoid having a second child is not reduced for the working mother.

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Efforts to change the distribution of income through income transfers would tend to equalize the income differences among SORGs, and this change would probably tend to reduce fertility differentials among the groups. But income subsidies to the poorest echelons of the high fertility SORGs may have the unintentional effect of stimulating fertility. Other things being equal, additional income may induce these groups to have larger families by diminishing the income constraint on family size without significantly altering either the relative price or status constraints on fertility. A potentially fruitful countermeasure is to aim fertility reduction campaigns not solely at the poorest members of society, but at the more affluent, style-setting couples within each SORG. The hope would be to alter group as well as individual standards pertaining not only to ideal family size but to consumption aspirations as well.

Two final policies can be identified that could be expected to affect fertility through their effects on the costs and benefits of having children. It will be recalled that one motive for desiring to have children is the real income they can contribute to the family, especially if the family is engaged in peasant agriculture. An anti-natalist policy would, therefore, attempt to undercut this particular motive for desiring children by prohibiting or seriously curtailing the use of child labor in both rural and urban areas. The suggestion made earlier for enforced universal compulsory school attendance would automatically help dampen the possibilities for parents to reap economic returns from employing their children.

The strong negative association found in this study between fertility and residence in a urban environment could be employed as an important ingredient in a fertility reduction program. Rather than perceiving only difficulties stemming from the recent rapid urbanization in Costa Rica, the positive effect of this trend on reducing fertility should be recognized. Public measures could be designed to encourage urbanization, particularly if some of the more serious negative aspects of rapid urbanization could be dealt with. Economically, the negative aspects of rapid urbanization largely have to do with insufficient urban job opportunities and consequently very high urban unemployment rates. Thus, one antinatalist policy would be to develop an aggressive government program for urban employment that would increase the population flow out of the rural backlands into urban surroundings. Of course, once a pro-urbanization scheme were agreed to and adopted, incentives to speed-up urban in-migration through public subsidization of relocation costs could be easily designed. A large body of literature exists that deals with the responsiveness of migration decisionmaking to the perceived economic costs and benefits of relocating (Carvajal and Geithman 1974).

Finally, it must be recognized that some of the conceptual and empirical variables used in this study are very crude and more refined measures must

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be developed for explaining differences in fertility within the demand-for children framework. Models of household decisionmaking need to be extended, especially to incorporate additional endogenous allocative choices, nonlinear demand relationships, and dynamic behavioral processes. In particular, the dynamics by which fertility and consumption norms are established and disseminated within SORGs need to be further investigated if SORG classification is to be useful for policies aimed at changing tastes and preferences. Furthermore, the process by which individual families climb the socioeconomic status ladder needs to be investigated to predict confidently the fertility outcome of income redistribution policies.

Despite its many shortcomings, the demand for children approach to fertility employed in this study broadly corroborates the view that human fertility adjusts voluntarily to environmental conditions. Changes in fertility can be expected to come about in response to changing environmental conditions within limitations posed by income, relative prices, and status constraints. Nonetheless, although the economist's framework adds important new insights into numerous aspects of reproductive behavior, a great deal more remains to be learned about the limits as well as the potential value of economic analyses of fertility.

### ACKNOWLEDGMENTS

This study was supported in part by the Interdisciplinary Communications Program (ICP), Smithsonian Institution, under terms of its contract with the U.S. Agency for International Development. The authors wish to express their sincere appreciation to M. C. Shelesnyak, Director of ICP, and his staff for their assistance and support.

Acknowledgment is extended to William R. Goodwin, Lydia Berlin Neuhauser, and Patricio Uuzúa for their research assistance. Recognition also is due the Northeast Regional Data Center of the University of Florida for the use of its computer facilities in the empirical portion of the study. Thanks also are extended to Patrick Armstrong for his programming services. Other assistants who have worked on the project include Rosina Fait and Rita M. FlorCruz, to whom the authors extend their appreciation.

The authors thank David Rybak, USAID Population Officer in Costa Rica; León López, USAID Assistant Population Officer in Costa Rica; René Sánchez, Director of the Costa Rican Census Bureau; John Quebedeaux, Technical Advisor from the U.S. Census Bureau; and Victor Morgan, Director of the Costa Rican Demographic Association, for their kind cooperation and valuable suggestions.

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## Economic Development and Fertility Change

Alan Sweezy

### Abstract

The hypothesis that a large measure of economic development must take place in a country before significant drops in fertility can be expected is refuted time and again by the historical record. During the nineteenth and twentieth centuries, nations in Europe which remained economically backward even by the standards of today's developing countries, nonetheless experienced the demographic transition from high to low fertility. Sweezy argues that such differing patterns of demographic evolution probably have more to do with the persistence of traditional modes of thought and behavior than with changes in socioeconomic conditions.

People in poor countries—and poor people in rich countries—have large families, according to the currently dominant economic determinist view, because children are a valuable asset. Such behavior is based on rational calculation. Given the conditions under which these people live, they believe that the benefits of having many children outweigh the costs. Economic and social development effects a change in their behavior, creating a new set of conditions under which to live. The new conditions shift the advantage from large to small families, and people, who act rationally, and can perceive where their best interests lie, modify their behavior accordingly.

If this explanation of fertility change is accurate, a close relationship over both time and space should exist between economic and social conditions and fertility levels. It is assumed that adequate proof of such a relationship is

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*Note:* ICP social scientist David N. Holmes helped prepare this study for publication. Correspondence may be directed to Dr. Sweezy at the CALTECH Population Program, California Institute of Technology, Pasadena, California 91109.

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provided by the current low fertility in the highly developed countries of the world and the still high fertility in the least developed countries. This position overlooks that in a number of developed countries, fertility had dropped to a moderate or low level well before a significant degree of development had taken place. In addition, the persistence of high fertility in spite of considerable economic and social progress, is increasingly evident.

To demonstrate the wide degree of freedom existing in the relationship between fertility and development, the author has compared two sets of countries, at two different periods of time, as examples of the extremes of this relationship. The first set consists of the countries of southern and eastern Europe in the decade or so before World War II and the second set, the larger countries of Latin America (excluding Argentina, Uruguay, and Chile) in recent years. Categories of comparison are derived from the major conditions of life which are thought to influence fertility. These include mortality, urbanization, industrialization, and the level of real income.

#### BACKGROUND

In an earlier paper, this investigator described the determinist view of fertility change. Adherents to this view emphasize the importance of motivation rather than the technology of birth control. They maintain that motivation depends on the conditions under which people live. Couples will be motivated to limit the size of their families when, and only when, a sufficiently high level of economic and social development has been reached. Given this reasoning, implications for policy are clear: It is futile to try to influence fertility before requisite development has taken place, and unnecessary afterward. Family planning programs, then, if not harmful, are of little use. At best they facilitate a trend toward smaller families, but the trend must be firmly established as a consequence of basic economic and social change. Family planning programs can never initiate nor provide impetus for such change. (Sweezy 1973)

Despite questions raised by recent research on the history of fertility decline, the determinist view continues to dominate thinking on both the popular and academic levels. (Coale 1969, Teitelbaum 1975) The Bucharest Conference provided a good illustration of its popular appeal. At that conference, the necessity of development as a condition of fertility decline was repeatedly stressed. The idea was summarized by Pierre Prandervand (1973), in the title of his article "Development is the Best Pill." The author states flatly that "the demographic history of humanity illustrates that the widespread adoption of contraception follows, and does not precede, development. Not only is birth control not a precondition of development, as certain neo-Malthusians would have us think, but on the contrary, economic initia-

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tive is indispensable to assure antinatalist patterns of behavior."

The same idea was expressed in one of the favorite slogans of the conference, "Take care of the people and the population will take care of itself," or provide people with better living conditions and population growth will slow down of its own accord.

On the academic level, leading demographers have recently reiterated support for the determinist view. In a *Scientific American* article Paul Demeny (1974) says, "In demographic matters as in others, people tend to act in accordance with their interests as they best see them." Moreover, people themselves are the best judges of what is in their best interest. It follows that if they have large numbers of children, the reason must be that they perceive their best interests to lie in having large numbers of children; and since they are the best judges of their interests, it must actually be in their best interests to have large numbers of children. Thus their decision is grounded in the objective facts of life. To get them to change their behavior through education or by making a means of birth control readily available can have little effect since the effort involves trying to get people to act contrary to their own self interests.

Judith Blake and Prithwis Das Gupta (1975) distinguish between two schools of thought as to what leads people to curtail their fertility. The one school emphasizes contraceptive technology—the other, motivation. They quote Ravenholt and Chao, leading spokesmen for the contraceptive technology school, as saying, "Recent data strongly suggest that over the short run for developing countries today, the most important single factor in attainment of sharp fertility decline is the availability of effective methods of fertility control distributed through vigorous nationwide family planning programs." (Blake and Das Gupta 1975) Blake and Das Gupta belong to the motivational school, whose thesis is that "people will regulate their fertility only if they are highly motivated to do so, in which case they will actively seek out means of birth control and practice them diligently even if these means are bothersome or distasteful. This approach sees the principal causal influences on voluntary family size inherent in the system of reproductive incentives—in particular, in factors affecting the economic and noneconomic benefits of children and their direct and indirect economic and noneconomic costs (1975 p. 229)." Motivation is not a subjective matter; it is determined by external conditions. Consequently, reproductive behavior can only be changed by changing the conditions under which people live.

If the determinists are right, there should be a close relationship between levels of fertility and the economic and social conditions which accompany them. If, on the other hand, different levels of fertility have prevailed at the same level of economic and social development—or, restated, different levels of development are associated with the same level of fertility—there is a

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→ strong presumption that other elements enter into the determination of fertility.

## FINDINGS

The central contention of this paper is that, while development is, in a broad sense, an important element in the determination of fertility, the relationship is not a close one. In fact, the relationship is loose enough to conclude that other factors also play a significant role.

Viewing the countries of the world in cross-section—or one major part at a particular moment—seems to support the determinist position. The least developed countries (those with per capita income less than \$200) all have high fertility (birth rate near 40 or more) while the more developed countries (income over \$1,000) all have moderate or low fertility (20 or less). A few years ago, according to Berelson (1974), there were few countries in between these categories, but that number has been growing recently.\* However, it is still too small to provide a major exception to the rule that high fertility goes with low income and low fertility with high income.

When the element of time is taken into account, however, the picture changes significantly. There is still, of course, a trend toward decreasing fertility, with a rising real income. But the relation is a considerably loose one. In fact, specified levels of fertility have been reached at widely different levels of per capita real income—the best overall measure available of economic development. Nor are the differences confined to a few exceptional cases. Major groups of countries exhibit a wide disparity in the relationship between economic and fertility levels if one inquires as to the time when the fertility level was first reached.

A striking illustration of such a disparity is afforded by comparison of the major northern Latin American countries (Rothman 1970, Alejandro 1970) today with the countries of southern and eastern Europe just before World War II. The significance of this comparison has been overlooked because of the prevailing habit of considering fertility and income in cross section rather than in historical terms. Countries in southern and eastern Europe have undergone rapid development in the last 30 years and all now have per capita incomes near or over the \$1,000 mark. But what this observation misses is the decline in fertility in these countries before World War II, at a time when they were still economically poor and undeveloped.

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\*"With respect to fertility, the difference between developed and developing countries is far greater than for mortality and there has been little convergence. Indeed, at this time the birth rate is an efficient way of distinguishing developing from developed countries: there is hardly a developing country with a birth rate below 30 per thousand or a developed country with a birth rate above that figure." (p. 7)

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Tables 1 and 2 show the relationship between birth rates and per capita real income in the two areas in two different periods. Fertility in Latin America has remained extremely high. Table 2 may even understate the extent to which this is true. In Mexico, for instance, a strong pronatalist policy prevailed until 1973, and the Bureau of the Census in its recent *Demographic Profile* estimates that the birth rate was 44.7 in 1972, 46.3 in 1973, and 43 to 45 in 1974. According to the determinist view, such a sustained high level of fertility could only be explained in terms of a low level of economic and social development. This level is, to be sure, still low compared with the United States or western Europe and—as will be shown later—is still uneven in distribution. But the Latin American economies have been growing in the last three or four decades and, as Table 2 shows, have already achieved levels of real income equal to, or well above, those of southern and eastern Europe 40 years ago.

Bulgaria, Greece, Poland, Hungary, and Portugal were all poor predominantly agricultural countries in the period before World War II. (See Table 3 for the proportion of the labor force engaged in agriculture.) Their per capita income and product were less than those of the poorer Latin American

**Table 1**  
Income and Fertility,  
Southern and Eastern Europe, pre-World War II

	Per Capita National Income <sup>a</sup> in 1967 Dollars	Birth Rate <sup>d</sup>	
		1930-34	1935-39
Bulgaria	180	30.3	24.1
Poland	197	28.9	25.4
Portugal	197 <sup>b</sup>	29.3	27.1
Hungary	199	23.2	20.1
Greece	215	30.0	26.5
Spain	273 <sup>c</sup>	27.5	22.0

*Sources:*

<sup>a</sup>United Nations. 1949. *Statistical Yearbook, 1948*. United Nations: New York City.

<sup>b</sup>The estimate for Portugal is for 1938. United Nations. 1954. *Statistical Yearbook, 1953*. United Nations: New York City.

<sup>c</sup>Kuznets, Simon. 1956-1957. Quantitative Aspects of the Economic Growth of Nations. In *Economic Development and Cultural Change*. 5: 79.

<sup>d</sup>United Nations. 1966. *Demographic Yearbook, 1965*. Table 12. United Nations: New York City.

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**Table 2**  
**Income and Fertility,**  
**Latin America, 1965-75**

	Per Capita National Income <sup>a</sup> in 1967 Dollars		Birth Rate	
	1967	1971	1965-70 <sup>b</sup>	1970-75 <sup>c</sup>
Brazil	266	353	37.8	37.1
Colombia	286	330	44.6	40.6
Peru	299	316	41.8	41.0
Mexico	499	568	43.2	42.0
Venezuela	820	830	40.9	36.1

Sources:

<sup>a</sup>United Nations, 1972. *Statistical Yearbook, 1971*. United Nations: New York City.

<sup>b</sup>United Nations, 1974. *Demographic Yearbook, 1973*. United Nations: New York City.

<sup>c</sup>World Population Data Sheet, 1975. Population Reference Bureau: Washington, D.C.

**Table 3**  
**Percentage of Labor Force in Agriculture**

Southern and Eastern Europe		Latin America	
Bulgaria (1934)	80%	Brazil (1970)	44%
Hungary (1941)	48%	Colombia (1964)	47%
Poland (1931)	65%	Mexico (1970)	39%
Portugal (1940)	49%	Peru (1961)	50%
		Venezuela (1971)	20%
*Greece (1961)	54%		
*Spain (1960)	41%		

Sources:

Europe. United Nations, 1949. *Statistical Yearbook, 1948*. United Nations: New York City.

\*Perfil Demográfico de Mexico, 1972. Fundación para Estudios de la Población: Mexico.

Latin America. Ruddle, Kenneth and Kathleen Barrows, eds. 1974. *Statistical Abstract of Latin America, 1972*. University of California: Los Angeles.

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countries in 1967 and less than half of those of Mexico and Venezuela, the most advanced of the northern Latin American countries. It was believed that 1967 would allow time for an effect on fertility to begin to appear if fertility were determined in any close way by economic development. The historical record as evidenced in these tables shows that factors other than economic development must have played an important role in determining the course of fertility—at least, in these two groups of countries.

A broader look at history also reveals wide variance in the relationship between levels of development and of fertility. Thanks to Kuznets' heroic efforts, estimates of real income or product exist extending back into the nineteenth century for a number of countries. Table 4 shows the relationship between income and fertility trends for England and France. In France,

**Table 4**  
Income and Fertility in Historical Perspective, France and England

	England		France	
	Per Capita Income, 1967 Dollars (U.K.)	Birth Rate	Per Capita Income, 1967 Dollars	Birth Rate
1831-40	—	—	165	29.2
1860-69	493			
1861-70		35.2	292	26.4
1870-79	523			
1871-80		35.4	298	25.4
1880-89	606			
1881-90		32.5	356	23.6
1890-99	749			
1891-1900		29.9	429	22.1
1900-09	806			
1901-10		27.2	504	20.0

*Sources:*

National income (for France net national produce). Kuznets, Simon. 1956-1957. Quantitative Aspects of the Economic Growth of Nations. In *Economic Development and Cultural Change*, 5:53, 59.

Unfortunately, Kuznets gives the French estimates in 1938 francs, by which time the franc was under heavy pressure and the exchange rate, as a result, abnormally low. To get around this difficulty 1938 francs were converted into 1929 francs, using the French cost of living index, and then into dollars at the 1929 exchange rate. There is no difficulty in the case of the U.K. since Kuznets' figures are in 1912-13 pounds.

Birth rates. Kuczynski, R. R. 1936. *The Measurement of Population Growth*. Oxford University Press; New York City. France in the decade 1831-40. Kuczynski, R. R. 1931. *Balance of Births and Deaths*. The Brookings Institution: Washington, D.C.

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fertility had started to fall either before or soon after the turn of the century. By the 1830s it had dropped below 30. On a generous estimate, per capita income at that time was below \$200 (in terms of 1967 purchasing power). This level falls within the general range of incomes in the poorest European countries before World War II, below the average of the major Latin American countries in the late 1960s, and far below the most advanced Latin American countries—Mexico and Venezuela. Fertility in France fell slowly as the economy grew over the rest of the century. By 1901-1910 the birth rate had reached 20, while per capita income was about \$500. This income level is approximately equal to that reached by Mexico in the last decade. The disparity in fertility levels is, of course, striking. Mexico's birth rate is still twice as high as France's was at that time, even though the overall economic development level of the two countries is about the same.

Development in England, however, followed a different course. Although Kuznets' income estimates go back only to the 1860s, it is reasonable to assume that income had been rising since at least the early part of the century—probably longer. In any case, fertility, as is well known, had been on a high plateau and had shown no signs of falling until after the 1870s. According to Beaver (1975) it did not reach the 1830s French level until the 1890s, by which time per capita income was some \$750 (again in terms of 1967 purchasing power).\*

Other countries for which historical income series are available fall between the poles of the French and English experience. Table 5 shows the income levels in various countries at the time the birth rate first dropped below 30 for a five-year period; in fact, these birth rates dropped permanently below 30. Sweden reached this fertility level earlier than England and at an income level closer to that of France than of England. Germany's fertility decline occurred later and at an intermediate level of income. Italy's was much later, at a level of income which was about twice as high as that of the southern and eastern European countries shown above in Table 1, but lower than Mexico's level in recent years.

