Brazil

An Analysis of Reproductive Behavior in Brazil

Nelson do Valle Silva
Maria Helena F. T. Henriques
Amaury de Souza

The Population Council

DHS

Demographic and Health Surveys
Institute for Resource Development/Macro Systems, Inc.

BRAZIL

An Analysis of Reproductive Behavior in Brazil

Nelson do Valle Silva
Maria Helena F. T. Henriques
Amaury de Souza

A study conducted under the auspices of the
Instituto de Estudos Econômicos, Sociais e Políticos de São Paulo

Demographic and Health Surveys Further Analysis Series

Number 6

April 1990

PREFACE

The Demographic and Health Surveys (DHS) Program was initiated in September 1984 and designed as a follow-on to the World Fertility Survey (WFS) and Contraceptive Prevalence Surveys (CPS). The objectives of the program include the expansion of the international population and health data base in Africa, Asia, and Latin America to assist in policy formulation and implementation and the development of skills and resources in survey design and analysis among those working in the program.

With funding provided by the U.S. Agency for International Development, DHS is implemented by the Institute for Resource Development/Macro Systems, Inc. and the Population Council, a major subcontractor. The Population Council, an international nonprofit organization established in 1952, undertakes social and health science programs and research relevant to developing countries and conducts biomedical research to develop and improve contraceptive technology. The Council provides advice and technical assistance to governments, international agencies, and nongovernmental organizations, and it disseminates information on population issues through publications, conferences, seminars, and workshops.

The Population Council was responsible for the establishment, funding, and provision of technical assistance to as many as 25 further analysis studies, in countries where DHS surveys were conducted during the years 1986 and 1987. The studies focus on one or more of the topics covered in the DHS survey, such as fertility, contraception, maternal and child health, breastfeeding, marriage, and fertility preferences; their interrelationships, for example, the effects of the proximate determinants of fertility and the determinants of contraceptive use or child survival; and their correlation with background variables. Although the principal source of data is the DHS survey, comparisons with previous WFS, CPS, or other surveys in order to examine trends over time are included in some of the studies.

Information on the DHS Program can be obtained by writing to: DHS Program, IRD/Macro, 8850 Stanford Boulevard, Suite 4000, Columbia, Maryland 21045, USA (Telephone: 301-290-2800; Telex: 87775; Fax: 301-290-2999). For copies of the studies published in the DHS Further Analysis series, which are listed on the last page, write to the DHS Program, The Population Council, One Dag Hammarskjold Plaza, New York, New York 10017, USA.

ABSTRACT

Brazil's population has undergone a major fertility decline in the past twenty years. Changing fertility patterns are analyzed in this report with data from a 1986 nationwide maternity-child health and contraceptive survey. Following Easterlin's "synthesis framework," fertility decline is viewed as a result of the modernization process, as the latter alters the mechanisms of fertility choices from natural forces to deliberate decisions on the part of individuals or families. Analyses of the proximate determinants of fertility in Brazil indicate that wife's education and religiosity constitute the principal factors through which modernization affects fertility. Traditional values, as measured by women's religiosity, increase both desired family size and the costs of fertility regulation. They exert, however, no measurable effect on the couples' potential family size. Wife's education, in turn, affects fertility in more complex ways, as it tends to decrease both potential and desired family sizes. It also has a negative impact on the costs of regulation, as it increases knowledge of contraception. Thus, an unanticipated consequence of rising women's education may be a reduction in the motivation for fertility control.

ACKNOWLEDGMENTS

The analysis presented here was made possible by Population Council Contract No. CP88.10W. It is based on the Westinghouse/BEMFAM maternity-child health and contraceptive survey carried out in Brazil in 1986 and was written under the auspices of the Instituto de Estudos Econômicos, Sociais e Políticos de São Paulo (IDESP). José Maria Arruda of BEMFAM provided support and encouragement. We are pleased to acknowledge the support of these institutions.

CONTENTS

I. INTRODUCTION

Until 1965, Brazilian demographic dynamics were more or less stable: Fertility was as high as 40 births per 1,000 population, general mortality was around 12 per 1,000 population, with infant mortality (109 deaths per 1,000 live births) constituting a large component of it. Growing at a rate of 2.8 percent per year, the population counted by the 1970 census was 92.7 million. In the following decade, these values were 2.5 percent and 125 million, respectively. During the last twenty years, therefore, remarkable changes have taken place in Brazilian fertility behavior, as noted in Table 1.

Fertility decline has accelerated in recent years. The total fertility rate dropped 24.5 percent between 1970 and 1980 and another 18.9 percent only in the first five years of the 1980s. Regional variations remained large, however, as fertility differentials between the Northeast and the Southeast increased on average from one child in 1960 to two children today.

During this period, declines were slightly greater for the urban population (33.3 percent) than the rural (31.1 percent). The range of regional fertility differences shows that fertility reduction in Brazil still has a long way to go, despite the fact that the population was already 68 percent urban in 1980.

The 1986 Brazilian DHS survey provides more recent estimates of fertility levels. Estimated total fertility rates are compatible with the observed trends obtained from previous data sources both at the national and regional levels. Estimates for age-specific fertility rates are shown in Table 2, with the proviso that there is some random fluctuation, due to the small number of cases in the older age categories. Concomitant with the change in fertility levels, a change in fertility patterns has also taken place. The first two age groups have increased their proportionate share of total fertility, and the mean age at childbearing has declined by almost two years, as shown in Table 3.

The purpose of this report is to test a simple model of fertility components to determine the contribution of a set of variables to fertility decline. Given its exploratory nature, relatively simple methods of estimation are employed in the analysis.

II. EXPLANATIONS OF FERTILITY DECLINE

Two theoretical explanations for the decline of fertility have been suggested in the literature. On the one hand, substantial increases in female schooling and labor force participation occurred throughout the 1970s. According to conventional modernization theory, such changes should be conducive to fertility decline. Merrick and Berquó have discussed the plausibility of this hypothesis with respect to the Brazilian case. In their words:

> Brazil's accelerated fertility decline coincided with a period during which lower and middle-income urban households were raising their consumption expectations through increased purchase of housing and other consumer durables, including televisions and automobiles with most purchases made on the installment plan. Because of unequal treatment of wages and credit obligations in Brazil's indexing system, it was more difficult for families to keep up with payments, and even to purchase basic necessities during periods of high inflation. A working hypothesis is that this pattern, combined with increased knowledge of and access to contraception, may have altered reproductive strategies and/or reduced family size desires. While income was an important covariate of contraceptive use, survey evidence suggests that low-income women are also controlling fertility, particularly in the higher income southern region and in states that have established community-based family planning programs. This explanation does not compete with more conventional explanations of fertility decline as part of the process of modernization, but is an extension of it, incorporating other structural changes (Merrick and Berquó, 1983, pp. 6-8; see also Merrick, 1985).

On the other hand, a structural explanation for the fertility decline has been proposed by Carvalho, Paiva, and Sawyer (1981). In their view, an individual's class position is the departure point in the causal flow of determination. Each social class displays a different pattern of causality leading to the same outcome, namely, fertility decline.

The authors suggest how Brazil's pattern of uneven distribution of returns to economic growth may induce fertility reduction within the middle and lower classes. The availability of new consumer durables and increased access to installment plans resulted in a sharp increase in consumption levels, to consumption diversification, and to larger personal indebtedness within the middle classes. A gap between aspirations and actual consumption ensued, pushing middle-class families toward fertility control.

This explanation, incidently, is the same as Merrick and Berquó's, only it is now applied solely to the middle classes. With regard to the poorer sectors of society, the process at work is thought to be proletarianization and its related disincentives to raise large families. Loss of purchasing power has led to the deterioration of living standards in urban areas--higher cost of food, transportation, housing, and the like--as well as to increased fertility control by the lower classes.

In contrast, we conceive of fertility behavior as a normatively bounded plan of behavior. Far from ignoring that fertility change is partly structurally induced, we argue that there is opportunity for autonomous modification of behavior, due to dissemination of new information and attitudes. In other words, there is room for innovation, and fertility control can be seen as an innovation congenial to most aspects of modern life.

Needless to say, fertility behavior is also an expression of the position an individual holds in society. Fertility decisions are outcomes of satisfaction-maximizing behavior, given fixed tastes and some price constraints. In this sense, children can be viewed as a special kind of goods, and fertility is a response to the demand for children relative to other goods. Fertility analysis, therefore, is essentially concerned with the ways in which changing constraints affect reproductive behavior.

In this report, we have adopted Easterlin's "synthesis framework" (1975; Easterlin and Crimmins, 1985). This theoretical approach seeks to combine the two sets of explanations into a coherent scheme, as detailed in the next section.

III. EASTERLIN'S MODEL

The synthesis framework seeks to explain fertility decline in the light of more general societal transformations, usually referred to as the modernization process. According to this conceptualization, modernization consists of structural change, which affects the political, economic, and social dimensions of the society in which it occurs. During the process of economic change, modernization increases per capita income thanks to new forms of production, transportation, and distribution; and changes in the scale and technological content of production and in the structure of input and output relations take place. Also, as part of the economic transformation, a major industrial, occupational, and spatial reorganization of productive resources occurs at the same time as extensive monetization of the economy.