Returning to Prandervand's thesis—typical of the determinist school in general—that “widespread adoption of contraception follows, and does not

\*Attempts to explain away the difference in pattern of fertility decline between France and England have not been very convincing. Beaver, for instance, admits that natality decline began early in France, which was not “particularly developed by 1875,” and came late in “two of the most industrial” countries, England and the Netherlands. He seeks to explain the anomaly by the facts that 1) “In terms of education and literacy, France was either close to or ahead of England and the Netherlands circa 1900” and 2) “mortality levels . . . seem to have been about equal in all of these countries in the late nineteenth century.” These facts, of course, do nothing to explain why fertility fell in France at the beginning of the nineteenth century and by the 1830s was lower than in England fifty years later—by which time per capita income and product were some four times as large as in France at the earlier period.

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**Table 5**  
Income and Fertility in Historical Perspective, Five European Countries

	Per Capita Income (1967 Dollars)	Birth Rate
France	165 <sup>a</sup> (1831-40)	29.6 (1830-34)
England	800 (1895-04)	29.7 (1894-98)
Sweden	304 <sup>b</sup> (1879-88)	29.6 (1878-82)
Germany	510 (1905-14)	28.2 (1910-14)
Italy	407 (1924-33)	27.9 (1923-27)

<sup>a</sup>Net National Product  
<sup>b</sup>Gross National Product

*Sources:*

National income. Kuznets, Simon. 1956-1957. *Quantitative Aspects of the Economic Growth of Nations*. In *Economic Development and Cultural Change*. 5:53, 59.

Birth rates. Kuczynski, R. R. 1931. *Balance of Births and Deaths*. Vol. 1. The Brookings Institution: Washington, D.C.

precede, development," one must ask, how much development is required? If the degree of the development represented by a \$200 per capita income (in 1967 prices) was enough to produce a marked decline in fertility in France, Bulgaria, Poland, Portugal, Hungary, and Greece, why has that income level—and in some cases much more—not been enough in Latin America? The answer lies beyond economics.

Estimates of national income or product extending far back into the past are subject to much uncertainty. Members of the determinist, or motivational, school may say that comparisons such as those offered here have little meaning. If that is true, statements about the importance of development in governing fertility likewise have little meaning. It is senseless to assert fertility depends on economic and social development if there is no possible way of measuring development.

Per capita income or product—in one or another of its variants—remains the best indicator of the economic development of a country as a whole.\* However, by itself, it does not tell anything about income distribution. To the extent that people make decisions about fertility, they are presumably influenced by their individual circumstances. Hence, in comparing two different countries—or the same country at different periods of time—the distribution

\*The leading alternative is per capita energy consumption.

of income should be investigated. One country might have a larger total income, relative to population size, than another and yet so much of it goes to a small group at the top that the majority of people are poor. In such a case, there would be no reason to expect fertility to be lower.

While economic development is important in determining the material conditions under which people live (hence the costs and benefits of children which the motivational school relies on so heavily to explain fertility behavior), other objective conditions such as mortality and urbanization may play a role somewhat independent of the level of the economy itself. Mortality is affected by the quality of health care, the nutrition level, and the material standard of living in general. There is strong evidence, especially as reported by Preston (1975), that with the progress of both public health and individual medical care, mortality has fallen more than can be explained by the rise of real income alone. The degree of urbanization might also be different on the same overall level of economic development. Accordingly, both mortality and urbanization must be considered as possible independent explanatory variables in connection with the difference in fertility between Latin America today and southern and eastern Europe 40 years ago.

#### Mortality

It has often been suggested that the decline of fertility in the Western world was in some way a response to the decline of mortality which, in most cases, had preceded it (France is a possible exception). A number of explanations have been advanced to account for this: 1) With lower mortality, more children survive and fewer births are necessary to achieve a specific family size (which is assumed to remain roughly constant over time). 2) Lower mortality is one component of a higher standard of living which involves a different way of life and different values with respect to children. 3) The decline of mortality is a result of the scientific/rationalist revolution in outlook on life which also eventually brought about the drop in fertility.

Before venturing into explanations of the mortality issue, there are two factual questions that must be answered. First, how does the mortality level in recent years in Latin America compare with that in southern and eastern Europe at the time fertility reached moderate to low levels there? This is similar to the question already examined with respect to per capita real income. Second, how does the lag between the decline of mortality and fertility in the first group of countries compare with the lag in the second? In other words, has there been time enough in the former group—judging by what happened in the latter—for fertility to adjust to the new level of mortality? Arriaga (1970), in his study of mortality trends in Latin America, suggests there has not been enough time. He thinks the rapid drop in mortality accounts for fertility remaining high.

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Table 6 shows, to the contrary, that the mortality level in Mexico has been low enough for some time to warrant a much lower level of fertility. The expectation of life had reached 50 in 1949-1951. This is about the level which prevailed in northern Europe around 1900, when the birth rate had dropped below 30 in most countries. By 1960 Mexican life expectancy had risen to 59, comparable to that of northern Europe in 1920-1930.

The contrast between Mexico and southern Latin America and southern and eastern Europe is more striking. Mexico reached the 1947 Argentinian life expectancy level in 1960. By 1947 the birth rate in Argentina had already been in the low twenties for over a decade, in contrast to Mexico where it was still in the mid-forties a decade later. Likewise in Spain, the birth rate was already below thirty at a time when life expectancy was no higher than it was in Mexico in 1940. What has been said about Mexico also holds true for the other major northern Latin American countries.

Table 6.  
Expectation of Life at Birth

Mexico	Argentina	Spain	England & Wales	France	Sweden
			1838-54 40.9		
1895-10 29.5			1901-10 50.5	1861-65 39	1861-70 43
1929-31 36.9		1908-23 42	1930-32 60.8	1908-13 48.5	1891-00 51
1939-41 41.5	1941 46.6			1928-33 57	1921-25 61
1949-51 49.7	1947 59.1				
1959-61 58.9	1959-61 66				
1965 61.9					

*Sources:*

Mexico, Argentina. *Dinámica de la Población de México*. 1970. Centro de Estudios Económicos y Demográficos, El Colegio de México: Mexico.

Spain, England, France, Sweden. Dublin, Louis I.; Alfred J. Lotka, and Mortimer Spiegelman. 1949. *Length of Life: A Study of the Life Table*. The Ronald Press Co.: New York City.

But what about the rate of decline? As already mentioned, Arriaga argues that the drop in mortality in Latin America has been so rapid that there has not been time for fertility to follow suit. "Under actual Latin American social and demographic conditions, the European mortality-fertility experience could not have been duplicated—the different period of time involved is a principal cause." (1970 p. 211)

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There is a curious twist to the argument which leads the author to his conclusion. Arriaga first calculates from a scatter diagram of birth rates and life expectancies for a number of European countries at various times—from roughly the middle of the nineteenth to the middle of the twentieth century—a curve which gives a reasonably good fit to the data. He then asks how much of a drop in the birth rate from the 1930s to the 1960s would have been necessary in Latin America to produce the same relationship of births to deaths as in Europe. In view of the fact that death rates declined much more rapidly in Latin America, "an unprecedented decline in birth rates of Latin American countries would have been necessary for these countries to reach the same mortality-fertility relationship as that registered in Europe." (Arriaga 1970 p. 201) But why the same relationship? Why didn't the drop in mortality produce some decline in fertility? The relevant question is, not how far, but over what period of time did mortality fall? If, in so many years a certain reduction of mortality caused a given reduction of fertility in Europe, in the same period of time an even greater reduction of mortality would be expected to cause at least as great a reduction of fertility in Latin America.

Tables 7 and 8 may be used to compare death rates and birth rates in Latin America with those of a number of European countries. In each case the series starts when the death rate was approximately equal to that of Mexico in 1930. (Death rates rather than life expectancies are used since continuous series of the latter are believed to be unavailable for most countries included.) Judging by the experience of the European countries studied, there has been ample time for fertility to decline in Mexico. Something other than lack of time to adjust to lower mortality is impeding the decline in fertility.

#### Urbanization

Although demographic literature places much emphasis on the urban way of life as a cause of reduced fertility, urbanization as such does not play an important part in explaining fertility differentials over either space or time. In a recent study Kuznets (unpublished) has shown that little fertility difference between the developed and the less developed countries in the world today can be accounted for by the difference in proportion of population living in urban as compared with rural areas. Fertility is much lower in both urban and rural sectors of developed countries than in the corresponding sectors of less developed countries. That more of the population in developed countries lives in urban areas is of relatively little importance. States Kuznets, "Because of the narrow range of rural-urban differences in fertility revealed by the data, these intracountry differentials contribute little to the explanation of the wide intercountry differentials in fertility between the less developed and the developed regions of the world." Kuznets also observes, ". . . if 'rurality' is associated with high fertility and 'urbanity' with low fertility, the rural popula-

**Table 7**  
**Crude Death and Birth Rates**

Austria		Bulgaria		Spain		Italy		Hungary						
DR	BR	DR	BR	DR	BR	DR	BR	DR	BR					
1886-90	28.9	37.8	1891-95	27.8	37.5	1896-00	28.8	34.3	1876-80	29.4	36.9	1896-00	27.9	39.4
1891-05	27.9	37.4	1896-00	23.9	41	1901-05	25.9	35.1	1881-85	27.3	38	1901-05	26.4	37.4
1896-00	25.6	37.3	1901-05	22.5	40.7	1906-10	24.0	33.2	1886-90	27.2	37.5	1906-10	25.0	36.7
1901-05	24.3	35.7	1906-10	23.8	42.1	1911-14	22.1	30.8	1891-95	25.5	36	1911-14	23.8	35.1
1906-10	22.4	33.7	1911-14	22.9	38.2	1915-19	24.3	29.4	1896-00	22.9	34	1915	25.7	—
1911-13	20.9	30.8	1915-19	22.9	—	1920-24	21	30	1901-05	22	32.6	1920-24	20.8	32-27
1915-19	—	—	1920-24	21.0	40-38	1925-29	18.7	29	1906-10	21.2	32.7	1925-29	17.3	28-25
1920-24	19-15	23-21	1925-29	18.1	37-31	1930-33	17	28	1911-14	19.1	31.7	1930-33	16.2	25-22
1925-29	14.5	20-17	1930-33	16.2	31-29				1915-19	—	—			
									1920-24	17.5	31-29			
									1925-29	16.6	28-26			

*Sources:*

Birth rates. Kuczynski, Robert R. 1931. *The Balance of Births and Deaths*. Vol. 2. The Brookings Institution: Washington, D.C.

Death rates. Kuczynski, Robert R. 1936. *The Measurement of Population Growth*. Oxford University Press: New York City.

**Table 8**  
**Crude Death and Birth Rates**

	Mexico		Colombia		Peru		Venezuela	
	DR	BR	DR	BR	DR	BR	DR	BR
1920-24	28.4	45.3	23.7	44.6			26.0	41.2
1925-29	26.7	44.3	22.4	44.9			24.6	43.1
1930-34	26.7	44.1	22.5	43.3			21.9	39.9
1935-39	23.5	43.5	21.6	42.6			21.1	40.2
1940-44	21.8	43.8	20.3	42.4	28.8	44.5	19.8	41.5
1945-49	17.8	44.5	20.8	43.4	24.7	44.9	16.1	43.6
1950-54	15.4	45.0	18.4	44.0	22.4	45.5	12.3	44.2
1955-59	12.5	45.8	16.0	45.1	18.6	46.2	10.8	44.3
1968	9.4		8.5				6.7	
1965-70		43.2		44.6				40.9

*Sources:*

All data through 1955-59. Colver, O. Andrew. 1965. *Birth Rates in Latin America: New Estimates of Historical Trends and Fluctuations*. Tables 20, 41, 48, 51. Institute of International Studies, University of California: Berkeley.

Death rates, 1968: Ruddle, Kenneth and Kathleen Darrows, eds. 1974. *Statistical Abstract of Latin America*. Birth rates, 1965-1970, from Table 1 in this report.

tion of the DCs are far more urban than the urban populations of the LDCs; and the urban populations of the LDCs are far more rural than even the rural populations of the DCs:" (Kuznets unpublished)

The same situation holds in the historical transition: from high to low fertility in what are now the developed countries. In the United States, urban fertility, as measured by the child/woman ratio, was 845 in 1800 while rural was 1,319. By 1940, urban fertility had dropped to 311 and rural to 551. Using the standardization procedure, Bogue (1959) estimates that only 14 percent of the decline in overall fertility can be attributed to the massive shift of population from rural to urban areas which occurred during this time.

Urbanization does not help explain the difference in fertility in the present study. As would be expected from the data already given on the proportion of the labor force in agriculture, southern and eastern European countries were even less urban before World War II than Latin American countries in recent years. In Greece, for example, 45.6 percent of the population was classified as urban in 1928, that is, living in places of 2,000 or more. In Mexico, with a slightly more restrictive definition of urban—2,500 instead of 2,000—58.7 percent of the population was urban in 1970. (Valaras et al. 1969)

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Both 2,000 or 2,500 people are too low a criterion of what is urban. In countries where the agricultural population is often concentrated in large villages, places with considerably higher densities may be thoroughly rural. The figure of 10,000 people has been selected as a more realistic dividing line between what is truly an urban setting and what is rural or mixed in character. In 1970, Mexico was far more urbanized than Bulgaria at the time fertility there began to reach modern levels. Forty-two percent of Mexico's population lived in cities of 10,000 or more at that time. In Bulgaria in 1934, only 17 percent of its population lived in cities of that size. Mexico was likewise slightly more urban than Spain in the 1920s where 39 percent of the population lived in Spanish cities of 10,000 or more people. Obviously, the wide difference in fertility cannot be explained on the grounds that a smaller proportion of the Mexican people were exposed to the conditions of life in urban centers.

According to data in Table 9, Bulgaria provides a good example that neither industrialization nor urbanization is a necessary condition for a decline of fertility. Table 9 shows birth rates by occupation of the father. Fertility of the nonagricultural population was already at a moderate level in 1910-1911. But the fertility rate was high—at a level on par with Latin American countries—in agriculture and, as a result of agriculture's numerical preponderance, in the population as a whole. The drop from 1910 to the mid-thirties was almost entirely the result of the decline within agriculture. Since incomes remained low, and mortality was relatively high, the drop must have represented the result of changes in attitudes and ideas rather than in the objective conditions of life.

Table 9  
Bulgaria: Birth Rate by Profession of the Father

	1910-11	1933-36
Agriculture	44.2	29.0
Mining and industry	31.4	28.1
Transport and communication	33.5	28.1
Commerce, credit	27.1	18.8
Science, instruction, religion, et cetera	29.0	25.6
Public administration	28.7	20.4

Of 176,481 births in 1910-11, 144,275 were accounted for by agriculture (82 percent).  
Of 164,696 births in 1933-36, 129,149 were accounted for by agriculture (79 percent).

Source:  
*Annuaire Statistique*, 1939.

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As already noted, a study of fertility must consider not only the overall volume of income or output, but also its distribution. If the bulk of income goes to a small group at the top, while the great majority remain poor, there will not be a significant change in fertility. The elite might limit their families but their reduced numbers would be too few to have an effect on the level for society as a whole. A comprehensive study of income distribution in the countries under review here is a task far beyond the scope of this report. Instead, investigation was made to see if in Mexico, the unequal distribution of income could help explain why fertility has remained so high. Mexico is an appropriate choice since it has been singled out as a case in point by several writers. (Wionczek et al. 1971) William Rich (1973), for instance, explains that although income levels are practically the same, fertility is lower in Taiwan than in the Philippines by the difference in degree of equality of income distribution which exists—and, according to the author, has been increasing—between the two countries. Rich believes.

These two factors help to explain why a much greater share of the population appears to have reached the socioeconomic level conducive to reduced fertility in Taiwan than in the Philippines. Comparisons similar to that between Taiwan and the Philippines can also be made between Barbados, Argentina, South Korea, Singapore, Uruguay, Cuba, Costa Rica, or China, on the one hand, and Venezuela, Mexico, Brazil, and many of the other Latin American countries on the other. (1973 p. 24)

Sanders (1974) likewise calls attention to the fact that a sizable proportion of the Mexican population has not shared in the benefits of the country's impressive economic growth. He also points out, however, that a substantial middle class has grown up.

The surface momentum of the economy, however, obscures a number of social problems revealed in the population characteristics of recent censuses. It is now recognized by critical public opinion that Mexican development has not significantly benefited a sizable percentage of the population, even though the highest earning groups have accumulated and invested substantial capital and an appreciable middle class has appeared. The "marginal" population is found among low-paid urban and especially rural workers and those of minimal or no education. (1974 p. 7)

Chenery and his associates (1974) have pulled together the available figures on income distribution for a number of countries, and Mexico is in the high inequality, medium income group in their tabulation.

An initial distinction must be made between two periods in Mexican

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history, the first before and the second after the Revolution. During the first period—at least from the late nineteenth century on—there was considerable economic growth. “Over the whole Porfiriato,” says Clark Reynolds (1970), “the economic growth rate was perhaps 2.6 percent per annum, compared with a population growth of 1.4 percent. While there is doubtless an upward bias in the figures owing to improving coverage of the data, this is offset by the disproportional growth of new sectors not included in our representative index, so that the general trend indicates rising production and productivity through most of the 35 year period.” (1970 p. 23) The fruits of this progress however, were, unevenly divided. Reynolds goes on to say:

What these figures do not reveal and what, in retrospect, has brought forth much criticism of Díaz's policies, is the special character of economic growth during the Porfiriato. Mexico was following the pattern of a typical export economy, which depends upon increasing exploitation of natural resources with cheap labor and foreign capital and technology to expand production for overseas markets. As in many other Latin American countries of the time, this type of export-led growth brought prosperity to some portions of society but almost entirely excluded much of the population from the development process. (1970 p. 23)

Since the Revolution, however, the pattern of development has changed significantly. Reynolds comments:

The process of internalization of the economy after 1910 had a high price in terms of lives lost, output foregone, capital destroyed, and new investment discouraged. Nevertheless, the policies of these three decades laid the foundations for a pattern of subsequent economic growth in which those sectors would be encouraged that provided the greatest scope for absorption of the large and increasing supply of unskilled labor. This marked a sharp reversal from policies in the past, favoring the rapid growth of extractive industries and the plantation agriculture regardless of the social consequences. Balanced growth of output for domestic as well as foreign markets permitted a broadening participation of the population in development, rising levels of real income and consumption for most, and a wider distribution of property ownership and economic responsibility than had ever before been experienced in the country. (1970 p. 36)

It is true, that the benefits of progress have been unequally distributed in Mexico. Subsistence agriculture is still widespread and the real incomes of this sector of the population may not have increased in the last 40 years. High birth rates have likewise caused an excess flow of population to the cities

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where the growth of a large marginal urban proletariat has kept incomes low, particularly in the service occupations. (Lomnitz 1975) But it is not true that all the gains of economic growth have gone to a tiny group at the top. At least three other groups, which are substantial in size, have shared in the progress: Business and professional people, commercial farmers, and industrial workers.

Numerically, the last group is especially important. In 1969, there were 2.2 million workers in manufacturing out of a total labor force of some 13 million. (*Perfil Demografico de Mexico* 1972) This was an increase of almost 700,000 persons over the number in the 1960 census. How had the industrial workers fared in terms of their standard of living? Had they shared in the general growth of output and income? These questions can be answered by comparing average earnings in manufacturing with Mexico's per capita gross national product.

Industrial workers have shared fully in their country's economic growth. Earnings in manufacturing actually increased slightly more than per capita GDP from 1955 to 1970. For the years 1955, 1960, 1965, and 1970, the per capita real gross domestic product for Mexico was 61, 70, 84 and 100 pesos, respectively. The average real monthly earnings in manufacturing were 57, 65, 92, and 100 pesos respectively. This means, of course, that per capita GDP is a good index of the standard of living, as far as industrial workers are concerned. Unlike the marginales in subsistence agriculture, who are at the bottom of the urban proletariat, these people have gained a share of the country's wealth.\*

Why then do people have large families? Judith Blake and Das Gupta (1975) cite two possible reasons: Either they lack knowledge of, or access to, the means of birth control, or they have good reasons for wanting large numbers of children. They reject the former as inconsistent with both current reproductive behavior in the developing countries and the history of fertility reduction in the developed countries, which leaves only the latter explanation: They have large families because, on balance, the benefits of large numbers of children outweigh the costs.

While the emphasis on motivation is acceptable to this investigator, Blake and Das Gupta's view seems too narrow. There may be negative as well as positive reasons for having large families, apart from lack of mechanical knowledge or means. People may think it is wrong to control reproduction,

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\*This does not mean, of course, that industrial workers in Mexico are well off in any absolute sense, or that their incomes compare favorably with those of workers in the U.S., for example—a comparison that is often made explicitly or implicitly. They do, however, compare favorably with those of industrial workers in various other countries at periods when fertility in those countries was far below what it has been in Mexico.

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except by delaying or refraining from marriage. The fact that this taboo is completely ignored suggests that modern social science is in danger of forgetting its existence. The violent moral opposition to artificial control of conception is vividly portrayed in the opinion of Lord Justice James when rendering the decision to deprive Annie Besant of the custody of her daughter.

It is impossible for us not to feel that the conduct of the appellant in writing and publishing such works is so repugnant, so abhorrent, to the feelings of the great majority of decent Englishmen and Englishwomen, and would be regarded by them with such disgust, not as matters of opinion, but as violations of morality, decency, and womanly propriety, that the future of a girl brought up in association with such propaganda would be incalculably prejudiced. . . . If the ward were allowed to remain with the mother it is possible, and perhaps not improbable, that she would grow up to be the writer and publisher of such works. (Banks 1964 p. 89)

Another negative reason for having many children is the failure to plan consistently and effectively. Rainwater (1965) found that consistent, purposeful behavior is by no means universal—even in a large city in a modern, highly developed country.

Some respondents speak of family planning in a matter-of-fact, cut-and-dried way; family limitation for them is a well-established habit. Others seem less sure of what they are doing, more bothered by the possibility of accidents, less confident in the method, or they look forward with uncertainty to a time when they will begin using contraception. Finally some respondents are quite passive and fatalistic about family planning; they do nothing because they do not think anything will help, or they go through the motions of using a method in which they have little confidence (and therefore do not use it very consistently). (1965 p. 201)

If this behavior remains a factor in explaining fertility differences in the United States in recent times, it must be an even more significant factor in explaining differences between developed and less developed countries, as well as the historical transition from high to low fertility. However, the important point is that many leading students of population ignore such data.

In addition to negative reasons for large families, there is the possibility that people may lack an accurate perception of where their real interests lie. They may believe there is an advantage in having a large number of children even though there is none. Adopting the practice of birth control may depend on a better understanding of what their real interests are rather than a result of change in the material circumstances of their lives.

It is often assumed that Indian peasants have large families because chil-

dren are an economic asset. Referring to Mamdani's reports of interviews conducted in one of the villages included in the Khanna study, Mandelbaum (1974) says:

Men from every social and economic level in Manupur village, with few exceptions, testified to the economic value of children, especially of sons. Farmers who have little land, five acres or less, cannot afford to hire any outside labor and have to rely on the family for all their labor requirements. Economic improvement for these men can come about only through increasing the family labor force. (1974 pp. 19-20)

A contrary experience occurred in Hungary. Years before the end of the nineteenth century, Hungarian peasants were found to be severely limiting the size of their families. The reason again was economic. The peasants found by having fewer children they could raise their standard of living. Paul Demeny, the leading authority on the subject, writes in a recent article:

These were small peasants who discovered that a reduction in the number of children increased the standard of living to the "appropriate" level. In most places, the reduction of fertility was an outcome of the judgment that keeping up fertility would reduce the standard of living. Indeed, the stage seemed to be reached where it was discovered that limiting the family to even less than two children per farm meant that the peasant could actually become rich. By the end of the nineteenth century, there were a number of villages where it was common for families to have one child, and for sons and daughters to intermarry. The explanation of the Hungarian situation therefore lay in the cultural pattern. Peasants developed a taste for good houses, good furniture, and good utensils. (Coale 1975 p. 237)

Hungarian peasants were not the only ones who were early to equate self-interest with material gain in the process of economic development. French peasants before them—and Bulgarian, Greek and others after—decided their best interests lay in not having many children. Did material circumstances effect the change in their lives, or had they developed a more accurate sense of self-interest? Do Indian, Egyptian, and Mexican peasants today benefit from having many children while historically French, Hungarian, and Bulgarian peasants improved their lot by having few? Or are the former people merely failing to break with traditional thinking while the latter had succeeded in liberating themselves sufficiently to afford a new, more accurate view of their situation?

Support for another thesis—that change can be correlated with new perceptions rather than with improved material conditions alone—is provided by recent reports of a decline in fertility in Kerala. (Nair 1974) Kerala is one of

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the poorer Indian states, whose distinguishing characteristics are a relatively high educational level and large proportion of Communist voters. The latter observation suggests that its people may be ready to discard traditional ways of thinking; the former that they may have a better understanding than their compatriots of where their true interests lie.

A similar example is provided by Bulgaria in the period of its fertility decline between the two world wars. Although the country was extremely poor, and technology, especially in agriculture, was primitive, the educational system was good. Also interesting was a marked increase in radicalism, mostly of an agrarian rather than Communist nature, during this period. Some evidence of a connection between a turn away from tradition, as reflected in political attitudes and the growing practice of birth control, is provided by the fact that the largest fertility declines occurred in the Pleven and Vratza provinces which, in the early 1920s, were the scene of the "world's first" anti-fascist uprising. (McIntyre 1973)

Social scientists are reluctant to venture into the realm of attitudes and ideas since these variables are elusive, hard to quantify, and often lead to subjective conclusions. Consider religion. Religion has been a major factor in the lives of millions of people, and most religions have been much concerned with reproduction. Religion must have affected reproductive behavior, but it is difficult to say exactly how this influence has been felt. Formal adherence explains little. Many Catholic countries have birth rates as low as, or lower than, those of Protestant countries. It is possible that a strong trend of skepticism and irreligiosity may have developed in a country whose population remains nominally loyal to the Church. Livi-Bacci (1971) thinks this may explain the much lower fertility in southern than in northern Portugal. The influence of irreligiosity may be restricted to certain specific aspects of life. Spain is a particularly baffling case. (Gallagher 1973) One would hesitate to say that Spaniards have been less sincere in their adherence to Catholicism than Mexicans or other Latin Americans. Perhaps it is not so much religious doctrine, as the degree of support religion gives to traditional ways of thinking. But while that broadens the scope of the inquiry, it does not make the phenomena in the realm of attitudes and ideas any more tangible.

Cultural diffusion is another factor worth considering in an explanation of fertility history. Cultural diffusion could have accounted for the decline of fertility in southern and eastern Europe when that area was still at a relatively low level of economic and social development. (Leasure 1963) People learned what their neighbors in western Europe were doing to control reproduction and decided to do likewise. The idea of cultural diffusion was eloquently expressed by Herbert Wilhelmy (1935), a German writer on Bulgaria in the 1930s: "The change of thousand year old social customs is the precise measure of the unceasing penetration of the Bulgarian peasantry by the spirit of the

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West." (1935 p. 235) It seems highly probable that such a process was at work and that it had an influence on various aspects of Bulgarian life, including the spread of birth control. But how does a social scientist give this idea concrete meaning? How does he or she identify the channels through which the Western spirit moved as it permeated Bulgarian thinking and attitudes? How does one quantify the effect it had on reproductive behavior of specific people as they began to adopt specific practices at specific times? More broadly, how can one explain that cultural diffusion influenced reproductive behavior in southern and eastern Europe but has failed to have a similar effect in Latin America?

These are difficult questions to answer, but they cannot be dismissed as unimportant. Social scientists would, by training, prefer to deal with "hard" facts, with measurable quantities such as amount of real income, percentage of the labor force in agriculture, degree of urbanization, and level of mortality. But where the hard facts fail to account for a major difference in fertility, such as that examined here between Latin America and southern and eastern Europe 40 years ago, there is no escape from venturing into the slippery, if not treacherous ground, of ideas and attitudes.

#### CONCLUSIONS AND POLICY RELEVANCE

To review this study briefly, it can be seen that from the statistical evidence available, southern and eastern Europe were in all categories at the same level of development—and possibly at a lower one—than Latin America today. By the 1930s, the birth rate had dropped below 30—in some cases much below that—in the countries of southern and eastern Europe studied above. In Latin America, in sharp contrast, the birth rate has remained near or above 40 up to the most recent period for which data is available.

A somewhat similar contrast appears in the nineteenth century between the course of events in France and England. In France, fertility began to fall early in the century and had already reached moderate levels when real income, expectation of life, and so on were no higher than in southern and eastern Europe in the 1930s. In England, on the other hand, fertility remained unchanged until after the 1870s, by which time the real income level was perhaps three times as high as it had been in France when fertility began to decline. Usually, England is treated as the rule and France the exception. This judgment is curious in view of France's population at the beginning of the nineteenth century being approximately three times as large as England's.

The determinist explanation of fertility change rests on an oversimplified theory of motivation. According to this theory, there are two principal reasons for people's failure to limit family size, with emphasis on the latter: Either they lack the technical means to control births or they see an advantage

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in having a large number of children. Such an approach leaves out a great deal that may be important in explaining fertility behavior. People may have negative as well as positive reasons for not limiting the size of their families. They may, for example, feel that it is wrong to interfere with the process of reproduction except by abstention from sexual relations. Such interference may be explicitly condemned by a religious or moral code, or it may run counter to accepted tradition. People may also fail to act in a planned, purposeful manner with respect to reproduction. They may permit chance or fate to determine the number of children they will have, or they may simply fail to implement an intended course of action. Still other fears—the fear of danger to health from the use of contraceptives, for instance—may keep people from attempting to exercise control over their fertility.

Further consideration may find that the people themselves are not aware of where their real interests lie. They may be convinced that having many children is economically advantageous because that is the conventional wisdom on which they have been reared.

Consequently, fertility may change not only as a result of change in the objective conditions under which people live but also as a result of the subjective way in which they perceive or react to those conditions. The implication for policy, particularly family planning policy, appears to be twofold.

First, family planners need not be deterred by thinking fertility cannot decline until a relatively high level of economic and social development has been reached. Decline of fertility has occurred at different levels of development, some of them lower than those prevailing in parts of the high fertility world today. The declines in the past were, moreover, achieved without help from organized programs or modern contraceptive technology. Quite possibly, vigorous family planning programs can reduce fertility at levels of development still lower than those found in the historical record. Some recently implemented programs—those of Taiwan and Korea, in particular—reportedly have had successes in reaching the poorer, less educated sectors of this population. (Freedman and Berelson 1976)

A second policy implication concerns the dichotomy between technology and motivation which is somewhat artificial. A family planning program may not only increase the availability of means of birth control but may also affect motivation, or attitudes and ideas, by helping to promulgate the idea that family limitation is both desirable and permissible. From a practical policy point of view, then, it would seem that, for the present, the most direct methods of bringing about fertility declines include the use of modern birth control technology and nationwide family planning programs.

However, for greater understanding of the population problem not only on the part of policymakers but also the social scientists—who, after all, generate

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ideas relevant to policy—further inquiry must be made into those intangible factors affecting fertility. At least in the social sciences the tendency is to pursue quantifiable facts such as mortality rates, real income levels, and the proportion of the population living in cities to the neglect of other crucially significant phenomena that do not lend themselves to concrete measurement. In the comparison of Latin America with southern and eastern Europe, one would be hard pressed to explain events in terms of hard data. Consequently, a mental shift takes place so analysis can be made in terms of attitudes and ideas. Questions arise. How do ideas diffuse from societies at one level of development to those at a lower level? What part does the weakening of religious tradition play? Is there a carry over in the relation of innovative thinking in one area, say, science and technology, to thinking in other areas such as social organization or control of reproduction? Research on these questions is apt to be difficult and perhaps lacking in precision and conclusiveness. But unless social scientists are willing to tackle them, an understanding of fertility behavior for policymakers and for all who share an interest in this problem is not likely to progress beyond its present stage.

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## The Demographic Transition Among the Parsis of India

Leela Visaria

### Abstract

This study is an empirical examination of various hypothesized causes of the Parsi demographic transition. Demographic, social, and economic factors were studied by means of a re-analysis of data from various Indian censuses from 1881 to 1971, vital events registration records, and a 1962 fertility survey of Parsis residing in the Greater Bombay area. The findings suggest very low fertility levels were reached by 1950 although Parsis had low levels of contraceptive usage. The path to this demographic transition from a moderately high to a low fertility level appears to have been achieved between 1881 and 1931, by a slow downward trend in nuptiality and marital fertility.

In many developing countries, rapid population growth, resulting from persistence of high fertility rates in the face of falling death rates, hinders national development efforts. A question of crucial importance for policy-makers confronted with this problem is how to speed the process of demographic transition and arrive at the pattern of low birth and death rates characteristic of presentday industrialized countries. In this respect, examination of the experience of the Parsi sect of Western India may be useful, since in contrast to the general demographic pattern in India and many other Third World countries, fertility here has decreased in step with mortality reduction. For the past two decades, the size of the Parsi population of India

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*Note:* Correspondence to Dr. Visaria should be directed to Dr. Leela Visaria, % ESCAP, Statistics Division, Sala Santhitham, Bangkok 2, Thailand.

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has been shrinking at a rate of about 1 percent per year.\* Analysis of the reasons for this trend may aid Parsi leaders, concerned about the group's long-term survival prospects, to find ways of arresting the population reduction. Understanding how the demographic transition occurred among the Parsis may suggest promising strategies for policymakers whose goal is to reduce population growth. It is plausible that the Parsi experience is more relevant for other Third World societies than are the experiences of Western countries.

Included in this report are a brief account of the early history of the Parsis, a discussion of changes in selected demographic and socioeconomic characteristics of the population, and an examination and analysis of declining trends in fertility and mortality rates over the past century.

## METHOD

Since 1881, the Indian subcontinent has had an unbroken series of decennial censuses. However, detailed census information on the Parsis is available only for the period 1881-1931. In 1941, due to wartime stringencies, age data for the Parsis and other minorities were not tabulated separately, and the 1951 and 1961 censuses of India did not include religion as a variable for tabulations of demographic or economic data. Special tables compiled from the 1961 census for Greater Bombay—where nearly 70 percent of the Parsis in India resided—do include age, sex, and marital status distribution for the Parsis. A survey of about 18 percent of the Parsi community of Greater Bombay, conducted in 1962 at the request of a community organization, the Parsi Panchayat,\*\* also helps fill the post-1931 information gap. The purpose of the survey was to ascertain the reasons for the increasing proportions of never-married persons among the Parsis and for the low fertility of Parsi women.† Similar information has been obtained from 1971 census data for

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\*Not all of the decrease is attributable to low birth rates: Probable contributing factors are migration and the practice of considering as non-Parsi the children of Parsi women who married outside the group. Lack of information precludes quantification of these factors at present.

\*\*The Parsi Panchayat, founded in Bombay in the late eighteenth century, was at first largely concerned with settling disputes between community members and formulating laws regulating inheritance, marriage, and divorce. In the mid-nineteenth century, it began providing funds for support of poor and disabled Parsis in Bombay and for education of children of poor Parsis in Bombay and other Parsi centers (Karaka 1884).

†A sample of about 20 percent of the Parsi households in Greater Bombay was drawn from the 1961 census household schedules. Perhaps because 15-18 months elapsed between the census and the survey, the non-response rate was rather high, 19 percent. The final sample thus numbered 9,215 persons, or about 18 percent of the Parsi population of Greater Bombay (Census of India [1961] 1971).

Greater Bombay.\* Other sources, including registration and hospital records, are described in the appropriate sections.

Data for the period after Independence in 1947 are identified, whenever they appear, as pertaining to the Indian subcontinent (India, Pakistan, and Bangladesh) or to India alone.

## CHARACTERISTICS OF THE PARSIS OF INDIA

### Early History

The Parsis of India, followers of the Persian religious leader Zarathustra (c. 600 B.C.), migrated to Western India from Persia about 640 A.D. to escape religious persecution by Muslim conquerors. An account in a priestly chronicle of about 1600 A.D.\*\* indicates that the Parsis adopted the language and dress of their new home, but maintained a degree of isolation by practicing endogamy and refusing converts to their faith. Early in their history, they were known as traders, and beginning in the seventeenth century, references to them as merchants and traders in seaports are found in travelogues by westerners.