As a social as well as a demographic phenomenon, modernization alters the level and structure of fertility; mortality and migration patterns; and the type and structure of the family, educational and health services. Changes of this magnitude are normally associated with improvements in income levels and a weakening of the stratification system which, in turn, foster the reorganization of social institutions and the political system. There arises a growing demand for democratic forms of participation, challenges to parental authority, a search for rational decision-making, and increased respect for individuals' needs (Easterlin and Crimmins, 1985, pp. 3-4).

From a demographic viewpoint, finally, the major change is related to fertility and the possibility and will for controlling it. This transformation is crucially important not only in a quantitative sense, but mostly for the reorganization of family life which it produces, profoundly affecting the status of women and freeing them from the "wheel of childbearing" (Titmuss, 1966, p. 9 quoted in Easterlin and Crimmins, 1985, p. 5). Thus, women substantially reduce the time spent in pregnancy and nursing, becoming available to seek alternative roles.

Parallel to this revolution in fertility levels, an equally significant transformation occurs in the mechanism which makes fertility choices possible. This process can be conceived of as a shift from a situation where control is exerted through biological and social mechanisms--sexual taboos, for instance--to another in which fertility control results from deliberate decisions on the part of individuals or families. Thus, what changes is the very nature of the phenomenon under study. A diagrammatic representation of this change is shown in Figure 1.

Potential fertility (P) represents the number of children that would be born, given the most favorable reproductive conditions; natural fertility (N) indicates the number of children that would be born in the absence of deliberate fertility control. The difference between P and N expresses the fact that at any given moment, and in every society, physiological and cultural restrictions--for instance, sterility, breastfeeding, etc.--prevent fertility from reaching its biological maximum, even in the absence of deliberate control. While potential fertility remains constant, however, natural fertility can actually increase with modernization, as a consequence of the breakdown of taboos, the shortening of the duration of breastfeeding, and improvements in child survival.

For awhile, actual fertility (B) follows the course of natural fertility but from a certain point onwards in the modernization process (here called "h"), it begins to fall under the impact of deliberate fertility control. The gap between B and N thus represents the extent of control, that is, averted births. The simplified representation of this phenomenon does not take into account the fluctuations that invariably occur during the demographic transition, as well as the fact that fertility reduction can result from other factors unrelated to voluntary control, such as variations in nuptiality levels and structure. It is generally accepted that the absence of fertility control stems from one or both of the following circumstances: absence of motivation to control or lack of access to services and methods of family planning. As regards the latter, it should be emphasized that, historically, fertility decline in industrialized countries took place without the benefit of family planning programs or significant innovations in contraceptive techniques.

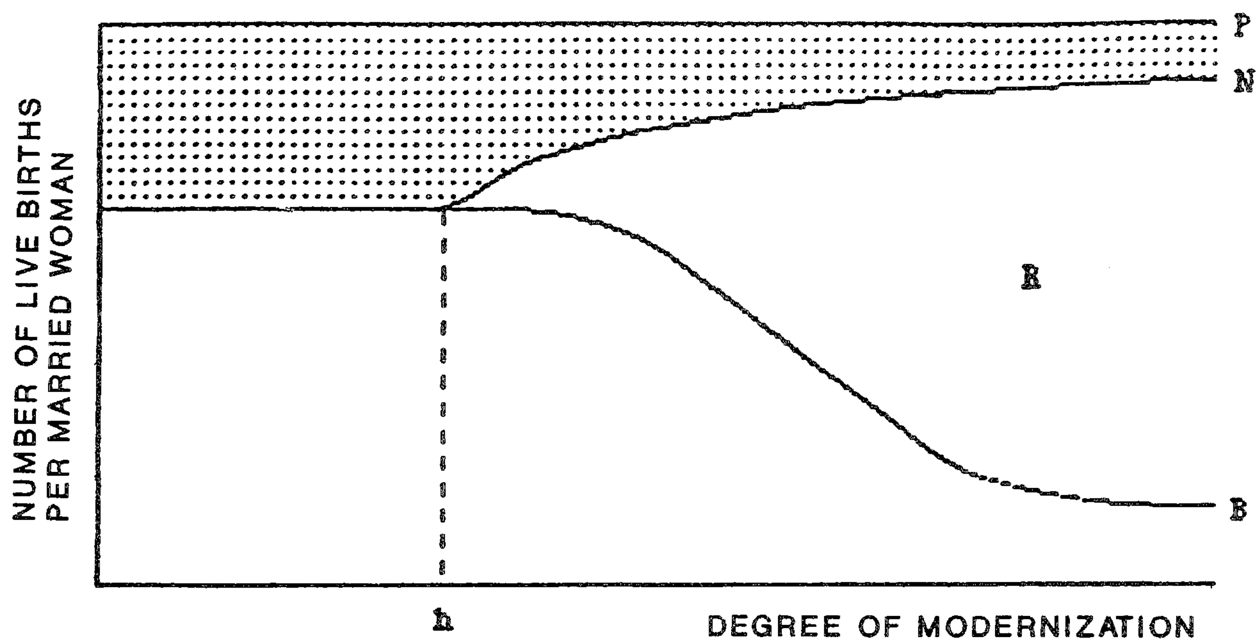
The model herein used is based on those premises but also takes into account other elements. The "Demand for children" is defined as the set of ideals regarding family size. "Regulation costs" encompass the whole set of elements that may prevent or promote fertility control practices, including ease of access to family planning services and the subjective or objective rejection of contraception, as well as monetary costs. "Supply of children" refers to a couple's reproductive capacity. Different circumstances often prevent couples from fulfilling their reproductive ideals: In industrial societies, these are predominantly related to infertility; in developing societies, this occurrence is related more often to high levels of infant mortality.

Taking into account these elements, the motivation for fertility control can no longer be seen exclusively as a matter of demand, but as an attempt to reach a balance between the supply of and demand for children. It is a central hypothesis of this report that use of fertility-regulating methods is a direct function of supply in excess of the demand for children. That is to say, motivation for control varies directly with the number of children and inversely with fertility-regulating costs (both objective and subjective).

Easterlin's approach involves a three-stage analysis of fertility determination, proceeding backwards from fertility behavior to its more remote structural determinants, as Figure 2 illustrates. The first stage consists of an individual-level intermediate variable analysis of the proximate determinants of fertility, following the classical approach suggested by Davis and Blake (1956; also, Bongaarts, 1978). In general terms, the focus is on the impact of intermediate variables on cumulative fertility through their effect on the length of exposure to intercourse, the risk of conception, and the outcome of gestation.

There are strong indications that contraception within marriage has played a major role in Brazil's accelerated fertility decline. The effect of breastfeeding, induced abortion, and duration of marriage is only modestly important on the aggregate level, although the last variable tends to play a significant role in the explanation of individual differences in fertility behavior (Merrick and Berquó, 1983). Accordingly, in the second stage, one intermediate variable--the use of fertility control--is selected for analysis. Here the focus is on the impact of differences in motivation and the costs of regulation on fertility control. Following Easterlin (1975; also, Easterlin and Crimmins, 1985), motivation and costs are conceptualized as follows:

FIGURE 1. FERTILITY TRANSITION



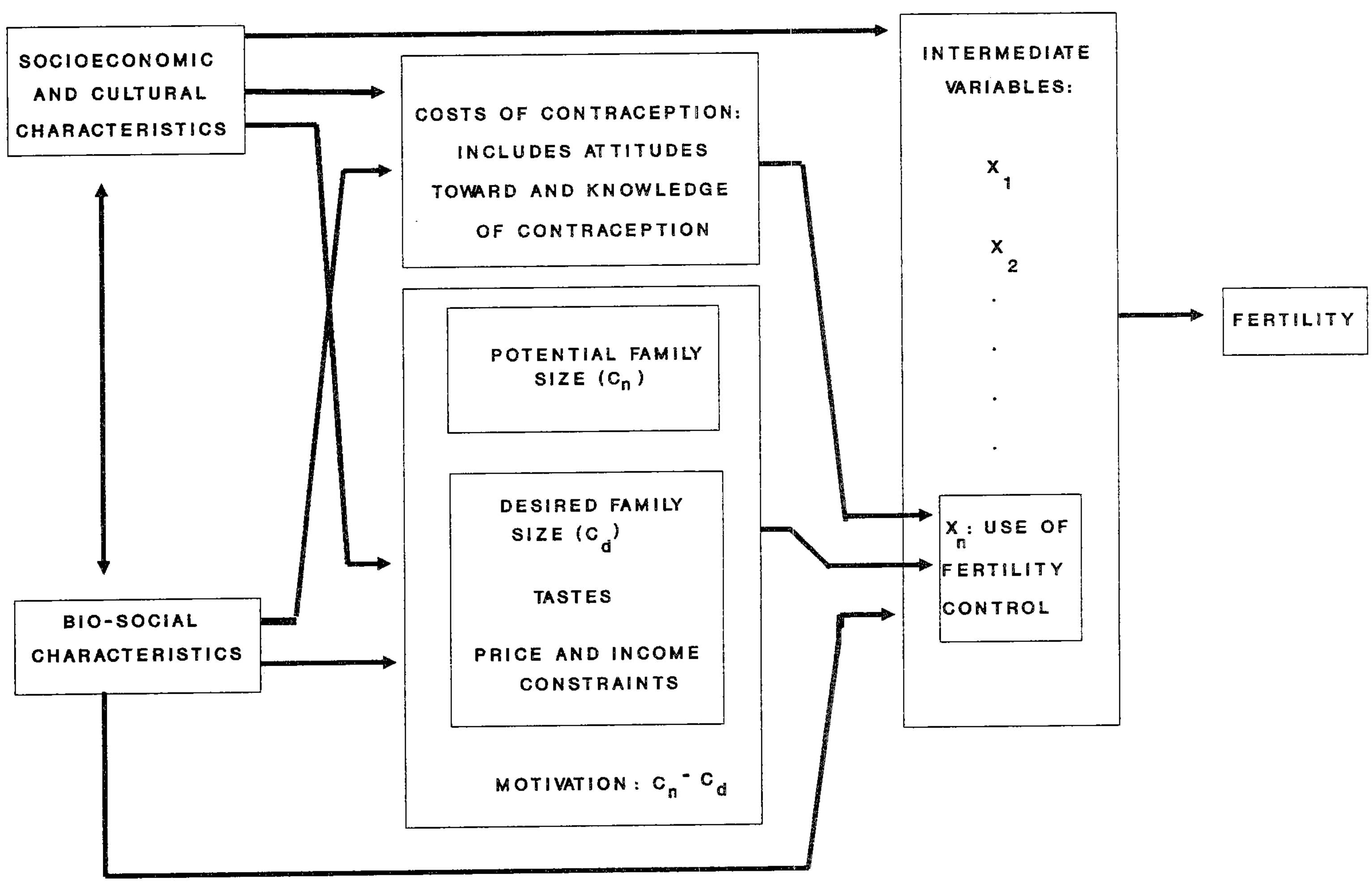
P = REPRODUCTIVE POTENTIAL

N = NATURAL FERTILITY

E = ACTUAL FERTILITY

R = N - B, DELIBERATE FERTILITY CONTROL ("BIRTHS AVERTED")

FIGURE 2. FRAMEWORK FOR FERTILITY ANALYSIS



F2FFFA

(a) Motivation: The larger the number of unwanted children a couple would have in the absence of fertility control, the greater the motivation to control fertility. Thus, motivation can be understood as the difference between two components (C_n - C_d), where:

1. Desired family size (C_d) represents the demand for children, that is, the number of children wanted by a couple given "taste" considerations and price and income constraints. It should be pointed out that it is mainly through "tastes" that normative factors are supposed to operate.

2. Potential family size (C_n) is the number of surviving children a couple would have if fertility was not deliberately controlled. It is the product of a couple's "natural" fertility and the survival rate. Obviously, this variable is not directly observable but can be estimated by means of some proximate determinants, especially information regarding the incidence of child mortality.

(b) Costs of fertility regulation (RC) refer to two different types of costs: psychic costs (attitudes and feelings about fertility regulation) and market costs (time and money involved in learning and using fertility control).

Finally, in the third and last stage, the variables entered in the previous stages are treated as dependent variables to be explained by family background characteristics as well as women's cultural values and practices, such as religiosity.

IV. THE PROXIMATE DETERMINANTS OF FERTILITY: AN AGGREGATE ANALYSIS

A number of alternative models of proximate fertility determinants are available (Gaslonde and Carrasco, 1982; Hobcraft and Little, 1984). Among these, Bongaarts' (1978) is probably the best known and most widely used model. The variables comprised by it are as follows:

1. Proportion of married women
2. Contraceptive usage and effectiveness
3. Prevalence of induced abortion
4. Duration of postpartum infecundability
5. Fecundability (or frequency of intercourse)
6. Spontaneous intrauterine mortality
7. Prevalence of permanent sterility

The first variable assumes that exposure to intercourse occurs mostly in unions, legal or consensual. The second and third variables measure the prevalence of deliberate fertility control. The last four variables, finally, are related to natural fertility levels, which prevail in the absence of deliberate fertility control and are parity-dependent. Past research (Bongaarts, 1982) suggests that such factors do not have an equally important bearing on the final fertility outcome. The previous list can thus be shortened to include four basic components: the proportion of married women; contraceptive usage and effectiveness; the duration of postpartum infecundability; and the prevalence of induced abortion. A description of the Brazilian case as regards these four components is presented below.

Marriage

Marriage as used here encompasses both legal and consensual unions. However, a high incidence of consensual unions is a confounding factor in the analysis of nuptiality patterns. Thus in 1986, one in every ten reproductive-age women was involved in a consensual union, and the proportion has been increasing steadily, particularly among younger women (Berquó and Loyola, 1984; Henriques, 1980).

The analytical challenge comes from the fact that a significant number of consensually married women tend to report themselves as being single. The same is true of women who have left consensual unions (Silva, 1979). The 1986 DHS survey tried to identify the latter by asking single women whether they had ever lived with anyone. Affirmative answers reclassified the respondents as separated women.[1]

The current marital status profile estimated by DHS indicates that in 1986, 34 percent of the women of reproductive age were single, approximately 59 percent were married (15 percent of whom were consensually married), and the remaining 7 percent were either widows (1.4 percent) or separated or divorced (5.3 percent). Through age at marriage it is possible to estimate the median age at marriage for women in the 25-29 age group (at younger age groups more than 50 percent of all women were still single). For Brazil as a whole, this parameter has a value of 21.2, varying regionally from 19.7 for the North/Center-West to 22.1 in São Paulo state. Predictably, women in more developed regions tend to postpone marriage, given the range of alternatives open to them.

Marital fertility levels can be obtained by means of current fertility levels and the proportion of currently married women by age. Table 4 presents age-specific fertility rates estimated from information on children born in the previous 12 months.

Age-specific marital fertility rates, g(a), are obtained as a quotient of f(a)/m(a), with the exception of the first age group where, following Bongaarts' recommendation, g(15-19) = 0.75 x g(20-24).[2] The aggregate outcome of this procedure indicates a total marital fertility rate of 5.91 children per married woman, applicable to the year before the survey date. In comparison to previous estimates obtained for 1970 and 1976 (Merrick and Berquó, 1983, p. 36), it is apparent that marital fertility rates declined by 23.8 percent between 1970 and 1976 (from 9.27 to 7.06) and by an additional 16.3 percent between 1976 and 1986.

Changes in the age profile of marital fertility rates were even more pronounced, as shown in Figure 3. The effects of the abrupt decline, which took place between 1970 and 1976, are evident throughout the span of the reproductive life cycle, but changes from 1976 to 1986 are concentrated within the older age groups, indicating a decisive alteration in the pattern of fertility control.

Focusing now on the cumulated marital fertility rates, it appears that by the end of the reproductive cycle, married women have had, on average, 5.0 children. Needless to say, this average varies widely across different groups of women. For instance, 43.5 percent of the respondents had had at most 3 children, while 10.7 percent reported 10 or more live births. The results are shown in Table 5.

Recent changes, therefore, indicate that the younger cohorts tend to display less fertility variation because fertility has dropped drastically during the past 25 years. A significant part of this variation might be attributed to various economic, social, and cultural conditions that affect the life of different social groups in Brazil.