As the European trading companies rose to political power in India, the Parsis began migrating to the commercial centers of Western India, particularly Bombay. After the British gained power, the Parsis experienced a rapid rise in prosperity. They quickly took advantage of Western education, and their knowledge of the English language enabled them to work as interpreters, mediators, and trading agents. By the nineteenth century, they had assumed a position of leadership in the economic, social, educational, and political spheres.†

### Size, Growth, and Distribution

The first official census of the Indian subcontinent (known as the census of 1871) was taken between 1867 and 1872. Most previous estimates of the Parsi population were based on guesswork or partial surveys, but a census of Bombay island taken in 1849 showed a Parsi population of 114,698 (Briggs 1852).

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\*A 20 percent sample of data cards from the 1971 Census in Greater-Bombay was sorted on the religion column, yielding cards for 12,740 Parsis, or 19.7 percent of the Parsi population of the city. The sex ratio of the sample population was 994, compared to 954 for the total Parsi population of Greater Bombay, indicating an overrepresentation of males in the sample.

\*\*The *Kissah-i-Sanjan*.

†For an account of the exodus of the Parsis to India, see Katrak (1965). Detailed information on the Parsis' religion and social customs is found in Karaka (1884).

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The 1871 census was imperfect, being neither synchronous nor complete. It placed the Parsi population of the subcontinent at 78,864 persons, 44,091 (57.4 percent) of whom lived on Bombay island. Data from this and subsequent censuses suggest that the much higher 1849 figure was exaggerated, but in the absence of details about early censuses, it is difficult to identify the nature or source of errors.

Between 1871 and 1951, according to census data, the Parsi population increased slowly but steadily, in contrast to the marked fluctuations due to famines and epidemics, that characterized the general population of India until 1921. After 1921, population growth rates for the subcontinent increased sharply. This trend did not extend to the Parsis; instead, by 1951-1961, the group's growth rate had become negative and its population in India fell from 111,791 in 1951 to 100,772 in 1961 and 91,266 in 1971. Aside from fertility reduction, a possible cause of the negative growth rate is migration. Unfortunately, no reliable statistics are available.

The proportion of Indian subcontinent Parsis living in Greater Bombay increased from 51 percent in 1901 to 66 percent in 1961, or 69.5 percent of the Parsis in India only. According to the 1971 Census of India, nearly 71 percent of all Parsis lived in Bombay. Parsis outside Bombay also reside mainly in urban areas. At the time of the 1891 Census, nearly 87 percent of all Parsis lived in cities and towns of 20,000 or more; by 1931, nearly 91 percent were urban.\*\*

### Sex and Age Composition

Until 1951, the Parsis, like the general Indian population, had a preponderance of males, although the excess was much smaller than among other religious groups in India. Since 1951, there has been an excess of females, as is characteristic of developed countries.

Unlike populations in most developing societies, the Parsi population is aging. The proportion of persons ages 0-14 declined by nearly 43 percent between 1881 and 1931. According to the data for Greater Bombay, this proportion fell by another 38 percent between 1931 and 1971—from 26 percent to 16 percent of the population. The proportion of persons ages 60 and above

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\*According to Katrak (1965), the total number of Parsis in the world in 1951 was 140,000—112,000 in India, 18,000 in Iran, 6,000 in Pakistan, and 4,000 in the United States, Canada, and elsewhere.

\*\*In Pakistan, too, the Parsis are primarily an urban group. According to the 1951 Census of Pakistan, 94 percent of the country's 5,356 Parsis lived in Karachi; in 1961, 87 percent of the 5,412 Parsis were Karachi residents. Gustafson (1969) has examined fertility patterns among the Parsis of Karachi, who have remarkably low fertility rates for the Asian context, although slightly higher than the rates for the Parsis of India.

grew from 5 percent in 1881 to 8 percent in 1931. Since then, this proportion has increased dramatically, until in 1971 more than 20 percent of the population was in the 60-and-above age group.

#### Marital Status Distribution

The principal sources of information on nuptiality among the Parsis are the decennial censuses, 1881-1931; the 1961 and 1971 censuses of Greater Bombay; marriage records kept by the Parsi Panchayat since 1865; and age at marriage data from the 1962 survey in Greater Bombay and the 1971 census sample.

A sharp change in age at marriage occurred during the period for which accurate data are available. In 1881, 50 percent of all Parsi women were married by age 15, but by 1961-1971, this median had risen to age 27-28. The marriage age rose for men as well, the median increasing from age 19 in 1881 to age 31-32 in 1961 and 1971. Marriage of persons under age 20 has virtually disappeared among the Parsis, and permanent celibacy for both men and women has risen to high levels in this century. In 1971, for example, 14.3 percent of women ages 60 and above, and 17.9 percent of males in this age group, had never been married. The 1962 survey data, which permits analysis of nuptiality for various age cohorts, provide additional evidence of a steady increase in marriage age. However, sample data from the 1971 Census suggest that the upward trend has not continued in recent years. In recent decades, a decline appears to have taken place. The mean age at marriage for women ages 60-69 in 1971 was 23.5. For the cohort ages 55-59, it was 25.4, but for women ages 45-49 it had dropped to 24.5.

#### Educational Characteristics

As early as the eighteenth century, Parsi men were exposed to the English language through contacts with Europeans and found mastery of the language necessary to pursue occupations as traders and interpreters. Parsis soon took advantage of missionary and government schools and at the beginning of the nineteenth century, schools for boys were opened in Bombay by Eurasians or ex-soldiers. To allow the poor to receive the benefits of education, the Parsi Panchayat opened a boys' school in Bombay in 1849 out of its own endowments and members' contributions; additional schools in and outside the city were established soon after.

Parsi girls' schools were opened in the mid-nineteenth century, but girls generally dropped out of school by age 11 or 12. However, public opinion was sympathetic toward female education, and attempts were made to keep girls in school for longer periods. Members of the Parsi Girls' School Association viewed education as a means of increasing age at marriage.

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In 1872, only 36.8 percent of Parsi women ages 5 and above were literate, as against 71.6 percent of Parsi males. By 1931 the difference between the sexes had narrowed considerably, to 73.4 percent literacy for women and 84.5 percent for men. In 1961 literacy was nearly universal for both men and women. The small proportion of illiterates reported—about 5 percent—probably consisted of those who could not be educated and young children learning to read.

Turning to the general Indian population, in 1931 only about 18 percent of males ages 5 and above were literate, and despite rapid improvement, by the 1960s more than half of all Indian men were still illiterate. The situation in urban India is significantly better; in 1961 and 1971, the literacy rate among urban males was 65-70 percent.

Less than 4 percent of Indian women were literate in 1931, and although literacy among them has increased at a faster rate than among the men, by 1971 the proportion literate was less than 25 percent. Even among urban Indian women, more than half were reported illiterate. In contrast, Parsi women are on the same level as their male counterparts in this respect.

Since illiteracy among Parsi males was almost eradicated by 1900, the century's major change has been in educational level attained. Among Parsi men ages 20-24, over 85 percent had at least completed high school in 1971. The proportion of men having only primary education increases with age, indicating that the older generation stopped with primary schooling, while younger men tended to continue their education.

Young Parsi women are almost on a par with men in level of education, and their educational attainment is much higher than that of Indian women in general. According to the 1971 Census, even in urban areas, only 21.4 percent of Indian women ages 20-24 had finished high school, compared to 84.4 percent of Parsi women ages 20-24 in Greater Bombay.

The educational level achieved by the Parsis has put them in an advantageous position for employment and income benefits. More significantly, education has played an important role in the process of modernization, enabling individuals to develop a rational approach to life.

#### Economic Characteristics

Data on economic characteristics of such small groups as the Parsis are not usually tabulated in the census returns. However, the special tabulations for Parsis in Greater Bombay undertaken in 1961 and 1971 include data on the economically active population, which provide insights as to the roles available to Parsi women other than marriage and childrearing. These data are of interest because, given certain conditions, female employment has been found to depress fertility.

Labor force participation rates for currently married Parsi women are considerably lower at every age than for the never-married. In urban areas, where workplace and residence are separate and a strict time schedule must be observed, it is difficult for married women to have jobs. The constraint of household duties is much less for single women, and their labor force participation rates are high—nearly 80 percent for ages 25-29 and over 60 percent for ages 30-44. Thus, Parsi women are able to find alternatives to traditional roles.

The next two sections contain a detailed examination of mortality and fertility rates, which together determine rate of natural increase.

## MORTALITY TRENDS AMONG THE PARSIS

### General Mortality Rate

Historically, reduction in mortality rates has been the first phase of the demographic transition. It is possible to construct a history of changing mortality rates among the Parsis over nearly a century by pooling various data sources. Vital statistics for Parsis in Bombay are available from the city's registration records, beginning with 1901. Another source is the record of bodies consigned to the *Dokhma*, or Tower of Silence.\* In addition, average death rates for 1881-1931 have been derived, using forward survival techniques, from the all-India age distribution of the Parsis and the intercensal growth rates.\*\* These estimates serve as an independent consistency check on those based on registration data.

The downward trend in Parsi mortality began before 1881; the late nineteenth century death rate of less than 30 per 1000 is already low in comparison with the estimated all-India death rate of over 50 per 1000. (Table 1) The community's ability to withstand the plagues and famines that caused high mortality in Western India during this period reflects its economic prosperity. Although the influenza epidemics of 1918-1920 apparently brought about a rise in mortality rates among the Parsis as well as in the subcontinent as a whole, during 1921-1931 there was a substantial decrease in the rate for both the Parsis and the general Indian population. According to census-based

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\*Believing that earth, fire, and water must not be defiled with impure dead bodies, the Parsis cast their dead to the vultures in the Tower of Silence.

\*\*This technique involves comparison of an estimated number of survivors—projected from the initial population by use of a model life table incorporating certain relationships between infant and adult mortality—with the actual surviving population enumerated at a subsequent count.

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estimates, the Parsi death rates reached a low of 17.7 per 1000 in that decade; the rate for India was 37.5 per 1000.

Non-availability of age data for the period 1931-1961 leaves us with only the estimates based on registration of vital events in Bombay. These indicate that the death rate fluctuated between 12 and 14 per 1000 until 1951 and has since moved slightly upward, presumably due to the aging of the Parsi population.

#### Infant Mortality Rate

In the past, inadequacy of sanitation facilities, lack of a protected water supply, and non-availability of such drugs as sulfa and antibiotics resulted in high infant mortality throughout the subcontinent. Infants were prone to succumb to gastroenteric and respiratory illnesses, and, despite the Parsis' overall prosperity, their young were also exposed to these risks. Direct data on infant mortality rates for Parsis in Bombay are available from registration statistics, beginning in 1901. During 1901-1911, the infant mortality rate was 220 per 1000 live births, meaning that one out of every five Parsi babies died before completing its first year. After 1911 and particularly after 1921, the infant mortality rate declined steadily, from 144 per 1000 in 1921-1931 to 72 per 1000 in 1941-1951. By the late 1960s, the rate was 25 deaths per 1000 live births, a level only achieved by the United States in about 1962. This reduction in infant mortality is indicative of the high quality of medical and health care provided by the Parsi community.

#### Life Expectancy at Birth

Progress in sanitation and prevention of common infections can also be measured in terms of longevity. In 1881-1901, the life expectancy at birth of Parsi males was nearly 32 years—an age significantly higher than that for the subcontinent. After a small dip in 1891-1901, life expectancy improved for both males and females in 1901-1911. The decennial average for 1911-1921 was affected by the heavy impact of the influenza epidemic, but during 1921-1931 it rose to 46 for males, 50 for females. (For the country as a whole, life expectancy in 1921-1931 was 25 for males, 22 for females.) Estimates for Parsis in Greater Bombay, 1960-1962, based on registration data, show a longevity of about 66 years for males, 69 for females, and by 1970-1972 a further rise of 1 year for both males and females.

Since the late nineteenth century, life expectancy of Parsi females has exceeded that of Parsi males by 3-4 years. This contrasts with the situation in the subcontinent and Sri Lanka, where males have higher longevity. Evidently, Parsi females are treated on a par with males, so that their biological superiority is not thwarted by adverse sociocultural influences.

### **Causes of Death**

An outstanding feature of the reduction in Parsi mortality is the change in major causes of death. Around 1900, the leading causes of death were diarrhea and enteritis (especially among children), pneumonia, influenza, and tuberculosis. In 1970-1972, the main causes were heart disease or cardiac failure (accounting for 52 percent of all deaths), senile debility and degeneration (10 percent) and cancer (9 percent). Thus, the major causes of death among Parsis today are associated with degeneration of tissues, an area where further health gains are only slowly being achieved.

### **Causes of Mortality Decline**

The historical record of the longevity and mortality of the Parsis of the Indian subcontinent parallels, with a slight time lag, that of the Western European countries and the United States. This reflects the social and economic progress of the community as well as its life-style, which, from the late nineteenth century, resembled Western European populations more than the Indian population. Rapid economic progress gave rise to a high standard of living, including improved home environments, emphasis on personal cleanliness, and abundant, high-quality food. Preventive measures, including expenditures for maternal and child health programs, have paid rich dividends in reduction of mortality, and these benefits have been distributed among the people through the efforts of the Parsi Panchayat and wealthy members of the community.

## **FERTILITY TRENDS AMONG THE PARSIS**

Despite the rapid decline in Parsi mortality in this century, the group's rate of growth has been low and, in the past two decades, has been negative. The explanation lies in a significant reduction in fertility concurrent with the decline in mortality.

### **Estimates of Birth Rates**

The time trend in Parsi fertility can be analyzed on the basis of four complementary estimates: 1) intercensal birth rates, 1881-1931, derived by adding intercensal growth rates to the death rates shown in Table 1; 2) annual birth rates for Parsis in Bombay, 1907-1972, based on municipal records (believed to be reasonably correct, since 65 percent of all Parsi births occur in hospitals); 3) age-specific marital fertility rates, based on hospital records for 1960-1962 and 1970-1972; and 4) average parity, derived from the 1962 survey in Greater Bombay. The last set of data permits examination of the fertility

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trend on the basis of the experience of women in successive cohorts.

The estimated Parsi birth rate for 1881-1901 was about 34 per 1000; by 1921-1931, it stood at only 25. (The all-India birth rate for 1921-1931 was 48 per 1000.) Registration data for Bombay indicate that the decline in the Parsi birth rate continued after 1931. During the 1960s, it decreased to about 12 per 1000 and by 1970-1972, it had sunk to 10.8. (Table 2)

Table 1  
Estimated Death Rates for Parsis  
and for the General Indian Population

	<i>Death rates, Indian subcontinent<sup>a</sup></i>	<i>Death rates, Bombay<sup>b</sup></i>
<i>Parsis</i>		
1881-1891	29.1	N.A.
1891-1901	29.7	N.A.
1901-1911	22.7	27.9
1911-1921	25.1	24.1
1921-1931	17.7	18.7
1931-1941	N.A.	14.1
1941-1951	N.A.	13.9
1951-1961	N.A.	13.1
1961-1971	N.A.	15.0
<i>All India</i>		
1891-1901	50.5	
1901-1911	41.5	
1911-1921	48.2	
1921-1931	37.5	
1931-1941	31.2	
1941-1951	30.0	
1951-1961	25.7	
1968 <sup>c</sup>	16.8	
1969 <sup>c</sup>	19.1	

*Sources:*

<sup>a</sup>Based on age data. Censuses of India

<sup>b</sup>Based on registration records obtained from Parsi Panchayat, Bombay

<sup>c</sup>Based on data for rural India only, collected under the sample registration scheme

*Other sources:* Davis, Kingsley. 1951. *The Population of India and Pakistan*. Princeton University Press: Princeton.

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**Total Fertility Rate and Gross Reproduction Rate**

The limitations of the birth rate as a fertility index are well known; it is affected by the age structure of the population. Therefore, TFR (total fertility rate) and GRR (gross reproduction rate) have been calculated to 1931, using the mean age of the fertility schedule and birth rates estimated from census age distributions. After 1931, lack of census data on age distribution prevents estimation of the TFR or GRR by this method. The 1962 Bombay survey data on total number of children ever born to cohorts of women who had reached the end of their reproductive period were therefore used as a basis for estimates.\*

The relatively refined TFR and GRR figures confirm that a century-long process of fertility decline has taken place among Parsi women. (Table 2)

\*Women who were ages 65-69 in 1962, the time of the survey, were in their prime reproductive period (ages 25-34, given the relatively late entry into marriage) in 1921-1931; the next younger cohort, ages 60-64, was in its prime reproductive period during 1926-1936, and so on. TFR of women ages 65-69 and 60-64, as estimated from the survey data, approximates the estimates from census data for 1921-1931. This similarity strengthens the case for using survey data on younger cohorts to fill the gap in census data after 1931.

**Table 2**  
**Comparisons of Measures of Fertility for the Parsis and for the General Population of the Indian Subcontinent**

A. Estimated Birth Rates, Total Fertility Rates and Gross Reproduction Rates for the Parsis and for the General Population of the Indian Subcontinent 1881-1972

Years	Parsis <sup>a</sup>	Crude Birth Rates All India <sup>a</sup>	Bombay Parsis <sup>b</sup>
1881-1891	34.3	N.A.	N.A.
1891-1901	34.1	51.6	N.A.
1901-1911	28.0	48.0	26.1
1911-1921	26.6	49.1	26.6
1921-1931	24.9	48.0	22.5
1931-1941	N.A.	45.2	18.3
1941-1951	N.A.	42.6	15.8
1951-1961	N.A.	44.9	12.5
1961-1971	N.A.	N.A.	11.7
1968 <sup>d</sup>	N.A.	39.0	N.A.
1969 <sup>d</sup>	N.A.	38.8	N.A.
1970-1972	N.A.	N.A.	10.8

(continued on p. 200)

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Table 2 (continued)

	<i>Total Fertility Rates<sup>a</sup></i>		<i>Gross Reproduction Rates<sup>c</sup></i>	
	<i>Parsis</i>	<i>All India</i>	<i>Parsis</i>	<i>All India</i>
1881-1891	4.41	N.A.	2.15	N.A.
1891-1901	4.20	6.50	4.20	3.17
1901-1911	3.24	6.15	3.24	3.00
1911-1921	3.11	6.27	3.11	3.06
1921-1931	2.93	6.33	2.93	3.09
1931-1941	N.A.	N.A.	N.A.	N.A.
1941-1951	N.A.	5.56	N.A.	2.71
1951-1961	N.A.	6.09	N.A.	2.97
1968 <sup>d</sup>	N.A.	5.74	N.A.	2.8
1969 <sup>d</sup>	N.A.	5.53	N.A.	2.7

B. Estimated Total Fertility Rates and Gross Reproduction Rates for the Parsis of the Indian Subcontinent by Age Cohort<sup>e</sup>

<i>Age Cohort</i>	<i>Total Fertility Rate</i>	<i>Gross Reproduction Rate</i>
65-69	2.98	1.45
60-64	2.74	1.34
55-59	2.36	1.15
50-54	2.22	1.08
45-49	2.01	0.98
40-44	1.72	0.84

*Sources:*

<sup>a</sup>Based on age data, Census of India.

<sup>b</sup>Based on registration data obtained from the Parsi Panchayat, Bombay.

<sup>c</sup>Based on mean age of fertility schedule and births calculated from census age data, using forward projection method.

<sup>d</sup>Based on data for rural India only, collected under sample registration scheme.

<sup>e</sup>Based on 1962 survey, Census of India [1961] 1971. *Parsis of Greater Bombay*, Part 10. The Maharashtra Census Office: Bombay.

*Other sources:* See Table 1.

Between 1881 and 1931, GRR dropped from 2.15 to 1.43, a decrease of 33 percent. The cohort data for Parsis in Bombay clearly indicate that this trend has continued. The cohort that had reached the end of its reproductive period by 1962 (ages 45-59) did not even replace itself; its GRR was 0.98. The cohort ages 40-44, assumed to have nearly completed its fertility by the time of the survey, 1962, had an even lower GRR of about 0.84.

In 1881-1891, GRR and TFR for the Parsis were nearly 32 percent lower than for the total population of the subcontinent. The difference increased as the fertility of the larger population remained more or less stationary and the fertility level of the Parsis continued to decline. By 1921-1931, the Parsis' GRR was less than half that of the subcontinent, and by 1961 the ratio was about one-third. The fertility of the Parsis is thus considerably lower than that of the general Indian population.

### Parity

Due to their late entry into marriage, significant numbers of Parsi women have their first babies in their 30s. In 1970-1972, 35 percent of births to women ages 30-34 and 30 percent among ages 35-39 were first order births, and 43 percent of all births in both age groups were second order births. A significant change occurred between 1960-1962 and 1970-1972; births of the higher orders almost disappeared. In 1960-1962, almost 20 percent of births to women ages 35-39, and over 25 percent in the next higher age group, were of the fourth order or higher. Ten years later, the proportions were only 6.2 and 20.0 percent, respectively.

### Analysis of Fertility Decline

Nuptiality and marital fertility determine the total fertility of any population in which illegitimacy is insignificant or non-existent. Both factors may be evaluated by comparison with the fertility of the Hutterite community of North America, whose members use no contraception and in 1921-1930 experienced the highest marital fertility ever recorded (Eaton and Mayer 1954). An index of the proportion of the population married ( $Im$ ) developed by the Office of Population Research, Princeton University, indicates the extent to which actual fertility would fall short of this presumed maximum because of non-marriage. An  $Im$  of 1.00 indicates universal marriage between ages 15 and 49, accompanied by low mortality at these ages and/or by remarriage of widows. Similarly, indexes of marital fertility ( $Ig$ ) and overall fertility ( $If$ ) can be calculated;  $If$  is the product of  $Im$  and  $Ig$ .

At the national level,  $Im$  has been observed to vary between 0.91 (Korea 1935) and 0.31 (Ireland 1900). For all-India,  $Im$  was 0.88 in 1961 and 0.86 in 1971; for urban India, it was significantly lower, standing at 0.67 in 1971. Among the Parsis of the Indian subcontinent,  $Im$  declined from an average 0.79 during 1881-1891 to 0.53 during 1921-1931; for Parsis in Greater Bombay, it was 0.48 in 1961 and 0.50 in 1971. The decline in the value of  $Im$  up to 1931 reflects a sharp upward trend in age at marriage as well as in the proportion of women remaining unmarried throughout their reproductive years. Since about 1931,  $Im$  has not decreased substantially, as the trend toward late

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marriage and non-marriage has been partially offset by the decline in mortality.

Turning to  $I_g$  (marital fertility), the number of children born to married Parsi women during 1881-1931 appears to have been only about 44-46 percent of the Hutterite maximum. The 1962 survey data indicate that, among Parsi women in Greater Bombay, marital fertility has been about 26 percent of the Hutterite level in recent years.

Declines both in the proportion of married women and in marital fertility have contributed to the remarkable decrease in the fertility of the Parsis. Overall fertility ( $I_f$ ), the product of  $I_m$  and  $I_g$ , dropped from about 37 percent of the Hutterite maximum in 1881-1891 to about 13 percent in 1961, a decline of 65 percent.

### Causes of Fertility Decline

The Parsis' transition from a moderately high to a very low fertility level appears to have come about in three stages: Achievement of a low level of marital fertility even before 1881; a shift in nuptiality between 1881 and 1931; and, since 1931, a slow downward turn in both nuptiality and marital fertility. It is difficult to give an explanation for the low marital fertility observed about 1881. A level of marital fertility less than 50 percent of the Hutterite maximum is unlikely without some form of birth control, but in the 1962 survey—the only available evidence on voluntary fertility control by Parsis—96 percent of women ages 65-69, 94 percent of those ages 60-64, and 89 percent of those ages 50-54 and 45-49 reported that they had never practiced contraception or planned a pregnancy (Census of India [1961] 1971). Perhaps responses on contraceptive practice were insufficiently probed and use of non-mechanical methods of birth control (coitus interruptus, for example) was underreported. Among women ages 30-34, nearly 33 percent reported ever using some method of contraception—a much higher proportion than for other segments of the Indian population.\*

Sterility is a possible explanation for low marital fertility. According to the 1962 survey, from 13 to 16 percent of the women in ever-married cohorts with completed fertility had not produced a live birth. To what extent childlessness is due to subfecundity or sterility rather than to voluntary fertility control is unknown. A possible cause of sterility is the prevalence of consanguineous

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\*The percentage of Indian married women ages 15-44 using contraceptives was estimated at 8.0 in 1969 and 13.5 in 1973 (International Bank for Reconstruction and Development 1974). According to the 1962 survey, the corresponding figure for Parsi women in the reproductive age group was 25.5 percent. However, the proportion of urban women practicing contraception could be expected to be higher than the all-India average and more comparable to the figure for the largely urban Parsis.

marriages; the 1962 survey data indicated that 14.3 percent of ever-married women had married blood relations, including relatives as close as first cousins. (The incidence of consanguineous marriages was somewhat higher among older than among younger cohorts.) The data do not show whether childlessness was higher among spouses who were related to each other than among non-related spouses, and the subject deserves further research.

### CONCLUSIONS

The Malthusian methods of delayed marriage and celibacy only partly explain the downward trend in the Parsis' fertility. Despite lack of evidence on practice of contraception, neo-Malthusian methods (that is, birth control) appear to have been prevalent among the Parsis even prior to 1881. Parents may have perceived the effect of rapidly declining mortality on survival of children and, given the community's Western outlook and high educational level, decided to have fewer children for whom they could provide better care and opportunities. It is plausible that, in the closely knit Parsi community, these values became accepted and fostered spread of conscious and effective family limitation.

#### Implications of Demographic Trends

The Parsis' low mortality level and even lower fertility level have led to a light child dependency burden. However, the proportion of elderly has steadily increased and, despite the group's relative prosperity, the extent to which the aged must depend on community charity is a cause of concern.

The community's dwindling size is of greater concern. If the Parsi population of India continues to decline at the annual rate of 1 percent observed during 1951-1971, it would reach half its present size around the year 2040 and a fourth of its present size in 2110. Eventual extinction thus appears distant, but possible. A reversal of recent trends seems to be contingent on a change in the attitudes and values among young Parsi men and women. Possible remedial measures might be to change restrictions on religious affiliation of children of Parsi women married to non-Parsi men, to accept converts, and to encourage marriages, particularly at younger ages. A modest rise in the proportion of women marrying, or a decline in the mean age of marriage, could contribute to an increased birth rate. Reasons for non-marriage cited by single persons in the 1962 survey included financial problems, need to care for aged parents, nonavailability of a "suitable match," and lack of housing. Community programs aimed at reducing these obstacles might induce young people to marry.

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### Significance For Other Societies

The Parsi case suggests paths along which demographic transition might be achieved, and in a sense, it is more relevant for the Indian demographic scene than models based on the experiences of the industrialized countries. However, there are crucial differences between the experience of the Parsis and that of the general Indian population. As early as the 1930s, the Parsis attained a death rate of about 15-18 per 1000, a level reached by India only in the 1960s and 1970s. More important than this time lag is that, around 1930, the Parsi birth rate had already declined to 22-25 per 1000. In contrast, India's rapid decline in mortality has not been accompanied by a significant decline in fertility.

The Parsis also differ from the general Indian population in that they have had time to adjust to the process of modernization. For several decades now, they have been living mainly in urban areas, where housing shortages and city lifestyle have forced couples to modify their attitudes and behavior regarding family size. Thus, although the historical experience of this small community cannot be replicated elsewhere, identification of factors that have been powerful fertility-reducing influences for the Parsis may be valuable for policy-makers elsewhere. Urbanization has been one such factor. Literacy and education have probably raised the aspirations of parents and potential parents concerning the advantages that can be provided to children. As a consequence, young people may postpone or forego marriage as long as they are not able to meet these socially-approved aspirations, leading to late marriages and a high rate of permanent celibacy. Also pivotal is the existence of alternatives to full-time motherhood, including education and employment opportunities. The greater number of alternatives for women interacts with late age at marriage to lower desired and actual family size. Once a woman starts to work, she is likely to postpone marriage for a few years, and if she does marry, may not be inclined to devote herself to home and children. Exposure to the outside world also better equips her to examine alternatives and develop maturity and rationality. A process of this kind seems to be highly effective as a fertility-reducing influence among the Parsis.

Thus, the Parsi case, despite its many special features, emphasizes the importance of education and alternative roles for women as tools for promoting changes in reproductive behavior.

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## Economic-Demographic Simulation for Indonesia

Hananto Sigit

### Abstract

The study contains economic and demographic projections for Indonesia, using a neoclassical growth model featuring alternative investment strategies. The investigator concludes that fertility reduction aids in achieving a given per capita income but does not ease the task of achieving a certain GNP growth rate.

As is common in developing countries, rapid population growth has been experienced in Indonesia as a result of an imbalance between declining mortality and continued high fertility. If current fertility rates remain unchanged and mortality declines further, as can be expected, the population of Indonesia will increase from the 1971 level of 119 million to nearly 475 million by 2021, or by about 300 percent in 50 years. Awareness of the archipelago's pressing demographic problems has led the Indonesian Government to take action to reduce fertility and encourage migration from the most densely populated islands to less crowded areas. In addition, in early 1970, a National Family Planning Coordinating Board was established, with the task of coordinating all family planning activities by government and voluntary organizations.

The results of the fertility reduction program will not be felt in the near future. Even if, at this moment, Indonesian parents could be persuaded to have only two children, in the years to come, females already born will produce more babies than are necessary for replacement of the population. Since control over mortality has been achieved earlier than control over

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*Note:* ICP social scientist David N. Holmes, Jr. helped prepare this report for publication. Correspondence may be directed to Dr. Hananto Sigit, Central Bureau of Statistics, Republic of Indonesia, 8, Jln. Dr. Sutomo, Jakarta, Indonesia.

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fertility, the question is not whether marked population increase will occur in Indonesia, but how large that growth is likely to be.

Demographic change affects the economy in complex ways. The purpose of the study reported in this paper is to explore the impact of various patterns of fertility reduction on the economic variables that are important to the Indonesian Government. These include size of the labor force, requirements for capital investment, consumption and savings levels, amount of government investment needed to fulfill economic plans, and need for investment from foreign sources. Although the demographic-economic model utilized for the analysis was constructed for the Indonesian economy, it can be applied, with appropriate modifications, to other developing countries.

### Description of the Study

The economic-demographic model adopted in this analysis is a modified neo-classical growth model that incorporates the important characteristics of the Indonesian economy. Consumption is treated both as cost and as growth factor, savings is defined as the amount left over after consumption, and the economy is somewhat disaggregated into rural-urban and food-nonfood sectors. In line with recent developments in this type of analysis, a variant of the Cobb-Douglas production function is employed in the model.

The model is constructed to explore the consequences of alternative population growth paths in a planned economy. Demographic and economic projections are calculated for a period of 50 years, 1971-2021. Unlimited combinations of fertility, mortality, and urbanization rates are possible, but for this study, the following assumptions concerning future demographic trends have been judged adequate:

- Life expectancy at birth increases by 2-1/2 years every 5 years during the projection period.
- Four alternative trends for fertility are projected: Constant 1971 fertility levels (High projection); reduction of fertility by 25 percent during the period (Medium projection); reduction of fertility by 50 percent (Low projection); and reduction such that zero population growth is achieved by about the year 2021 (Very Low projection).
- The rate of urbanization remains constant at 0.3 percent per year, the 1961-1971 level.

It is first assumed that the target is a given future trend in growth of GNP (Gross National Product) and its rural-urban components. Next, the target is assumed to be a given per capita income level. The differential effects of alternative demographic changes are investigated through estimates, for

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each assumption, of private, public, and total consumption; induced, autonomous, welfare, and demographic investments; savings; and investment from abroad. These projections are not forecasts of real future developments, but formal computations showing the implications of given assumptions. The outcomes, in other words, depend on the underlying assumptions.

The aim of the study is to analyze the economic consequences of population growth, not the reverse. The relevance for developing countries of Malthus' classical economic theory of population growth, that any rise in income tends to bring with it increased birth rates and decreased death rates, has been questioned, as has the more complicated demographic transition theory concerning the influence of economic development on fertility and mortality. With the importation of advanced technology in public health and sanitation, birth and death rates appear less dependent on economic growth than these theories suggest, and several demographer-economists hold that rates of population growth in developing countries are largely independent of their rates of economic growth (Walsh 1970).

## METHOD

### Demographic Variables

Demographic projections are made for 5-year intervals from 1971 to 2021. Data from the 1971 population census of Indonesia were used to obtain the base-year population, by age and sex, after adjustment to correct census errors (see Appendix A). In 1971, the population of Indonesia was over 119 million, and there were 97.5 males for every 100 females.

*Mortality.* The mortality level used for the projections must account for the tendency toward decreasing mortality in Indonesia resulting from advances in public health technology and improvements in economic conditions. For this study, it is assumed that life expectancy in 1971 was 42.1 years for males, 45.0 years for females. This is identical to estimates by the Demographic Institute of the University of Indonesia (1972) and in accordance with most other estimates that have been made. In the absence of sound information on past mortality to serve as a basis for projections, it is assumed that during the projection period, life expectancy at birth increases at the moderate rate of 2-1/2 years for every 5 years. This is the mortality pattern generally used for population projections for Indonesia. Only one mortality pattern is employed, since in this analysis, fertility, not mortality, is the policy variable.

*Fertility.* Due to widespread underreporting of births in Indonesia, it is not possible to obtain sound estimates of fertility rates from vital registration

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systems. A method developed by Grabill and Cho (1965) for estimating fertility levels from census data on young children was used by McNicoll and Mamas (1973) to compute fertility rates for Indonesia. These estimates, based on advanced tabulations of the 1971 census, are used in this study to establish initial fertility levels (Table 1).

Four alternative fertility trends are used in the projections:

- **High** Age-specific fertility rates remain constant at initial level during the period 1971-2021.
- **Medium** Age-specific fertility rates decrease by 50 percent during 1971-2021, a decline of 5 percent every 5 years.
- **Low** Age-specific fertility rates decline by 50 percent during 1971-1996, a decline of 10 percent every 5 years. After 1996, fertility rates remain constant. This is the projection that approximates the fertility reduction goals of the Indonesian Government.
- **Very Low** Age-specific fertility rates decline so that zero population growth is achieved by 2021. This entails a decrease of 12 percent every 5 years during 1971-1996. After 1996, the fertility rates are constant.

The fertility trends may also be expressed as annual percentages:

- **High** No change in fertility
- **Medium** Reduction in fertility of 1 percent per year, 1971-2021
- **Low** Reduction in fertility of 2 percent per year, 1971-1996
- **Very Low** Reduction in fertility of 2.4 percent per year, 1971-1996

Table 1  
Age Specific Fertility Rates, Indonesia  
Average 1966-1970

Age	Fertility Rate (per 1000)
15-19	151
20-24	274
25-29	265
30-34	206
35-39	124
40-44	55
45-49	18

Source: McNicoll and Mamas, 1973. *The Demographic Situation in Indonesia*. Paper No. 28. East-West Population Institute: Honolulu.

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*Rural-urban composition of the population.* The model requires inputs on population and labor force by sex and by rural-urban residence. Since data on sex-age distribution of rural-to-urban migrants is lacking, it is not possible to make separate rural and urban population projections using a cohort survival method, but the simpler method suggested by the United Nations (1971) is sufficient for our purposes. This method is applied to sex and age group categories of the population to yield rural-urban components. A crucial assumption is that the rate of urbanization observed between 1961 and 1971—0.3 percent per year—will hold for the projection period.

*Equivalent adult consumers.* Since children and old people are assumed to consume less than working-age persons, their consumption is reduced to a fraction of that of working-age persons. Methods of weighting vary; some authors apply different weights to different age and sex groups (Coale and Hoover 1958, Walsh 1970, Enke 1968, Demographic Institute 1972). In this study, the simplest method, also used by Kuznets (1967), is adopted. Persons ages 0-14 and ages 64 and over are assigned a weight of 0.6, persons of working age are weighted at 1.0. The ratio of equivalent adult consumers to total population reflects the age structure. A higher ratio indicates a population with a small proportion of dependents, and conversely.

Average household size is 6.5 percent larger in urban areas than in rural, and the difference in equivalent adult consumers is even larger, 7.9 percent. This reflects the high proportion of working-age persons, including students, among city residents. In rural areas, average household size is 4.89 persons, or 3.80 equivalent adult consumers, in urban areas, average household size is 5.21 persons or 4.10 equivalent adult consumers.