Contraception

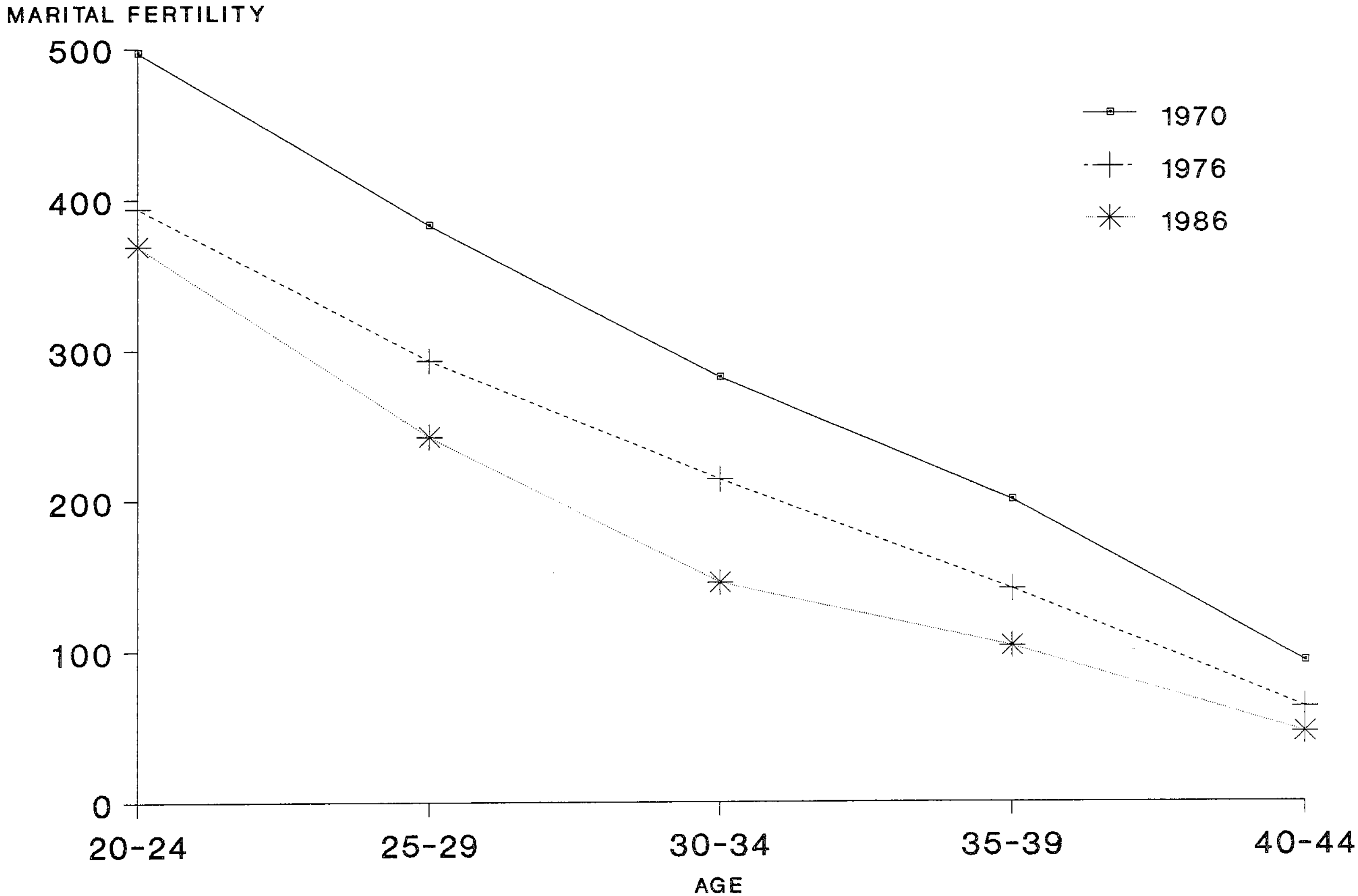
The 1986 DHS indicates a contraceptive prevalence of 66 percent of all married women of reproductive age. Available information suggests that contraceptive usage has been increasing during the past 20 years or so. Indeed, prevalence levels in 1970, 1976, and 1980 were 32, 47, and 52 percent, respectively (Mauldin, 1988). This systematic increase in contraceptive usage has also been observed in a large number of developing countries, especially in Asia and Latin America.

---

[1] Comparing the two resulting "single" women distributions, it is possible to estimate the extent of misclassification of currently separated women. This bias tends to increase as a function of age, changing from 10.1 percent in the 25-29 age group to 16.7 percent in the 35-39 group.

[2] See Bongaarts (1982).

FIGURE 3. AGE-SPECIFIC MARITAL FERTILITY RATES, BRAZIL, 1970-1986



F3ASMFRB SOURCE: MERRICK AND BERQUO (1982); DHS (1986).

With regard to the mix of contraceptive methods, sterilization is the most popular method, currently used by 28 percent of all married women of reproductive age (15-44). In spite of the controversy concerning sterilization in Brazil (Alencar, 1988; Barroso, 1984; Berquó, 1982), it is important to point out that the acceptance of surgical sterilization is a worldwide trend, found both in developing and developed countries. It is also worth mentioning that as part of this trend, less than 10 percent of sterilized women regret their decision (London et al., 1985; Mauldin and Segal, 1988; Ross, Hong, and Huber 1986; Warren, Monteik, Johnson, and Oberle, 1988).

The highest sterilization levels are found in Puerto Rico (44 percent), South Korea (41 percent), Canada (44 percent), China (37 percent), Panama (36 percent), El Salvador (31 percent), the United Kingdom (28 percent), the United States (27 percent), and Thailand (28 percent), a group of countries which displays considerable cultural and socioeconomic variety. An interesting related fact is that almost everywhere--the exceptions being China and Latin America--vasectomies are at least as prevalent as tubal ligations. In Puerto Rico, the overall sterilization prevalence of 44 percent is composed of 4 percent vasectomies and 40 percent tubal ligations.

Elsewhere in Latin America, however, the incidence of vasectomies is much lower, as exemplified by Brazil, where male sterilization is accepted by less than 1 percent of the couples reporting at least one sterilized party. This fact may be taken as an illustration of a male-oriented culture, which places the responsibility for fertility control almost exclusively onto women.

The remaining 38.5 percent reporting contraceptive usage rely on the pill. Thus, the proportion of women using the pill (25 percent) compares favorably with the proportion sterilized. It amounts to saying that over 50 percent of users rely on fertility control methods that are the sole responsibility of women. Only 12 percent reported using methods which require a modicum of male involvement, such as withdrawal, abstinence (rhythm and Billings method), and condoms.

Regional differentials in contraceptive usage are quite pronounced. In urban areas, 69.3 percent of currently married women of reproductive age are contraceptive users, whereas in rural areas the proportion drops to 56.7 percent. This difference is largely due to variations in the incidence of sterilization (30.1 and 18.3 percent, respectively). Table 6 shows that the South has the highest level of contraceptive usage, involving 74.4 percent of all married women of reproductive age. In contrast, contraceptive usage in the Northeast reaches no more than 52.9 percent of the comparable population.

As regards the mix of methods, each region presents a different profile. Rio de Janeiro and São Paulo display similar contraceptive mixes, with approximately one-third of the respondents reporting having been sterilized and one-fourth as users of the pill. The South has relatively low sterilization levels (18.7 percent) but rather high pill usage (41.0 percent). In contrast, the urban areas of the North and the Center-West show the lowest proportion of pill users (12.4 percent) and the highest levels of sterilization (42.5 percent). In the remaining regions, prevalence levels are roughly balanced between the pill and sterilization, with about one-fourth of the respondents relying on each method.

As is known, use-effectiveness varies according to the characteristics of methods and users. Following Bongaarts (1982), use-effectiveness estimates for Brazil were obtained by applying the pattern derived from the Philippine's values, modified slightly downwards to reflect the relatively high educational levels found among women in this country. These estimates are presented in Table 7. General effectiveness is therefore estimated as the ratio, $e = 59.9/66.2 = 0.91$, implying that contraceptive use is at a level of 91 percent effectiveness in Brazil. Similar estimates are also provided for DHS regions (see the last row of Table 6). It is noteworthy that the Southern region, having the highest prevalence (characterized by a high incidence of pill use relative to sterilization) should display the lowest effectiveness (88.7 percent). By the same token, the North and Center-West regions show the highest effectiveness value (98 percent), given the high incidence of sterilization.

Age-related variations in the choice of contraceptive methods imply similar variations in use-effectiveness estimates. As previously noted, there is a tendency toward increased pill usage as women age, up to the point when it is replaced by sterilization or a male method. As the latter are characterized by relatively low effectiveness, their use side-by-side with highly effective methods, such as sterilization, results in average use-effectiveness values, which cannot be determined on an a priori basis. The aggregate outcome resulting from these processes is presented below in Table 8.

The first three columns of Table 8 introduce the required elements for the determination of mean effectiveness by age. The result is a non-linear pattern. Use-effectiveness drops in the 20-24 age group to its lowest estimated value (86.6 percent), then increases up to 92.5 percent in the 35-39 age group, and drops again slightly at the end of the reproductive period.

An additional factor must be taken into consideration. It is a well known fact that fecundity declines with age. Vaessen (1984) has estimated the mean proportion of infecund women by age for 28 different countries. The proportion infecund tends to decline from 0.99 in the first age group to 0.52 for women aged 45-49. The last column of Table 8 presents these proportions, and through them it is possible to estimate the proportion of protected women among all fecund women, i.e., the group for which use of contraception makes sense.

Thus, the index of contraceptive protection can be developed as the ratio, for each age group, of the proportion of protected women ($\Sigma\, u_{im} \cdot e_m$) over the proportion of protected women, who effectively need contraception (ft_i). The index values are shown in the last column of Table 8. It is clear that protection reaches its lowest value for the youngest age group (42.2 percent) and then increases systematically with age, reaching a maximum value of 77.8 percent for the oldest age group.