*Labor force.* The concepts used by the Indonesian Government in estimating employed labor are the same as those used by the United Nations. Working age is defined as ages 15-64, but not all working-age persons are economically active. Some are in schools or institutions, are handicapped in some way, or are unpaid home workers. The labor force consists only of persons currently employed, plus unemployed persons who are seeking work. The percentage of the working-age population that is in the labor force is the labor force participation rate, and the percentage of labor force actually employed is the employment rate.

Indonesian data show that the female labor force participation rate increased from 31.31 percent in 1961 to 38.40 percent in 1971, while the male labor force participation rate decreased from 89.31 to 80.36 percent during the same period (Central Bureau of Statistics 1973). For comparison, in Japan, labor force participation rates have been stable since 1955 at about 50 percent for females, 84 percent for males. In this study, it is assumed that the stable levels observed in Japan will be achieved in Indonesia in 2021, implying an increase of about 43 percent in female labor force participation and a

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nearly stable male labor force participation rate during the projection period. Employment rates in Indonesia are deceptively high, over 96 percent according to the 1961 and 1971 censuses and the 1964-1965 Social Economic Survey. It is suspected, however, that a large proportion of these so-called employed are really underemployed. For this study, it is assumed that the high employment rates observed in 1971 will hold constant through 2021—implying that labor productivity will increase as the economy develops and that there will be full employment.

*Number of family planning acceptors required.* No acceptors are required for the High projection, since no fertility reduction occurs. For the remaining projections, births prevented are calculated for each fertility reduction pattern, and the number of acceptors required to avert that number of births is estimated.

## Economic Variables

*Gross National Product.* In the model, total production can be projected from current levels of inputs by means of a production function. The more factors that are included as inputs, the more precise are the estimates, but the problem also becomes more complicated and requires more extensive data. Especially in developing countries, lack of data restricts inclusion of all inputs suspected of influencing production. For the purposes of this study, capital, labor, and technological progress are considered sufficient,\* and these are included in the Cobb-Douglas production function that is employed. (See Appendix B for equations.)

Technological progress is assumed constant over the projections and neutral as regards its effect on the relative productivity of capital and labor in the production function. The amount of labor available depends on the fertility pattern and thus varies over the four projections. The effect of population change on several significant economic factors may be examined by calculating the amount of capital stock needed to produce the target GNP growth rate, given the amount of labor available. In addition, a number of economic variables depend directly on population.

*Investment.* Total investment is defined as the sum of induced investment, autonomous investment, net welfare investment, demographic investment, and depreciation allowance. Each of these factors is described below. In-

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\*Land is not entered separately as a determinant of output. This is not a serious omission, provided that the supply of land is adequate (that is, not all of it will be fully used before the end of the projection period), and necessary additions to cultivated land can be realized without steep increases in cost per unit of land of average productivity (Walsh 1970). These conditions are satisfied in the case of Indonesia where pressures on the land are felt only in Java, an island accounting for 13 percent of the nation's total area.

duced investment plus autonomous investment is equal to net economic investment, one of the determinants of capital stock and thus of GNP. (Capital stock, the amount of fixed productive capital at the end of a given year, is equal to capital stock at the end of the previous year plus net economic investment during the year.)

1) Induced investment—An important determinant of induced investment is the rate of return to capital. In the absence of data on rate of return, the level of induced investment is estimated as a portion of the residual after total consumption is deducted from GNP.

2) Autonomous investment—Autonomous investment is the amount that the government must invest in order to make up the difference between total net economic investment required to attain the target GNP and induced investment by the private sector. The greater the amount of private sector investment, the smaller the amount of government investment required. This type of investment may thus be regarded as a policy variable whereby government deliberately influences growth of GNP.

3) Welfare investment—This includes all outlays in social fields, including religion, education, culture, health, and housing. Since the main purpose of this investment is to provide social services for the people, it is considered a function of population. The functional relationship adopted in this study is identical to that used by Walsh (1970). Because of its distinctive characteristics, welfare investment is treated separately from government consumption expenditures, and since it does not contribute directly to growth, it is also treated differently from economic investment. It is defined as increasing at the same rate as government consumption expenditure (see below), but with a provision for population increase.

4) Demographic investment—Demographic investment consists of public and private spending required to bring fertility to a desired level. The term was first used by Demeny (1965), who distinguished between indirect and direct demographic investment. The former was described as that portion of investment in conventional economic projects expected to influence population trends; the latter comprised funds channeled directly into population-influencing schemes, including family planning programs. In this study, all investments in economic projects are considered economic investments, even though they may affect fertility, because it is not practicable to isolate and quantify the demographic portion of conventional investment. Thus, only investment undertaken specifically to reduce fertility is considered demographic investment, and the concept of indirect demographic investment is not used.

The extent to which fertility can be reduced and population growth slowed depends on many variables, most of which are not quantifiable, since they reflect the traditional and social values of the people. However, it can be

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reasonably assumed that these variables will operate in the same way under each of the four alternative fertility assumptions employed in the study. Fertility reduction is therefore assumed to depend only on efforts by government and the private sector, as reflected in the amounts spent on this activity.

The amount of demographic investment required to bring about a specified fertility decline is calculated by multiplying the number of family planning acceptors needed by estimated average cost per acceptor. Cost per family planning acceptor normally decreases over time. Starting cost, consisting mainly of fixed expenses, is high, whereas the number of acceptors recruited is low, making for a high cost per acceptor. As the number of acceptors increases, average cost decreases, but finally levels off. After five years of the national family planning effort, cost per acceptor in Indonesia was US\$9.57 in 1972-1973. In the Republic of Korea and Taiwan, where family planning programs have been active longer, costs were lower—US\$6.70 in Korea in 1967, US\$4.00 in Taiwan in 1968 (Lapham and Mauldin 1972). Enke et al (1968) estimated that after about five years, the direct cost of contraceptives was about US\$5.00 per acceptor, not including costs of incentives and educational programs. Cost per acceptor for Indonesia is therefore estimated at US\$7.00, or 400.76 rupiahs (at 1960 prices). To be conservative, this cost was assumed to be constant.

5) Depreciation allowance—The investment necessary to replace productive fixed capital that has become worn out or obsolete is the depreciation allowance. Since depreciation of fixed social capital has been deducted from welfare investment, only depreciation of productive fixed capital is included.

The depreciation allowance is believed to be lower in developing than in developed countries. Scarcity of capital forces developing countries to take good care of existing capital, and repair and maintenance costs are low because of low wage rates. Available capital is therefore used longer before it becomes economically obsolete.

Data on depreciation allowance is difficult to collect for developing countries. It is usually estimated as a percentage of capital stock or GNP. In the absence of data on depreciation, the Indonesian Central Bureau of Statistics estimates that the depreciation allowance is about 5.94 percent of GNP. Since the capital-output ratio is estimated at 2.75, this implies an allowance of approximately 2.16 percent of capital stock, or a lifetime for the capital stock of about 46 years. Even for Indonesia, this figure seems too high and the depreciation allowance too low. Especially with the large amount of investment in recent years and the growing competitiveness in the economy, future allowance for depreciation must be larger. A capital lifetime of 25 years is assumed to be more reasonable for Indonesia, and in this study, the

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depreciation allowance is accordingly set at about 4 percent of capital stock. (For comparison, the average capital consumption allowance for Jamaica for the period 1958-1966 was 4.038 percent.)

*Savings and foreign sector investment.* Total investment may also be defined in terms of how it is financed, that is, as domestic savings plus foreign investment. Domestic savings is defined as the residual after private and government consumption (discussed below) is subtracted from GNP.

Foreign sector investment covers all foreign sources of investment, including foreign aid and direct investment by the foreign private sector. Actually, foreign aid is also used for consumption needs, for example, Indonesia has been receiving direct food aid for several years. However, domestic funds can be substituted analytically for foreign aid so that, for the purpose of this study, all consumption is financed by domestic sources and all foreign funds are used for investment.

*Consumption.* In a study of Indonesia, the Demographic Institute (1972) used the same consumption function employed by Coale and Hoover (1958) and by Demeny (1965), except that population was expressed in terms of equivalent adult consumers. This formulation is adopted as the basic consumption function in this study, except that government consumption is treated separately, since it is not considered a function of population.

1) Government consumption—Most economic-demographic studies take government consumption into account in one way or another. In this study, government consumption expenditure is assumed to be a function of GNP and previous year's expenditure.

2) Private consumption—The private consumption function is computed from SUSENAS IV (Fourth National Sample Survey 1969) data, covering all Indonesia except for several provinces in the outer islands. Regencies (*kabupaten*) are used as sample units. Not all *kabupaten* could be taken into account, due to exclusion of several provinces and to some nonresponses. However, the available *kabupaten* are large enough to justify reasonable estimates. In rural areas, data are available for 166 *kabupaten*; in urban areas for 80.

Average income is higher in urban areas than in rural by 25.9 percent, giving rise to higher food and nonfood consumption in urban areas. More striking is the difference in consumption patterns in the two sectors. Average per capita food consumption in 1969 (in 1960 prices) was 2,863 rupiahs in rural areas, 3,452 rupiahs in urban areas. For nonfood items, average rural consumption was 798 rupiahs, compared to 1,317 rupiahs in urban areas.\*

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\* Price differences in urban and rural sectors are considered nonexistent due to differences in quality and kind of most consumption goods and services.

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Thus, rural dwellers spent about 78 percent of total expenditures on food; urban residents spent 72 percent of their higher incomes on food items. Since consumption patterns apparently differ between rural and urban areas, consumption functions are estimated separately for food and nonfood items and according to rural and urban sectors. These estimated functions, listed in Appendix A, were used in the projections which follow.

## FINDINGS

### Notes on the Findings

Only summaries of the quantitative results of the projections made from the model will be included in this publication (Tables 2 and 3). Equations used in the model are presented in Appendix B, with brief explanations of the methods used, where necessary. Conclusions drawn from analysis of the projections follow.

Table 2  
Relative Magnitudes of the Key Economic Variables Under Four  
Alternative Population Projections With GNP Given, Indonesia, 2021.

Variable	High	Medium	Low	Very Low
Y	100	100	100	100
Y/P	100	167.30	237.83	311.91
PC/P	100	167.02	237.22	310.97
PC	100	99.83	99.75	99.70
GC	100	100	100	100
TC	100	99.85	99.77	99.73
II	100	99.82	99.73	99.67
IA	100	161.07	227.32	277.04
IW	100	63.09	45.10	35.10
ID	0	12.5	8.8	8.3
TGI	100	120.67	151.82	176.71
I	100	105.33	113.67	120.36
S	100	100.73	101.10	101.30
FSI	100	110.32	127.20	141.04

Note: Y=Gross National Product, P=Population, PC=Private Consumption, GC=Government Consumption, TC=Total Consumption, II=Induced Investment, IA=Autonomous Investment, IW=Welfare Investment, ID=Demographic Investment, TGI=Total Government Investment, I=Total Investment, S=Domestic Savings, and FSI=Foreign Sector Investment. All the figures are in percentages, except ID, given in billions of rupiahs at 1960 prices.

(Index: High Projection Values = 100)

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**Table 3**  
**Relative Magnitudes of the Key Economic Variables Under Four**  
**Alternative Population Projections with Per Capita Income Given,**  
**Indonesia, 2021**

Variable	High	Medium	Low	Very Low
Y	100	59.77	42.05	32.06
Y/P	100	100	100	100
PC/P	100	99.54	99.22	98.95
PC	100	59.50	41.72	31.72
GC	100	60.26	42.49	32.49
TC	100	59.58	41.80	31.80
II	100	62.65	44.42	34.33
IA	100	0	0	0
IW	100	40.15	20.58	12.52
ID	0	12.5	8.8	8.3
TGI	100	17.01	8.78	5.40
I	100	47.71	31.44	22.17
S	100	60.71	43.25	33.31
FSI	100	33.60	18.63	10.09

*Note:* Y=Gross National Product, P=Population, PC=Private Consumption, GC=Government Consumption, TC=Total Consumption, II=Induced Investment, IA=Autonomous Investment, IW=Welfare Investment, ID=Demographic Investment, TGI=Total Government Investment, I=Total Investment, S=Domestic Savings and FSI=Foreign Sector Investment. All the figures are in percentages, except ID, given in billions of rupiahs at 1960 prices.

(Index: High Projection Values = 100)

### Demographic Projections

*Total population.* The projections show, if current high fertility is maintained, the population of Indonesia will increase from 119 million in 1971 to about 474 million in 2021, an increase of approximately 300 percent in 50 years (High projection). A yearly fertility reduction of 1 percent (Medium projection) will generate a total population of 284 million by the end of the period. A more rapid decline (Low projection) will produce a population of about 200 million by 2021. Even the assumption underlying the Very Low projection will result in a population of 152 million before stabilization occurs about 2011.

*Age structure.* Different fertility trends give rise to differences in age composition of the population. Since the projections are computed for only a

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50-year period, the number of old people is not affected by reduced fertility and is the same for all projections. Differential effects are found, however, in the groups ages 0-14 and 15-64.

During the first 15 years following the onset of fertility decline, only the number of children is affected. By 1986, the number of persons ages 0-14 is 70,844 under the High projections, compared to 61,105 (Medium), 49,417 (Low), and 41,524 (Very Low). By 2021, with unchanged fertility, the number of persons ages 0-14 is 209,088, but under the Very Low projection it is only 25,836, or 12 percent of the High projection. For the Medium and Low projections, the percentages are 39 and 22 percent, respectively.

After 1991, the impact of fertility reduction begins to be felt in the working-age group. By 2021, under the Very Low projection, the population ages 15-64 is about 44 percent of the size of this group under the High projection; in fact, the number of working-age persons decreases between 2011 and 2021 under conditions of very low fertility. Under the Medium and Low projections, working-age population continues to grow in size, but it is only 75 percent of the High level under the Medium projection, and only 55 percent under the Low projection.

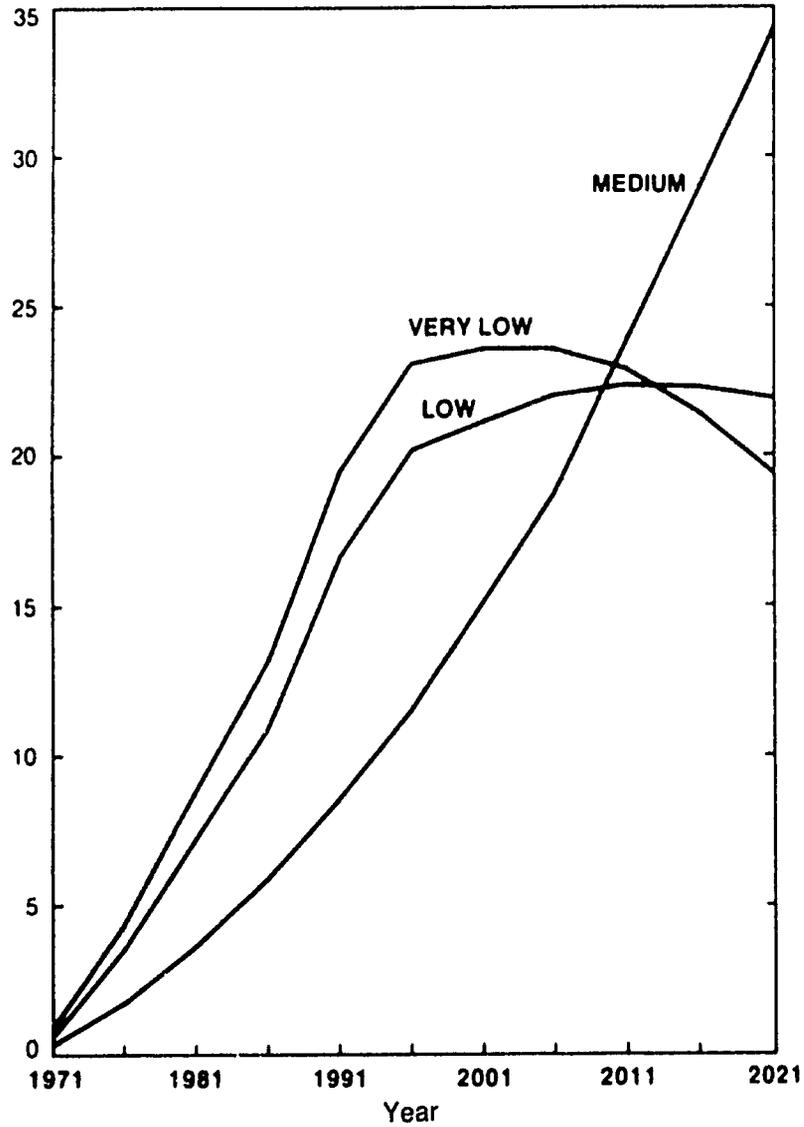
*Dependency ratio.* During the 50-year period, under reduced fertility, the number of children declines faster than the number of working-age persons, while the older population remains unchanged. The result is a consistent decline in the dependency ratio (the ratio of the number of persons ages 0-14 and 65 and over to the number of persons ages 15-64) in the lower projections. In 1971, this ratio was 85. In 2011, the dependency ratio is 88 with unchanged fertility, compared to 58 (Medium projection), 45 (Low), and 27 (Very Low). After 2011, the ratio increases again in the Very Low projection because the size of the working-age population has stabilized and begun to decline. Dependency ratios in 2021 are 89 (High), 51 (Medium), 45 (Low), and 36 (Very Low).

*Rural-urban distribution.* The urbanization rate is assumed constant at 0.3 percent per annum, as observed in 1961-1971. By 2021, under all projections, about 33 percent of the population resides in urban areas.

*Number of family planning acceptors.* The number of family planning acceptors required to realize the projected fertility changes depends on the number of females of childbearing age, the initial fertility level, and the size of the desired fertility reduction (Figure 1). In the early years of the projections, the number of women of childbearing age and the fertility level are the same for all projections, and the number of acceptors required depends solely on the degree of fertility reduction. Thus, the higher the reduction in fertility desired, the larger the number of acceptors needed. This trend holds for about 35 years, but by 2011, fewer acceptors will be needed to maintain the Low and Very Low patterns than to maintain the Medium projection,

Figure 1  
Net Acceptors Required to Reach Three Population Projections,  
Indonesia, 1971-2021

Acceptors\*  
(millions)



\*Net acceptors = new acceptors minus dropouts

Note: Since no fertility reduction occurs under a high projection, this projection is not shown.