Abortion

Abortion is illegal in Brazil except in cases of rape or risk to the mother's life. However, its practice is believed to be widespread, especially among young and low-income women. Since it is illegal, statistics on the practice of abortion are obviously scarce and unreliable, being to a large extent based on hospital registers (Melo, 1982). Conventional wisdom has lent credence to countrywide estimates of some 3 million abortions per year--a figure which is considerably larger than the total number of live births. More conservative estimates, which are consistent with the prevailing high levels of contraceptive prevalence, suggest a number within the range of 500,000 to 1.2 million abortions per year (Henriques, Silva, Singh, and Wulf, 1989, p. 59; Merrick and Berquó, 1983, p. 54).

From a methodological point of view, abortion analysis is not dissimilar from fertility analysis. Two measures are widely used: the general abortion rate, which measures the frequency of abortions per 1,000 women of reproductive age for a given period of time, generally one year; and the total abortion rate, which indicates the number of abortions a woman would have had at the end of the reproductive period for a constant set of age-specific abortion rates. Given the small number of abortions registered by surveys (a probable indication of underreporting), abortions recorded for the oldest age group are normally used as estimates of the total abortion rate.

Underreporting of abortions has apparently occurred in the 1986 DHS. The general abortion rate for women of reproductive age, estimated by means of a question on the number of abortions performed during the previous twelve months, was 3.4 abortions per 1,000 women annually. The total abortion rate was estimated to be 0.11 abortions per woman at the end of the reproductive period. These estimates imply a total number of 140,000 abortions per year in Brazil, obviously a very small figure, even taking into consideration a probable reduction in abortions in recent years, given the dramatic increase in the use of effective contraceptive methods. This figure is comparable to Berquó's 1975 abortion estimates for the municipality of Santa Cruz, in Rio Grande do Sul--a setting which is far from typical for the country as a whole.[3]

---

[3] Estimates for other municipalities are as follows: urban Santa Cruz (Rio Grande do Sul): 0.068; rural Santa Cruz (Rio Grande do Sul): 0.104; urban Cachoeira (Espírito Santo): 0.179; rural Conceição do Araguaia (Pará): 0.263; rural Sertãozinho (São Paulo): 0.454; urban São José (São Paulo): 0.462; urban Recife (Pernambuco): 0.478; urban Parnaíba (Piauí): 0.617; and rural Parnaíba (Piauí): 0.753. See Berquó, 1980 (quoted in Merrick and Berquó, 1983, p. 52).

Given underreporting, miscarriage and abortion rates are generally combined into a single value under the assumption that some abortions are reported as miscarriages. This procedure increases the 1986 general abortion rate to 20.7 abortions per 1,000 women of reproductive age and the total abortion rate to 0.641 abortions per woman during her reproductive life. These new rates indicate a total number of 850,000 abortions per year, a value which is closer to the estimates obtained by previous studies (Arruda et al., n.d.; Nakamura et al., 1979; Rodrigues et al., 1981, 1982, 1983a, 1983b, 1983c, 1984).

From the viewpoint of the proximate determinants of fertility, interest is clearly focused on the frequency of abortions within marriage. However, it is worth mentioning that a substantial proportion of abortions probably occurs outside marriage, affecting young single women. Being restricted to married women, abortion rates reported here should be lower than the rates estimated for the population as a whole.

As regards married women, the general abortion rate drops to 2.9 abortions per 1,000 women per year and the total abortion rate to 0.08 abortions per woman. Adding miscarriages to abortions, the estimated general abortion rate increases to 28.2 abortions per 1,000 women, whereas the total abortion rate jumps to 0.846 abortions per woman at the end of the reproductive period. Because miscarriages are specifically dealt with in the analysis of the proximate determinants, model consistency tests set the total abortion rate in the range of 0.1 to 0.5.

Postpartum Sterility and Breastfeeding

Deliveries are commonly followed by a period of postpartum sterility due to the action of many factors, among which breastfeeding and prolonged abstinence are of immediate interest. If prolonged abstinence acts through the mere prevention of intercourse, breastfeeding mechanisms operate in more complex ways. Exclusive breastfeeding might prevent ovulation and menstruation, whereas partial breastfeeding can reduce ovulation even for women who are regularly menstruating (Bongaarts, 1985, pp. 86-90; Jain and Hermalin, 1985, p. 88; Short, 1984, p. 35).

The 1986 DHS asked women who had had a baby in the previous five years a number of postpartum sterility-related questions focusing on the status of current breastfeeding, return of menses, and resumption of intercourse. These questions were used to estimate average durations for the various components of postpartum sterility for Brazil as a whole and for the survey regions. Estimates were derived from data published in Arruda et al. (1987, pp. 95-96) as well as the incidence/prevalence method (Mosley, Werner, and Becker, n.d.). The results are displayed in Table 9.

On average, Brazilian women nurse their babies for slightly over 9 months. However, there is substantial variation around average durations. It can be as low as 7.5 months in the Northeast or as high as 13.2 months in the Southeast. Similar regional variations can be observed for amenorrhea and abstinence. On average, ovulation resumes some 4.2 months after delivery, but for half of the women interviewed, amenorrhea lasted at most 2.4 months. Similarly, intercourse resumes 3 months after delivery, but half of the women reported engagement in sexual activities after only 1.6 months.

The discrepancy between mean and median durations is worth noting, as the latter indicates considerable variation and asymmetry in the distribution of durations. In addition, the incidence/prevalence method used demands a large number of observations and, consequently, does not permit more disaggregated analyses. An alternative way to estimate durations, therefore, is to focus on the last child born. These values are presented in Table 10.

The average duration of breastfeeding for the last child is 5.7 months. Average duration varies with age, hence younger mothers report shorter periods. Since average breastfeeding duration is known, it is possible to estimate postpartum sterility (i.e., infecundability) through the following equation (Bongaarts, 1982):

$$i = 1.753 \exp. (0.1396 \cdot B - 0.001872 \cdot B^2)$$

where B is the average duration of breastfeeding, and $\underline{i}$ is the average duration of postpartum infecundability or sterility. Results are presented in the last column of Table 10. On average, postpartum sterility lasts for 3.6 months, although estimates produced by the incidence/prevalence method can be as high as 5.4 months.

Bongaarts' Model: An Aggregate Analysis

The simplified version of the four determinants model proposed by Bongaarts assumes fertility levels to be lower than the maximum biological ceiling, given the inhibiting effects of marriage delay and disruption, contraception, abortion, and postpartum infecundability, including breastfeeding and voluntary abstinence.

These factors operate sequentially to reduce maximum fertility, here named the fecundity rate (TF), to the observed value of the total fertility rate (TFR). Empirical evidence has established that for almost all populations, observed fecundity rates vary within the range of 13 to 17 children per woman and around an average value of 15.3 children (Bongaarts and Potter, 1983).

Due to several sociocultural factors, including breastfeeding and abstinence, postpartum infecundability tends to reduce fecundity to the level of the total natural marital fertility rate (TN). Contraception and abortion further reduce fecundity to the total marital fertility rate (TM). Finally, marriage delay and disruption reduce fecundity to the observed total fertility rate (TFR).

In the Bongaarts' model, the effect of each proximate determinant is measured through indices that vary from 0 to 1. A value of 1 indicates that the determinant under observation exerts no inhibiting effect on fertility, whereas a value of 0 indicates a completely inhibiting effect (Bongaarts, 1982, p. 181). The indices are the following:

C_m: index of marriage (coded 1 if all women of reproductive age are married and 0 in the absence of marriage);

C_c: index of contraception (coded 1 in the absence of contraception and 0 if all fecund women use 100 percent effective contraception);

C_a: index of induced abortion (coded 1 in the absence of abortion and 0 if all pregnancies are aborted);

C_i: index of postpartum infecundability (coded 1 in the absence of lactation and postpartum abstinence and 0 if the duration of infecundability is infinite).

The relationship between the various indices and rates can be summarized by a multiplicative model, such as:

$$TFR = C_m \cdot C_c \cdot C_a \cdot C_i \cdot TF$$

where the intermediate rates are defined as follows:

$$TN = C_i \cdot TF,$$

implying that $C_i = TN/TF$;

$$TM = C_c \cdot C_a \cdot TN;$$

$$TFR = C_m \cdot TM,$$

implying that $C_m = TFR/TM$.

Since indices and aggregated rates are known, it is possible to estimate the model through the above relationships. However, since relationships vary with age, it is advisable that age-specific data be used (please refer to Appendix A).

The estimated index of marriage, C_m, is based on direct estimates of marital fertility obtained from the 1986 survey data on births to married women. In interpreting index values, it is important to note that, by definition, the complement of each observed value represents the proportional reduction in fertility, which may be attributed to the determinant under observation. Thus, a value of $C_m = 0.636$ implies that marriage delay and disruption reduce marital fertility by 36.4 percent, for an observed total fertility rate of 3.4 children per currently married woman. The results are presented in Table 11. Focusing on DHS regions, it is clear that the inhibiting effect of marriage tends to be larger in Rio and São Paulo (43.6 percent) than in the Northeast and the South (31.5 percent).

The index of contraception is estimated by means of age-specific marital fertility rates, g_a, and the proportion of users by age among women in reproductive ages, p_a. The results are presented in Table 12. The resulting estimate is $C_c = 1.068/2.662 = 0.401$, implying that contraception reduces fertility by 60 percent, a comparatively high value.

The remaining indices have been estimated according to the methods described in Appendix A. Regarding the index of abortion, it is worth stressing that the value selected for the marital abortion rate was set within the range of 0.1 to 0.5 abortions per woman. Thus, the estimated abortion index also varies between $C_a = 0.981$ and $C_a = 0.911$. Regarding the index of postpartum infecundability, C_i, estimation through the distribution of duration of lactation by age yielded a value of $C_i = 0.911$.

To clarify the meaning of these indices, comparisons to estimates obtained for other Latin American countries were made. The values reported were estimated using the same methodology applied to WFS data, although the underlying assumption that $C_a = 1.00$ is believed not to hold true in many of the selected countries. The results are shown in Table 13.

Marriage indices for Latin American countries are reasonably similar, varying from a low 0.567 in Costa Rica to a high of 0.739 in Jamaica. On average, these values imply a reduction of 35 percent of potential fertility levels, due to marriage-related effects. The index value for Brazil lies within the regional range.

Symptomatically, the indices of contraception and postpartum infecundability tend to be inversely related. That is, countries with low values for the index of contraception display high values for the infecundability index and vice-versa. This finding is consistent with the underlying transition from a regime of natural fertility to one of controlled fertility, where postpartum sterility is shortened, given the reduced duration of lactation and increased contraceptive usage (Bongaarts, 1982, pp. 184-186). Brazil and Costa Rica have the lowest values for C_c, suggesting that the two countries are on the verge of completing a transition towards a more controlled reproductive process.

The last column of Table 13 presents estimated potential fertility rates, calculated through the following relationship:

$$TFR = C_m \cdot C_c \cdot C_i \cdot FR$$

Given that FR varies between 13 and 17, it is important to observe that some countries tend to display relatively low values for potential fertility rates. Such discrepancies may be partly due to the incidence of extramarital fertility and abortion misreporting. Estimated values for Brazil seem reasonable. Given that C_a varies within the range of 0.981 to 0.911, FR should lie within the range of 14.9 to 16.1 children per woman. Inversely, if $FR = 15.3$, then $C_a = 0.954$, strengthening the plausibility that estimated abortion rates vary between 0.1 to 0.5 abortions per woman.

To summarize, if all Brazilian women of reproductive age were married, none practiced contraception or abortion and did not breastfeed their babies, they would have had at the end of their reproductive period 15 to 16 children. The observed fertility rate of 3.4 children per woman is the outcome of the inhibiting effects of the proximate fertility determinants under discussion.

V. THE PROXIMATE DETERMINANTS OF FERTILITY: A MICRO-LEVEL ANALYSIS

The preceding analysis stressed the importance of deliberate fertility control in the determination of aggregate fertility levels. Individual level analyses, however, require a change in methodology. Briefly stated, the problem at hand consists in expressing a function which describes the reproductive behavior of individuals--that is, the total number of children a woman can be expected to have during her reproductive period, her parity--in terms of its dependence on Bongaarts' "proximate determinants," such as the duration of exposure to sexual intercourse or fecundability. In particular, a central concern is the measurement of the effect of contraceptive usage vis-à-vis the effects of infecundability, spontaneous fetal loss, and secondary sterility. The purpose of this section is therefore to discuss and estimate a model of the determinants of individual parity, corresponding to the first stage of the theoretical and conceptual framework described earlier.

Model and Methods

The equation for the proximate determinants of individual parity to be estimated is given by:[4]

$$B = \alpha_o + \sum_{i=1}^{7} \alpha_i X_i + y U + \epsilon \qquad (5.1)$$

where
- B = Number of children born alive (parity)
- X_1 = Marriage duration in years
- X_2 = First birth interval in months
- X_3 = Second birth interval in months
- X_4 = Not secondarily sterile
- X_5 = Duration of breastfeeding in the last birth interval
- X_6 = Proportion of spontaneous pregnancy losses
- X_7 = Proportion of child mortality
- U = Use of contraception
- ϵ = Random disturbance

Due to the peculiarities of the 1986 Brazilian DHS questionnaire, these variables are used to measure the proximate determinants of fertility at the individual level. In the original model, "Proportion of women married" was used to estimate the length of exposure to sexual intercourse. That variable was substituted here for X_1, "Marriage duration in years," including common-law marriages (or consensual unions).

Bongaarts' second variable, "Use and efficiency of contraception" is measured here by variable U, to be described later. The variable "Postpartum infecundability" is represented in equation 5.1 by three proxies--X_5, "Duration of breastfeeding in the last birth interval"; X_3, "Second birth interval in months"; and X_7, "Proportion of child mortality." As discussed earlier, postpartum infecundability depends on the length of breastfeeding, as measured by the second birth interval (referring of course to the length of lactation for the first child) and, more directly, by the length of breastfeeding for the last child born. The rationale for including child mortality is related to the fact that the premature death of a child can shorten the length of lactation and indirectly affect postpartum infecundability.

As regards Bongaarts' fifth proximate determinant--fecundability--the corresponding proxy in equation 5.1 is variable X_2, "First birth interval in months," under the assumption that the more fecund a couple is, the more rapidly they will reproduce after marriage, and the shorter will be the first birth interval.

---

[4] See Easterlin and Crimmins (1985, pp. 36-58).

The last two proximate determinants, finally, can be measured directly. Spontaneous intrauterine mortality is measured by variable X_6, "Proportion of spontaneous pregnancy losses," exclusive of induced abortion. The prevalence of permanent sterility is measured by X_4, "Not secondarily sterile," indicating women who are not yet menopausal.[5]

Following Easterlin and Crimmins, it can be hypothesized with regard to the parameter in equation 5.1 that the parity of a continuously married woman would be higher:

1. The lower the use of deliberate fertility control by one or both parties ($\alpha_0 < 0$);

2. The greater the length of exposure, that is, the longer the duration of marriage ($\alpha_1 > 0$);

3. The greater the couple's fecundability, that is, the shorter their first birth interval ($\alpha_2 < 0$);

4. The shorter her period of secondary sterility ($\alpha_4 > 0$);

5. The lower her spontaneous pregnancy losses ($\alpha_6 < 0$); and

6. The shorter her period of postpartum infecundability, that is, the shorter her second birth interval ($\alpha_3 < 0$), the shorter the last child's lactation period ($\alpha_5 < 0$), and the higher the proportion of child mortality ($\alpha_7 > 0$).[6]

It should be observed that the central variable under scrutiny--the deliberate control of fertility (U)--includes both the so-called "efficient" methods and the "inefficient" ones (such as rhythm and withdrawal). It also includes both female and male sterilization. However, as should be clear from the preceding discussion, it does not include lactation as a method of deliberate fertility control. The hypothesis is that the basic motivation for breastfeeding is not fertility reduction. Although there is an indirect effect through postpartum infecundability, the basic determinants of lactation are sociocultural in nature rather than the outcome of rational decision-making concerning family size.

The variable U, "Use of contraception," was measured in two different ways. In each case, women who reported having never used a contraceptive method had their fertility control value fixed at zero, whereas users were coded as 1. Users were also classified by the length of time (in months) that they had been using any particular method. The questionnaire recorded the respondent's age when contraceptive methods were first used. The length of time since first use was estimated by means of the date of interview and the date at first use, adding 12 months whenever the reference point was parity before first use. If fertility was controlled before the first birth, the reference point for measuring length of time since first use was age at marriage.

Equation 5.1 was estimated directly by Ordinary Least Squares, since the linear specification seemed to be an adequate functional form for the present study.[7] It should also be observed that other variables were tested but turned out to be not statistically significant, in addition to unnecessarily complicating the model.

---

[5] The detailed operational definition of each variable is presented in Appendix B.

[6] See Easterlin and Crimmins (1985), p. 38.

[7] Easterlin and Crimmins (1985) used a two-stage tobit estimation procedure to evaluate their model. However, after comparing results obtained through this procedure and through Ordinary Least Squares, they noted that "signs and significance tests are almost always the same," although the coefficients were somewhat different, depending on the technique used (op cit., p. 42). The choice of a simpler technique was also based on the exploratory nature of this study as well as the unavailability of adequate software.

The sample on which this study is based includes all continuously married women (that is, women who married only once and whose husbands were still alive at the time they were interviewed), with two or more children born to them. Restrictions regarding continuous marriages and parity are obviously derived from the measurement specifications of the variables in equation 5.1. As a result, the original sample of 3,867 ever-married women was reduced by 58 percent to 2,259 continuously married women at parity two and above. Considering now only cases with valid information on all variables, the sample was further reduced to a total of 1,157 women, representing about 30 percent of the original sample of ever-married women.[8]

Even though such restrictions tend to select women with slightly higher fertility,[9] there is sufficient evidence to the effect that the proposed model can be generalized for all women at parities zero and one in all age groups.[10]

Empirical Results

Means, standard deviations, and correlations for the variables used in the analysis of the proximate determinants of cumulative fertility are presented in Table 14.