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and by 2016, the Very Low pattern requires fewer acceptors than the Low pattern. The reason for this is, due to the faster pace of fertility reduction, the number of women of childbearing years is smaller under the lower projections. Thus, the largest fertility reduction requires more acceptors initially, but in the long run, the smallest fertility reduction (Medium projection) requires the largest number of acceptors. In 2021, the number of acceptors under the Medium projection is 176 percent of that required for the Very Low projection; for the Low projection, it is 112 percent of the Very Low projection.

### Economic Projections

*Planned growth of GNP.* Assuming that the annual rate of growth of GNP increases from 7.5 to 12 percent during 1971-2021 (as planned by the Indonesian Government), GNP increases 106 times, from 603,900,000,000 rupiahs in 1971 to 64,349,800,000,000 rupiahs by 2021. Since income increases more rapidly in urban than in rural areas, by 2021 urban income will have risen approximately 347 times and rural income will have increased to only 22 times its 1971 level. Rural income is only 16 percent of GNP in 2021.

1) Per capita income—With GNP given, per capita income grows at rates determined by population growth. Using an index of 100 for the High projection, per capita income in 2021 is 167 under the Medium projection, 238 under the Low projection, and 312 under the Very Low projection.

Since urban income grows more rapidly than rural income and urban population growth is slower, per capita income increases faster in urban than in rural areas. In 1971, the ratio of urban to rural per capita income was 1.6; in 2021, the ratio is 10.6.

2) Consumption—The projections show that slower population growth does not result in a significant reduction in private consumption, which is assumed to be dependent on income. Under all four projections, aggregate consumption increases about 101 times by the year 2021. Per capita consumption, like per capita income, is much larger in the lower projections, with their smaller total populations, than under the High projection. With an index of 100 for the High projection, per capita consumption in 2021 is 167 under the Medium projection, 237 under the Low projection, and 311 under the Very Low projection.

During the first 30 years of the period, aggregate consumption grows more slowly than income. However, with increasing urbanization, large numbers of people move into the higher per capita consumption pattern of urban areas, and, as a consequence, during the last 20 years of the projection period, consumption increases faster than income. By 2021, in all four cases, urban consumption is 331 times the 1971 level; rural consumption is about 20

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times the 1971 level. Since government consumption does not depend on population, it too is the same for all four projections. Thus, during the period, total private and government consumption will have the same pattern in all projections. (Per capita consumption, as mentioned, does differ under different projections.)

3) Savings—Savings is defined as income minus consumption. The savings rate therefore increases when income grows faster than consumption and decreases when consumption grows faster than income. Overall, the savings rate will increase from 13.2 percent in 1971 to over 17 percent in 2021, with the rates nearly the same for all projections. It reaches its high point—17.7 to 18.3, under various projections—in the year 2001 and then declines slightly. Since during the last 20 years of the projection, the growth of consumption exceeds that of income.

4) Induced investment—Induced investment is treated as a function of total consumption, which is not significantly affected by the fertility reductions. It is thus approximately the same for all four projections. However, the need for investment is greater with reduced fertility. This is because output is a function of capital and labor, and the smaller labor forces that result from fertility reduction require a larger capital stock to produce a given level of GNP. Since the level of induced investment is not significantly higher under the lower projections, government must fill the gap with its autonomous investment. The lowest population projection requires the largest investment by government. With the index for the High projection set at 100, autonomous investment in 2021 is 161 for the Medium projection, 227 for the Low projection, and 277 for the Very Low projection.

Government also participates in the economy through welfare and demographic investments. Since welfare investment is a function of population, it is lower for the lower projections. Demographic investment has a more complicated pattern, discussed in the first part of this section, but it is relatively small. Overall, the large amounts of autonomous investment required for smaller populations are not offset by the lessening in amount of welfare investment, and government's role in the economy is greater for the larger fertility reductions.

5) Foreign sector investment—As noted above, larger amounts of capital are needed to fulfill a given GNP target under the lower projections, in which the labor force is smaller. Because the level of domestic savings does not increase sufficiently under the lower projections, a greater input of foreign funds will be needed. Under the High projection, foreign investment in 2021 is 48 percent of total investment, compared to 50.2 percent (Medium), 53.7 percent (Low), and 56.2 percent (Very Low). With a given GNP growth as the target, reduction in fertility will bring about sharp increases in per capita income and per capita consumption. However, to achieve the planned GNP,

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larger investments are needed than if fertility remained unchanged, because the size of the labor force is smaller for the lower projections. Since neither domestic savings nor induced (private sector) investment increases, substantially where population is smaller, greater amounts of autonomous (government) and foreign investment will be required to fill the gap between total economic investment and induced investment\* (Table 3).

*Planned per capita income growth.* In the preceding case, the Indonesian Government's actual economic plans were projected to obtain a target GNP. Under the High projection, per capita income reached 135,526 rupiahs in 2021, when the GNP goal was achieved. Now, this per capita income level, rather than GNP, is taken as the target implied by the planned growth rate, and the results that follow from this way of stating the goal are explored.

1) Income—Under successively greater fertility reductions, smaller aggregate incomes are required to maintain the targeted per capita income, since population is smaller. Aggregate income must increase only 34 times in the Very Low projection, whereas the required increases for the Low and Medium projections are 45 and 64 times. Under the High projection (constant fertility), income must increase 107 times between 1971 and 2021 to fulfill the per capita income goal.

Rural income is assumed to grow at proportionately slower rates than aggregate income, and the percentage contribution of rural income to GNP is larger when GNP is relatively low. Under the High projection, rural income is 11 percent of GNP, compared to 19 percent (Medium), 22 percent (Low), and 24 percent (Very Low).

2) Consumption and savings—With the final value of per capita income fixed, in the lower projections, per capita urban income is lower than under the High projections and so is per capita urban consumption. (Per capita urban income and consumption are several times higher than per capita rural income and consumption, in all four cases, but the difference decreases in the lower projections.) Aggregate rural, urban, and total consumption all decline with declining fertility. The decline in per capita urban consumption outweighs the increase in per capita rural consumption under the lower projections, so that overall per capita consumption declines slightly with fertility reduction and savings increase accordingly. In 2021, per capita consumption under the Very Low projection is about 1 percent less than under the High projection, and aggregate total consumption is, consequently, substantially lower for lower projections.

Since government consumption is a function of income, it is markedly reduced by the lower levels of aggregate income corresponding to the reduced-fertility patterns.

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\*Recall, however, that this result depends critically on the assumption that induced investment is a function of total rather than per capita consumption.

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Total (government plus private) consumption declines faster than income in the lower projections, and higher savings rates result. In 2021, the savings rate is 17.3 for the High projection, compared to 17.6 (Medium), 17.8 (Low), and 18.0 (Very Low).

3) Investment—Less total investment is required to obtain the lower levels of aggregate income needed under the lower projections. Setting the index for induced investment at 100 for the High projection, the index is 63 for the Medium projection, 44 for Low, and 34 for Very Low. The role of government as investor can be correspondingly reduced. During the last five-year period under the Medium projection, average autonomous income is negative. In other words, projected private investment exceeds the level needed to achieve the targeted per capita income, and per capita income may grow faster than planned even without economic investment by the government. Autonomous investment is no longer required after 1995 in the Low projection, or after 1990 in the Very Low projection.

When autonomous investment is negative, government investment consists of demographic and welfare investment. This means, for example, that after 2015 in the Medium projection, government investment is only 5 percent of that required under the High projection.

4) Foreign sector investment—The demand for foreign funds is lower for the lower projections, because of the increased domestic savings rate. By the year 2021, the foreign sector accounts for only 21.8 percent of total investment under the Very Low projection, compared to 48.0 (High), 33.8 (Medium), and 28.4 (Low).

*Summary.* Where a given per capita income is the target, fertility reduction facilitates achievement of the goal, since a smaller GNP is required to attain a certain per capita income where the population is smaller. Total consumption under the lower projections is depressed by the lower (in relation to the High projection) urban per capita income. The savings rate is therefore higher. Less investment is needed to achieve lower aggregate income, and the economy consequently generates less demand for foreign funds. The government's role as investor is also reduced and by the end of the period consists only of welfare and demographic investments under all three reduced-fertility patterns (Figure 1).

### CONCLUSIONS

The findings suggest that if government's aim is to achieve a certain GNP growth rate, fertility reduction does not ease the task. The decline in the labor force (relative to the situation in which fertility remains high) necessitates greater investment in capital stock if the required output is to be produced. Much of this investment will have to be provided by government and foreign sources.

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Indonesia's fertility reduction goal is the equivalent of the Low projection in this study. If the government's economic goal is to increase the growth rate to achieve a target GNP, it must be prepared, given its fertility reduction goals, to increase annual autonomous investment to 127 percent of the level required under constant fertility. Government economic investment will comprise 30 percent of total investment in 2021, and total government investment, including demographic and welfare investments, will account for about 34 percent of all investment. Domestic savings will have to be supplemented with foreign funds. In 2021, about 56 percent of total investment will come from the foreign sector, compared to about 48 percent under constant fertility. However, there are compensations. The resulting per capita income will be 240 percent higher than under the constant fertility regime.

Turning to the alternative statement of the economic target—a specified per capita income—fertility reduction substantially aids achievement of this goal, since it is not necessary to maintain a given GNP with a smaller labor force. Rather, with smaller populations, lower levels of GNP are needed to satisfy the requirements. In the case of Indonesia, fertility reduction might be accompanied, in the latter part of the period, by an even faster than planned increase in per capita income because of the high level of induced investment. The government would not have to invest in the economy after 1996, private investment being sufficient to cover the domestic savings requirement, and foreign investment would account for only 28.4 percent of total investment in the Low projection as opposed to 48 percent in the High projection. In addition, a fertility reduction will promote greater income equality by reducing rural-urban differentials. Where aggregate income is lower (as under the reduced-fertility assumptions), the share of the relatively slow-growing rural sector in that income is larger than when income is higher. With a given per capita income, urban per capita income is consequently lower than in the High projection, in turn lowering urban per capita consumption. This results in a significant reduction in aggregate consumption and a corresponding gain in savings. Since the need for investment is smaller for a smaller population, the increased savings rate enables the private sector to cover most of the country's investment needs.

## APPENDIX A

### Computation of Demographic Data

Data used in making the population projections were: Base year (1971) population, by sex and age; age-specific survival rates, by sex; age-specific fertility rates; sex ratio at birth; and survival ratio at birth, by sex.

Data from the 1971 Population Census (Central Bureau of Statistics 1972)

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were used for the base population, after correction of errors.

Theoretically, with high fertility and a moderate level of mortality, the age pyramid for the Indonesian population should be broad at the base, with a gradual reduction in the size of the older age groups. This expectation is borne out, except that the population ages 0-4 is the same size as the next older group, ages 5-9, and there is a "hollow" at ages 20-24. The smaller than expected number of persons ages 0-4 is probably due to underenumeration of babies, a common phenomenon in population censuses and surveys. As for the "hollow" at ages 20-24, Nitsastro (1970) argued that the cohort ages 20-24 was born during the turbulent years of the 1940s, when fertility was low and mortality, especially child mortality, was high. This period was followed by a decade of relatively favorable economic conditions, stimulated by the Korean War boom in agricultural export prices, so that succeeding cohorts were much larger than the group ages 20-24.

*Corrections for errors.* Census data are adjusted in four consecutive steps:

- 1) Persons of unknown age (15,059 persons, or about 0.12 percent of the total) were prorated among the age groups in such a way that the percentage age-sex distribution remained unchanged

- 2) The population ages 70 and over was adjusted by applying a West model of stable population (Coale and Demeny 1966) to the rural and urban populations. Death rates used were 13 per 1000 for the urban population, 11 per 1000 for the rural population. A rate of natural increase of 2.5 percent was assumed.

- 3) The population ages 10-69 was adjusted by means of the "moving average" method. Size of any 5-year age group (ages  $x$  to  $x+5$ ) was determined by taking the average of three age groups, ages  $x-5$  to 5,  $x$  to  $x+5$ , and  $x+5$  to  $x+10$ . An implicit assumption was that age was misreported by no more than 15 years.

- 4) The population ages 0-9 was adjusted. Children ages 0-4 in 1971 were born during the period 1967-1971, and children ages 5-9 were born during 1962-1966. Since it is believed that fertility and mortality did not change significantly during this period, the number of children ages 0-4 is expected to be larger than the number ages 5-9. However, census data show approximately the same number in each group. This is attributed to underenumeration of children ages 0-4 and to exaggeration of the size of the group ages 5-9. To adjust for these errors, the 1971 population was back-projected (again using West life tables) to obtain the number of women in the childbearing years at the midpoints of the periods 1962-1966 and 1967-1971. The number of births in the two periods was estimated by multiplying the mid-interval number of women of childbearing age by age-specific fertility rates, as estimated by McNicoll and Mamas (1973). Survivors of births occurring during 1962-1966 and 1967-1971 constitute the cohorts ages 5-9 and 0-4 in 1971.

## DEMOGRAPHIC TRANSITION

### Level of Mortality

The expectation that the 1971 census would provide accurate mortality estimates for the 1960s was not well founded. McNicoll and Mamas (1973) estimated the mortality level from 1971 census data by fitting a Coale-Demeny life table to intercensal cohort survival rates by sex. The results are reasonable for Java, but erratic for other regions, making the all-Indonesia estimates unacceptable. The same authors also estimated mortality from an independent source—census retrospective data on children ever born and children still living, classified by age of mother. This method produced life expectancies at birth of 51 years for urban dwellers, 46 for the rural population, and 47 for the general population.

The Demographic Institute, in a recent population projection (1972) assumed that life expectancy in 1971 was 42.1 for males, 45.0 for females. Using 1961 census data and the 1964 life table of the Central Bureau of Statistics, McNicoll and Mamas (1973) estimated life expectancy at 44 for males, 47 for females. The Central Bureau of Statistics (1973), on the basis of National Sample Survey data, put life expectancy, for Java-Madura only, at 43.42 for males, 46.30 for females in 1964, and 44.79 for males and 47.68 for females in 1967. Most estimates agree that in 1971 life expectancy centered around 44 years for males, 47 for females. In this model, these figures are adjusted to the Coale-Demeny West life table of level 11, corresponding to life expectancies of 42.1 for males, 45.0 for females.

### Level of Fertility

As noted in the text, estimates by McNicoll and Mamas (1973) are accepted as base year age-specific fertility rates (Table 1).

## APPENDIX B

### The Model

Forty equations are employed, of which 22 are identities. Since the number of equations equals the number of endogenous variables to be solved (40), the solution is unique. The model is solved with 25 exogenous variables, most of them demographic variables derived from the population projections. There are 18 parameters.

### The Equations

Capital letters represent aggregate variables; lower case letters denote average variables and parameters. The subscript  $t$  indicates the value of a

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stock variable at the end of year  $t$ , or of a flow variable during the period  $t$ . Values for the year previous to  $t$  are given the subscript  $t-1$ .

*The Production Function*

$$Y_t = k(1+q)^T K_t^u L_t^v$$

**Variables:\***

- Y = Gross National Product
- T = Time difference from 1960
- K = Capital stock
- L = Total labor employed

**Parameters:**

- k = conversion constant relating capital-labor to output
- q = annual rate of technological progress
- u = capital elasticity of production
- v = labor elasticity of production.

*Capital Formation*

$$K_t = K_{t-1} + IE_t$$

IE = Net economic investment

*Net Economic Investment*

$$IE_t = II_t + IA_t$$

II = Induced investment by the private sector

IA = Autonomous investment by government

*Total Investment*

$$I_t = II_t + IA_t + IW_t + ID_t + DP_t$$

I = Total investment

IW = Welfare investment

ID = Demographic investment

DP = Depreciation allowance

*Net Borrowing from Abroad*

$$FSI_t = I_t - S_t$$

FSI = Foreign sector investment

S = Domestic savings

*Domestic Savings*

$$S_t = Y_t - PC_t - GC_t$$

PC = Private consumption expenditure

GC = Government consumption expenditure

*Private Consumption Expenditure*

$$PC_t = CR_t + CU_t$$

CR = Rural consumption expenditure

CU = Urban consumption expenditure

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\*Variables will be identified only when they are used for the first time or when they are used in widely separated equations.