First-order correlations between the dependent (B) and independent variables (last row of Table 14) are rather modest, except for "Duration of marriage." Independent variables are also weakly intercorrelated, except for "Duration of marriage" (X_1) and "Deliberate fertility control" (U_2) which, as expected, show a positive sign. It is noteworthy that all three indicators of postpartum infecundability (X_3, X_4, and X_5) show low intercorrelations, indicating little or no measurement redundancy. Also, there is a virtual absence of correlation between variable X_4, "Not secondarily sterile" and all other variables, including the dependent variable B, due to its small variability. Its mean value shows that about 98 percent of the women in the sample are not menopausal, a fact that limits the space for correlation with other variables. The results of fitting the model by means of multivariate linear regression are shown in Table 15.

Two separate sets of results are presented. One includes variable U defined as "Duration of contraceptive use (in months)." The other has the same variable defined as a dichotomy, "Contraceptive use/nonuse." In both regressions, all coefficients display the expected sign and are significant at the conventional levels, with the exception of the coefficients related to variables X_4, "Not secondarily sterile" and X_6, "Proportion of pregnancy losses"--a result which is readily explained by the former variable's low variability.

Overall, the model represented by equation 5.1 can explain about 75 percent of the variance in cumulative fertility, when variable U is defined as the duration of contraceptive use, and 69 percent when that variable takes a dichotomous form. The standardized coefficients suggest a clear hierarchy in fertility determination. In line with the results of the aggregate-level analysis discussed in the previous section, it seems clear that "Duration of marriage" and "Use of contraception" are the principal proximate determinants of fertility in Brazil. At the individual level, "Duration of marriage" (X_1)--which taps the length of exposure to the risk of conception--is the main determinant of current cumulated fertility.

---

[8] The main restriction on sample size derived from the variable "Duration of breastfeeding." In the 1986 Brazilian DHS, the question was posed only to women who had had a child during the past five years. Easterlin and Crimmins (1985) restricted their sample to women at the end of the reproductive period (35-44 years old). Had such an additional restriction been imposed on the Brazilian sample, it would result in a strong bias in favor of women with very high fertility levels. In such a case, the Brazilian sample would be reduced to only 326 cases and the mean parity would be 5.5 children (against a mean number of 3.8 children in the sample used). Whenever it was deemed necessary, however, an explicit statistical control for age was introduced in the analysis.

[9] The mean parity for ever-married women in the 1986 Brazilian DHS is 3.1 children.

[10] See Easterlin and Crimmins (1985, pp. 100-120) and Easterlin, Wongboonsin, and Ahmed (1988, p. 258).

Next comes the length of time since first use of deliberate fertility control. It is important to note that the dichotomous version of this same variable reduces the model's overall explanatory power (decreasing the value of R^2), as well as the variable's relative importance. Other variables also appear to exert significant effects upon the dependent variable, to wit: second and first birth intervals (X_3 and X_2) and the proportion of child mortality (X_7), in that order.

Finally, the coefficient for the "Duration of marriage" variable indicates a frequency of births of about one birth every 2.4 years, hence a completed fertility of some 12 children after 30 years of marriage. In contrast, it is also possible to establish that a couple who initiated contraception 10 years earlier would have reached a cumulative fertility of 1.7 fewer births than a comparable couple, who had not regulated their reproductive behavior.

VI. THE DETERMINANTS OF CONTRACEPTIVE USE

The second stage of the model consists of the analysis of the determinants of contraceptive use (variable U). The theoretical framework adopted here suggests that this variable should vary directly with the motivation for fertility control and inversely with the costs of fertility regulation. In turn, motivation for fertility control can be conceptualized as the difference between the potential supply of (surviving) children and the demand for children.

If U stands for deliberate fertility control and given variable X_1, "Duration of marriage," then all other variables X_2 through X_7 in equation 5.1 can be thought of as determinants of natural marital fertility. Thus, equation 5.1 can be redefined as follows:

$$B = N + \alpha_8 U + \epsilon \qquad (6.1)$$

where N, total natural fertility, is given by:

$$N = \alpha_0 + \sum_{i=1}^{7} \alpha_i X_i \qquad (6.2)$$

implying that differences in natural fertility among couples result solely from their respective differences in variables X_1 through X_7.

The second stage of the model can be thus defined:

$$U = \beta_0 + \delta(C_n - C_d) + y\,RC + \mu \qquad (6.3)$$

where

$C_n = (1 - X_7)N$ = the potential supply of surviving children
C_d = the demand for children;
RC = the costs of fertility regulation;
μ = random disturbance.

Regarding the parameters in equation 6.3, it is hypothesized that the coefficient related to fertility control, $C_n - C_d$, must be positive ($\delta > 0$), whereas the coefficient related to costs of regulation RC should be negative ($y < 0$).

It is important to note that according to this specification, $C_n - C_d$ has exactly the same coefficient δ. That is, the source of motivation for fertility control is the difference between C_n and C_d. This restriction will be removed later on to test the efficacy of an alternative definition of motivation to control as affected by each one of these components in a differentiated manner.

This section deals with measurement problems concerning the three independent variables in equation 6.3, bringing to light biases which might affect the analysis. The results of fitting the model expressed by equation 6.3 are then discussed, and attention is paid to alternative versions of the same model.

Potential Supply of Surviving Children (C_n)

The potential supply of surviving children is not directly observable, but it can be estimated as the product of a couple's natural fertility times its child survival rate, S. Using estimates derived from the fitting of equation 5.1, it can be established that $S = 1 - X_7$, hence $C_n = S \cdot N = (1 - X_7) \cdot N$. It is then possible to estimate S by means of the coefficients α_0 to α_7 (as shown in Table 15) and the respective values of each variable for each couple.[11] That is to say, it is possible to estimate the values of natural marital fertility for each couple in the absence of deliberate control of fertility (U).

Table 16 compares the estimated values of N to the present parity, classified by whether the couples are regulating fertility or not. With regard to the non-regulating population--the couples who never initiated deliberate control of fertility--their estimated natural fertility is almost identical to their actual fertility. Even though the fit of the model based on equation 5.1 is rather good, it cannot account entirely for the variation of the parity variable (B). Hence, the standard deviation of estimated natural fertility is smaller than the standard deviation of the estimated actual fertility. For the population that has tried the deliberate control of fertility at least once, their parity is below their estimated natural fertility value by an average difference of one child.

It is worth noting that estimated natural fertility is lower for regulators than for non-regulators by an average difference of 1.13 children. The decomposition of this difference through the application to the means of each group of the coefficients displayed in Table 15 indicates that the non-regulators' higher fertility is largely due to the average duration of their marriages. This factor accounts for 63 percent of the difference between the two groups, as shown in Table 17.

A second factor, responsible for about 18 percent of the estimated difference, is the higher proportion of child mortality among non-regulators. This combination of longer marriages and higher child mortality suggests that natural fertility differences between regulators and non-regulators is probably of a socioeconomic nature, since both factors tend to covary with individual life circumstances. It is important to stress, however, that the higher incidence of child mortality among non-regulators can be at least in part attributed to the higher parity typical of that population.

Finally, it is worth noting that the longer birth intervals among the population of regulators may indicate the use of deliberate fertility control between pregnancies, a possibility that should entail a small bias in estimation.

Demand for Children (C_d)

Demand for children was measured by reported desired family size.[12] This is a controversial question, since it has been argued that it tends to rationalize past behavior, that is, to reflect a subsequent rather than prior situation, as far as reproductive control decisions are concerned. The implication is naturally that desired or ideal family size becomes biased by actual parity, so that women report as desired those births, which at the time of their occurrence, were in fact undesired. However, evidence indicates that this is a relatively modest bias, and the traditional measure used here is quite consistent with estimates regarding the point of completion for

---

[11] The coefficients are derived from the estimation of the model, which defines U as the duration of contraceptive use in months.

[12] The question was worded as follows: "If you could choose exactly the number of children you would have throughout your life, how many children would you like to have?"

preferred family size.[13]

As suggested by Easterlin and Crimmins, the comparison between regulators and non-regulators provides an indication whether the information at hand reflects real differences regarding family size preferences.[14] It is expected that the bias in desired family size should be smaller among couples who have fewer children than their reported ideal. In the present study, the proportion of women with fewer surviving children than the number they deem ideal is smaller among regulators (47.6 percent) than among non-regulators (53.8 percent). In other words, the bias associated with responses about desired family size is larger in the population of regulators rather than non-regulators. Given that regulators reported a smaller desired number of children than non-regulators, it follows that not only is there a genuine difference in preferences between the two populations, but that this difference is probably being underestimated.