**DEMOGRAPHIC TRANSITION**

*Rural Consumption Expenditure*

$$CR_t = (PR_t)(cr_t)$$

PR = Rural population  
cr = rural consumption expenditure per capita

*Urban Consumption Expenditure*

$$CU_t = (PU_t)(cu_t)$$

PU = Urban population  
cu = urban consumption expenditure per capita

*Rural Food Consumption Expenditure*

$$CFR_t = (PR_t)(cfr_t)$$

CFR = Rural food consumption expenditure  
cfr = rural food consumption expenditure per capita

*Rural Nonfood Consumption Expenditure*

$$\bar{C}FR_t = CR_t - CFR_t$$

$\bar{C}FR$  = Rural nonfood consumption expenditure

*Urban Food Consumption Expenditure*

$$CFU_t = (PU_t)(cfu_t)$$

CFU = Urban food consumption expenditure  
cfu = urban food consumption expenditure per capita

*Urban Nonfood Consumption Expenditure*

$$\bar{C}FU_t = CU_t - CFU_t$$

$\bar{C}FU$  = Urban nonfood consumption expenditure

*Rural Per Capita Private Consumption Function*

$$cr_t = a_r yr_t + b_r ar_t$$

yr = rural income per capita  
ar = proportion of equivalent adult consumers to total rural population

**Parameters:**

$a_r$  = average propensity to consume out of income (before allowing for effect of equivalent adult consumer) in rural areas

$b_r$  = coefficient denoting effect of age structure on consumption in rural areas

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*Urban Per Capita Private  
Consumption Function*

$$cu_t = a_u yu_t + b_u au_t$$

$yu$  = urban income per capita  
 $au$  = proportion of equivalent adult consumers to total urban population

Parameters:

$a_u$  = average propensity to consume out of income (before allowing for effect of equivalent adult consumer) in urban areas

$b_u$  = coefficient denoting effect of age structure on consumption in urban areas

*Rural Per Capita Private Food  
Consumption Function*

$$cfr_t = a_{fr} yr_t + b_{fr} ar_t$$

$cfr$  = rural food consumption expenditure per capita

Parameters:

$a_{fr}$  = average propensity to consume food out of income (before allowing for effect of equivalent adult consumer) in rural areas

$b_{fr}$  = coefficient denoting effect of age structure on consumption of food in rural areas

*Urban Per Capita Private Food  
Consumption Function*

$$cfu_t = a_{fu} yu_t + b_{fu} au_t$$

$cfu$  = urban food consumption expenditure per capita

Parameters:

$a_{fu}$  = average propensity to consume food out of income (before allowing for effect of equivalent adult consumer) in urban areas

$b_{fu}$  = coefficient denoting effect of age structure on consumption of food in urban areas

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### Government Consumption Function

$$GC_t = cY_t + d(GC_{t-1})$$

GC = Government consumption

#### Parameters:

- c = average propensity of government to consume before allowing for effect of previous year's government consumption
- d = coefficient denoting effect of previous year's government consumption

### Welfare Investment Function

$$IW_t = IW_{t-1}(GC_t/GC_{t-1}) + (IW_t/P_t)(\Delta P_t)$$

IW = Welfare investment

P = Total population

$\Delta P$  = Population increase

### Demographic Investment Function

$$ID_t = ACP_t(cacp)$$

ID = Demographic investment

ACP = Number of acceptors

#### Parameters:

- cacp = cost per acceptor of family planning programs

### Induced Investment Function

$$II_t = a + b(TC_t)$$

II = Induced investment

TC = Total private and government consumption

#### Parameters:

- a = intercept
- b = coefficient denoting effect of total private and government consumption on induced investment

### Total Consumption Expenditure

$$TC_t = PC_t + GC_t$$

### Depreciation Function

$$DP_t = (dp)K_t$$

DP = Depreciation allowance

K = Capital stock

#### Parameters:

- dp = proportion of depreciation from income

### Total Labor Employed

$$L_t = LR_t + LU_t$$

LR = Rural labor employed

LU = Urban labor employed

*Economic-Demographic Simulation for Indonesia*

*Rural Labor Employed*  
 $LR_t = FLR_t + MLR_t$

FLR = Rural female labor employed  
 MLR = Rural male labor employed

*Urban Labor Employed*  
 $LU_t = FLU_t + MLU_t$

FLU = Urban female labor employed  
 MLU = Urban male labor employed

*Rural Female Labor Function*  
 $FLR_t = FR_{15-64}(\eta_{pr}) (fer_t)$

$FR_{15-64}$  = Rural female population ages 15-64  
 $\eta_{pr}$  = rural female labor force participation rate  
 $fer$  = rural female labor employment rate

*Urban Female Labor Function*  
 $FLU_t = FU_{15-64}(\eta_{pu}) (feu_t)$

$FU_{15-64}$  = Urban female population ages 15-64  
 $\eta_{pu}$  = urban female labor force participation rate  
 $feu$  = urban female labor employment rate

*Rural Male Labor Function*  
 $MLR_t = MR_{15-64}(\eta_{mpr}) (mer_t)$

$MR_{15-64}$  = Rural male population ages 15-64  
 $\eta_{mpr}$  = rural male labor force participation rate  
 $mer$  = rural male labor employment rate

*Urban Male Labor Function*  
 $MLU_t = MU_{15-64}(\eta_{mpu}) (meu_t)$

$MU_{15-64}$  = Urban male population ages 15-64  
 $\eta_{mpu}$  = urban male labor force participation rate  
 $meu$  = urban male labor employment rate

*Rural Equivalent Adult Consumer Function*  
 $AR_t = 0.6 [PR_{0-14} + PR_{15-64} + PR_{65-} ]$

AR = Rural equivalent adult consumers  
 $PR_{0-14}$  = Rural population ages 0-14  
 $PR_{15-64}$  = Rural population ages 15-64  
 $PR_{65-}$  = Rural population ages 65 and over

*Urban Equivalent Adult Consumer Function*  
 $AU_t = 0.6 [PU_{0-14} + PU_{15-64} + PU_{65-} ]$

AU = Urban equivalent adult consumer  
 $PU_{0-14}$  = Urban population ages 0-14  
 $PU_{15-64}$  = Urban population ages 15-64  
 $PU_{65-}$  = Urban population ages 65 and over

*Rural Proportion of Equivalent Adult Consumer to Population*  
 $ar_t = AR_t/PR_t$

*Urban Proportion of Equivalent Adult Consumer to Population*  
 $au_t = AU_t/PU_t$

*Rate of Income Growth*  
 $ry_t = (Y_t - Y_{t-1})/Y_{t-1}$

$ry$  = rate of income growth

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<i>Rural Income</i>	$YR_t = YR_{t-1} (1 + [5/7.5]ry_t)$	$YR_t =$ rural income
<i>Urban Income</i>	$YU_t = Y_t - YR_t$	$YU =$ urban income
<i>Per Capita Income</i>	$y_t = Y_t/P_t$	$y =$ per capita income
<i>Rural Per Capita Income</i>	$yr_t = YR_t/PR_t$	$yr_t =$ rural per capita income
<i>Urban Per Capita Income</i>	$yu_t = YU_t/PU_t$	$yu =$ urban per capita income

APPENDIX C

Estimation of Economic Relationships

The parameters are estimated from various data, as follows:

Parameter	Source
k q u v a b c d dp	Time series of national account data
$a_r, b_r, a_u, b_u, a_{fr}, b_{fr}$ $a_{ru}, b_{ru}$	1969 National Sample Survey data
cacp	National Family Planning Coordinating Board data

*Production function.* Estimation of the production function requires data on capital stock and labor. In the absence of these data, series of capital and labor employed must be constructed. These are used to estimate the aggregate production function for Indonesia, in conjunction with alternative assumptions concerning the rate of technological change.

1) Capital—The estimated capital output ratio was 2.75 in 1972 (Sigit 1975). This implies the full capacity used of capital was  $2.75 \times GNP_{1972}$  or 1,775,100,000,000 rupiahs. Since capital is assumed to be fully employed in 1972, capacity capital is equivalent to capital stock for that year. Capital stock for year t-1 is then obtained by subtracting investment in year t from capital stock in year t, and in this manner a series for the years 1960-1971 is constructed.

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Since capital was underemployed prior to 1972, it must be adjusted to account for the estimated underutilization in those years (an average 20 percent, according to Panglaykim and Arndt 1966). Several methods of adjusting capacity are available. In this study, the principle of the Wharton Index of Capacity Adjustment (Klein and Summers 1967) is selected for calculating the rate of utilization. This rate is equal to the ratio of actual to capacity output—capacity output being the output produced when industry is operating its existing stock of capital at its customary level of intensity. The "trend through peaks" method is used for estimating capacity output in Indonesia, taking peaks in GNP in 1961 and 1972. Since the 1961 output was not a capacity output, adjustment is required to account for underemployment. This is done by assuming a capital-output ratio of 3.22 in 1961. Two trends of capacity output, linear and exponential, connecting the two capacity outputs in 1961 and 1972, were computed. Rates of utilization were obtained by dividing actual by capacity outputs, and capacity capital was calculated by multiplying rate of utilization by capital stock.

2) Labor—The 1971 census gives the proportion of employed persons as 30.19 percent of the total population; in 1961, the figure was about 32 percent (Central Bureau of Statistics 1972, 1963). Surveys conducted in 1964/1965 for all Indonesia and in 1967 and 1969 for Java-Madura also show an employment rate of about 30 percent (Central Bureau of Statistics 1967, 1969). It is therefore assumed that during 1960-1972 the proportion of persons employed was constant at 30.19 percent. Labor employed is calculated by multiplying this rate by total population.

3) Productivity of capital and labor—Estimating the contributions of capital and labor to output is difficult. The generally accepted view is that capital elasticity is normally higher in developing than in developed countries. For the United States, Walsh (1970) suggested the value of 0.25, implying an increase of output by 0.25 if capital is increased by 1 percent. A regression developed by Ruprecht (1967) for the Philippines gives elasticities of 0.65 for land, 0.30 for capital, and 0.16 for labor. If land is subsumed under capital, the land-capital elasticity is 0.95. The Demographic Institute (1972) of the University of Indonesia assumed an elasticity of 0.35 for capital and an elasticity of 0.65 for labor. Recognizing the variability in the capital coefficient, Walsh (1970) used three alternative values for Jamaica, 0.3, 0.5, and 0.7. These were matched with several labor coefficients to obtain diminishing, constant, and increasing returns to scale.

4) Technological progress—A third factor contributing to output is technological progress. In developed countries, the contribution of technological progress to output is about 2.5 percent a year. For developing countries, Enke and Zind (1969) suggest a productivity increase of 1.5 percent due to this factor. Walsh (1970) accepts the same value for the economy

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of Jamaica, and the Demographic Institute (1972) adopts it for Indonesia. In these studies, technological change is assumed neutral, so that capital and labor coefficients are constant.

5) Estimation of the production function—The production function is estimated by using regressions with alternative values for technological progress as extraneous information. The data are then used to explore the alternative combination sets of coefficients of capital and labor.

The production function,  $Y_t = k(1+q)^T K_t^u L_t^v$ , is modified to read:

$$YG = Y/(1+q)^T + kK^u L^v$$

Taking the logarithm, the following linear regression function is generated:

$$\log(YG) = \log(k) + u \log(K) + v \log(L)$$

The results of the acceptable regressions show that the linear and exponential capacity adjustments produce almost the same outcomes.

Values for rate of technological progress used in the regression are 0.010, 0.0125, 0.0150, 0.0175, 0.020, 0.0225, and 0.0250. For values above 0.0175, the regressions were rejected, since some of the coefficients were not significant and labor coefficients were negative. Regressions for the value 0.010 were also rejected, since the sum of capital and labor coefficients was far above unity, indicating that the specified low rate of technological progress resulted in an overestimation of the return to scale. (Other studies of Indonesia have generally assumed a constant return to scale.) Rates of technological progress of 0.0150 and 0.0175 resulted in production functions in which the sum of the coefficients was close to unity. Of these the linear capacity adjustment using 0.0175 as the technological progress rate was chosen because the rate of return was exactly one, and the labor and capital coefficients were reasonable. Reconversion of the production function to its original form yielded the estimated equation:

$$Y_t = 0.14585(1+0.0175)^t K_t^{0.79} L_t^{0.21}$$

*The private consumption function.* As noted in the text, the private consumption function is computed from data collected in the Fourth National Sample Survey of Indonesia, 1969. The data, which indicate rural-urban differences in consumption expenditures, income household size, and age structure, provide strong support for the hypothesis that consumption patterns are different for rural and urban areas. Consumption functions are therefore estimated separately for food and nonfood, rural and urban sectors. Income-expenditure data from the survey were adjusted to the 1971 (base year) national account figures.

It was hypothesized that the regressions of the four private consumption functions would be zero, signifying that the effect of population on consump-

tion is negligible and consumption is a fixed proportion of income. In other words, marginal propensity to consume equals average propensity to consume, which is assumed constant throughout the projection period. Consumption in the United States shows this characteristic; in time series data, 1932-1970, the stable relationship of consumption is evident (Heller 1972).

Computations showed that the intercepts, except for rural food consumption, are not significantly different from zero, confirming the hypothesis that the relationship between income and consumption expenditure is stable provided there is no effect of population and its age structure. All intercepts were thus assumed to be zero, and estimated consumption functions were obtained:

$$\begin{aligned} cr_t &= 0.7218(yr_t) + 777.86(ar_t) \\ cu_t &= 0.8426(yu_t) + 347.74(au_t) \\ cfr_t &= 0.5645(yr_t) + 605.72(ar_t) \\ cfu_t &= 0.5986(yu_t) + 340.36(au_t) \end{aligned}$$

Urban food and nonfood consumption is less dependent on population and its structure than is rural consumption. Average propensity to consume is higher in urban areas; average propensity to consume food is almost the same in both rural and urban areas. The results support Engel's Law: A population with higher income (the urban population, in this case) consumes more nonfood items.

The  $R^2$  (coefficient of determination) was small for regressions on rural nonfood consumption per capita and urban nonfood consumption per capita, and therefore these variables were dropped. Nonfood consumption in both rural and urban areas is treated as residue after food consumption has been allocated. This is a reasonable procedure, since in Indonesia income is low, food consumption is dominant, and nonfood items are taken from whatever amount is left over.

Thus, only regressions representing average total consumption per capita in rural and in urban areas were employed formally in the model. However, the proportion and amount of nonfood consumption can be obtained by subtracting per capita food consumption from total consumption.

*The government consumption function.* Government consumption is assumed to be a function of GNP and previous year's expenditure. Naturally, government expenditure should depend on revenues, but since government revenues are also dependent on national income, GNP is taken as the independent variable.

The regression is estimated from a time series of national account data, available for 1960-1972. Since the figure for the turbulent year 1965 was

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extremely low (6.80 percent of GNP, compared to the average of 8.66 percent), it was omitted. The intercept did not differ significantly from zero and was dropped. A second regression was then estimated without intercept and was employed in the model as the government consumption expenditure function:

$$GC_t = 0.0586(Y_t) + 0.3223(GC_{t-1})$$

*The welfare investment function.* Welfare investment is assumed to increase at the same rate as government consumption expenditure, with the addition of an allowance for population increase:

$$IW_t = IW_{t-1}(0.3223 + 0.0586Y_t) + (IW_t/P_t)(\Delta P_t)$$

*The demographic investment function.* This form of investment is discussed in detail in the text. It is calculated by multiplying the number of acceptors needed to bring down the fertility rate by the cost per acceptor, which is fixed at 400.76 rupiahs.

$$ID_t = 400.76(ACP_t)$$

*Autonomous and induced investment.* Data on autonomous investment is available for the period 1960-1972/73.\* Autonomous investment is considered a policy variable, since government investment is used to supplement induced investment by the private sector to achieve planned income growth. A series of data on private investment can therefore be obtained by subtracting autonomous investment from total economic investment.

Induced investment may also be regarded as a function of total consumption expenditure, which consists of government and private consumption. Data on government and private consumption are available for 1960-1972, permitting construction of total consumption figures for that period. A linear regression of induced investment on total consumption yields the result:

$$II_t = -100.3608 + 0.3043(TC_t)$$

Both intercept and coefficient are highly significant. The regression has F value of 180.58 and  $R^2$  of 0.9601. The negative intercept obtained can be interpreted to indicate that total consumption must be large enough to induce investment from the private sector.

*Depreciation allowance.* As discussed in the text, a value of 4 percent of capital stock has been assigned to depreciation allowance:

$$DP_t = 0.04(K_t)$$

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\*Since 1969, when the First Five-Year Development Plan was launched, the Indonesian Government has been using April-March as the budget year. The adjustment to obtain calendar year figures is made by assuming that investment during the period March-December equals 3/4 of total investment in the budget year.

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*Labor force functions.* These are projections of the probable amounts of labor available for employment.

$$FLR_t = (fer_t) (flpr_t)FR_{(15-64)t}$$

$$FLU_t = (feu_t) (flpu_t)FU_{(15-64)t}$$

$$MLR_t = (mer_t) (mlpr_t)MR_{(15-64)t}$$

$$MLU_t = (meu_t) (mlpu_t)MU_{(15-64)t}$$

Concepts and data relating to the labor force functions are discussed in the text.

*Equivalent adult consumer.*

$$AR_t = 0.6 [PR_{(0-14)t} + PR_{(65-74)t}] + PR_{(15-64)t}$$

$$AU_t = 0.6 [PU_{(0-14)t} + PU_{(65-74)t}] + PU_{(15-64)t}$$

Concepts and data relating to the equivalent adult consumer are discussed in the text.

*National and rural income.* The equations on national and rural income are planned and projected for the future. Rate of income growth ( $ry$ ) increases linearly from 7.5 percent in 1971 to 12 percent in 2021.

$$Y_t = Y_{t-1}(1+ry_t)$$

$$YR_t = YR_{t-1}(1+[5/7.5]ry_t)$$

### ACKNOWLEDGMENTS

It is a great pleasure to acknowledge my indebtedness to Professor Paul Demeny, former Director of the East-West Population Institute, and Professor Moheb Ghali, for their invaluable advice during preparation of this paper at the University of Hawaii. Sincere thanks are also extended to Professors Lee-Jay Cho, John H. Power, Youngil Lim, and Johannes Overbeek. I am especially grateful to Dr. Geoffrey McNicoll for his critical reading of several important sections, and to Professor Alan A. Powell of Monash University (Victoria, Australia) for his comments and supply of needed materials.

My stay in Hawaii has been made possible by a grant from the East-West Population Institute, which also provided funds for the data collection in Indonesia. Generous financial assistance has also been received from the Smithsonian Institution and the Population Council.

I can only acknowledge, but hardly repay, my indebtedness to the staff of the Central Bureau of Statistics in Jakarta, Indonesia, who have given generous consideration in allowing me to take a long leave, and particularly to M. Abdulmadjid, director, Nugroho; Azwar Rasjid; and Dr. Sam Suharto who contributed to my coming to Hawaii.

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Special thanks are also due to Dr. Nathaniel Iskandar and his staff for their assistance during my research in the Demographic Institute at the University of Indonesia. Any errors, omissions and ambiguities are, of course, my responsibility.

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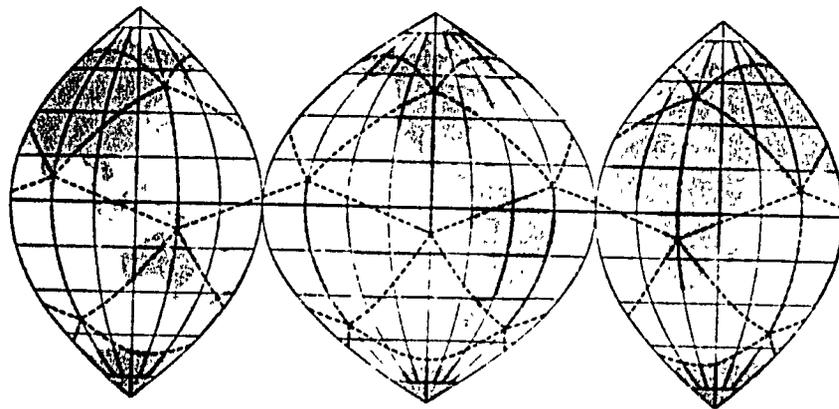
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International Program for Population Analysis  
INTERDISCIPLINARY COMMUNICATIONS PROGRAM  
Smithsonian Institution  
1717 Massachusetts Avenue, N.W.  
Washington, D.C. 20036  
U.S.A.

WAM-204-76

December 1, 1976

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