A related consequence of the regulators' tendency to boost their family size ideals is that the measure of motivation (C_n - C_d) will be underestimated for this population, attenuating the correlation between this variable and deliberate fertility control. That is to say, the measure of ideal family size used here may involve a bias, which will operate against the hypothesis being tested. Thus, the preferred number of children can be viewed as a reasonable measure of the demand for children.[15]

Costs of Fertility Regulation (RC)

There are two kinds of costs related to the regulation of fertility. One, psychic costs involving attitudes and feelings toward fertility regulation, and the other, market costs, that is, the time and the money needed to learn and effectively use some form of fertility control. Given that the decision to use a method of control probably induces a positive change both in attitudes and knowledge, a measure of the costs of fertility regulation should reflect a situation prior to that decision. This is required in order to avoid the bias derived from the reciprocal causation of costs and fertility control decisions. The Brazilian 1986 DHS did not include direct measures of psychic or market costs. It did, however, include questions regarding knowledge of and attitudes toward fertility regulation, which might serve as proxies. Unfortunately, most of the alternative measures tested--including attitudes toward contraception and family planning, as well as reasons to stop using contraceptives--were not significantly correlated with contraceptive use. Thus, the principal variable to be used as a proxy for regulation costs is the number of methods known or, alternatively, the sum of methods known weighted by their efficacy.

The measure used here is far from ideal not only because it excludes the psychic dimension of regulation costs, but also because it refers to a situation subsequent to the decision to use contraception, hence reflecting the effect of that decision upon the attitudes and knowledge levels of the population regulating fertility. That is, the costs of regulation will be excessively low (more known and/or efficacious methods) among regulators vis-à-vis non-regulating fertility because of the very decision to regulate fertility. In order to minimize the problem posed by the endogenous nature of regulation costs, the population of regulators will be analyzed separately as a means of controlling for the differential bias stemming from knowledge of control methods.

---

[13] See Easterlin and Crimmins (1985, pp 49-50). Reviewing the issue of family size preferences in light of the World Fertility Survey's results, Lightbourne (1985, p. 186) concludes that "despite objections raised against the conventional estimation of the average number of desired children, it is obvious that this estimate offers a reasonably good approximation of the average number of surviving children that women would have had if they had been successful in restraining family size at the point when they reportedly did not want an additional child; they did not suffer fecundity problems; and did not postpone indefinitely desired births."

[14] See Easterlin and Crimmins (1982) pp. 14-15.

[15] See McCleland (1985), p. 319.

Determinants of the Duration of Contraceptive Use

As earlier indicated, the basic measure of motivation to control fertility is the difference between potential family size and desired family size (C_n - C_d). The hypothesis to be tested here is that higher levels of motivation result in the use of contraception for longer periods of time.

The correlation between motivation and duration of contraceptive use is 0.38 for the total population under study and 0.45 for the population of regulators, and both values are significant at the conventional levels in addition to having a positive sign, as expected. These values also account for between 15 and 21 percent of the variation in length of use.

Following Easterlin and Crimmins,[16] some alternative measures of motivation were tested. The rationale for their use is as follows:

1. "Wants no more"--Responses to the question asking if an additional child was desired were coded 1 to mean that no more children were desired and 0, otherwise. It is hypothesized that respondents who reported that they did not want more children were more motivated to control their fertility.

2. (C - C_d)--The difference between actual family size and desired family size leads to the hypothesis that respondents who already had a larger than desired number of children were more motivated to control their fertility.

3. (C_n)--The potential number of surviving children implies a direct relationship to motivation to regulate fertility.

4. (C_d)--The desired family size should be inversely related to motivation to regulate fertility.

5. (C)--The actual family size should be directly related to motivation to regulate fertility.

Table 18 shows the correlations between duration of contraceptive use and several measures of motivation to regulate fertility, both for the total population and the population of regulators (first row and first column, respectively). In Table 18, values showing above the principal diagonal correspond to the total population; values showing below the principal diagonal, to the population of regulators. It should be observed at the onset that correlations are larger for the population of regulators rather than for the total population, as expected.

In addition, it is clear that the basic measure of motivation is positive and significantly correlated with the duration of contraceptive use and that its value is larger than that of any other alternative measure, with the exception of variable C_n, the potential number of children. Finally, and contrary to expectations, C_d, the desired family size variable is positively related to duration of use, although the value is not significant at the conventional levels. This result can be explained by the variable's correlation to C_n, the potential number of surviving children, and to C, the actual number of surviving children. It follows that the direct effect of this variable can only be assessed in a multivariate context, in which the other variables would be held constant.

With regard to the costs of regulation, the correlation between the variable, "Number of methods known" and duration of contraceptive use is 0.204 for the total population and only 0.087 for the population of regulators. Using now the variable "Efficacy of methods known," the correlation values are 0.210 and 0.094, respectively. Ignoring the issue of causal relations between variables, it is clear that higher levels of contraceptive knowledge are associated with higher levels of contraceptive use. Also, the knowledge measure weighted by the methods' efficacy yields better results than the measure based only on the number of methods. It follows that knowledge of more efficacious methods is associated with higher levels of fertility control.

---

[16] Easterlin and Crimmins (1982), p. 17.

Multivariate Analysis

Regarding the second stage of the model, it has been hypothesized that contraceptive use is positively related to the couples' motivation to regulate fertility and negatively to the costs of regulation. The correct test of this hypothesis thus involves the simultaneous consideration of relevant variables.

Four motivational variables were introduced: the basic variable (C_n - C_d); the variable: "Wants no more children"; the variable "Potential supply of children," C_n; and the variable, "Demand for children," C_d. Costs of regulation were also included, as measured by the variables, "Number of known methods" and "Efficacy of known methods." Correlations were then computed among all variables to verify the possible occurrence of collinearity problems. As shown in Table 19, the generally low values of the correlations for both populations indicate that no important collinearity effects are present.

The multivariate analysis yields results that were anticipated by the correlations. First, the model has a better fit for regulators rather than for the total population. In addition, the motivational variable "Wants no more children," which is measured as a dichotomy, underperforms in comparison with other variables, even though related coefficients are significant at the conventional levels. In fact, the basic motivational variable, (C_n - C_d), shows a much superior performance, with coefficients displaying the expected sign and higher significance.

However, as was already indicated at the bivariate level, the most decisive motivational variable is the "Potential supply of children," C_n. When this variable is introduced, the fit of the model increases from about 20 percent variance explained by (C_n - C_d) to 33 percent for the total population and nearly 44 percent for the population of regulators. In other words, the use of C_n practically doubles the predictive power of the model. Moreover, in the presence of C_n, the "Demand for children variable," C_d, displays the expected negative sign, which did not appear at the bivariate level. The "Costs of regulation" variables are also significant at the conventional level but are less important than the motivational variables. In short, it can be concluded that the potential supply of children is the principal determinant of contraceptive use in Brazil. The results are presented in Tables 20 and 21.

VII. THE DETERMINANTS OF THE DEMAND FOR CHILDREN: SUPPLY OF CHILDREN AND COSTS OF FERTILITY REGULATION

The third stage in the "synthesis framework" involves the analysis of socioeconomic and cultural determinants of fertility control as they affect the basic proximate factors: the costs of regulation, RC, and the two motivational variables, C_d and C_n. As indicated in the preceding sections, the supply of children (potential family size) component of motivation is the product of a couple's child survival rate, S, and its natural fertility, N. To estimate the latter, all proximate determinants of fertility were employed, but the use of fertility control methods (U). Thus, we can decompose C_n in terms of its own "determinants" and apply to these variables the same socioeconomic and cultural analysis applied to the costs of regulation (RC) and the demand for children (C_d). That is, we can extend the analysis to include the determinants of intervening variables other than fertility control.

Several background variables in the DHS questionnaire dealing with various aspects of the modernization process were used, including higher education, urbanization, higher income and consumption levels, changes in occupational structure, increased exposure to mass media, etc. More specific cultural determinants were also included (such as the wives' religiosity), in addition to other variables measuring the socioeconomic and cultural environment (as exemplified by Brazil's regions).

Preliminary regression analysis indicated that some predictors had only a small or nonsignificant effect on the dependent variables when other predictors were included in the equation (e.g., the wives' place of residence during childhood and the couples' literacy). Only variables which behaved consistently or were of general interest were selected to form a set of predictors used in all regressions. Such variables include "Region" (measured by means of dummy variables); "Place of residence"; "Education" (in years of completed schooling for both wives and husbands); "Wife's religiosity" (as frequency of church attendance); "Total household income"; "Media exposure" (as measured by a cumulative scale of newspaper reading, radio listening, and TV watching); and "Household consumption" (a cumulative scale based on the presence/absence of a series of consumption and expenditure items).[17]

Finally, because socioeconomic and cultural conditions as well as fertility behavior have been experiencing rapid changes during the past three decades, the variables tend to be related to the respondents' age. Thus, a statistical control for this variable was introduced, completing a set of 12 predictors for the analysis of the third stage of the model. Regression analysis results are in Table 22.

The predictive power of socioeconomic determinants varies widely. On the one hand, several variables have a significant relationship in the regression, fitted as in the case of basic cost and motivation variables. On the other, however, no variable appears to be significantly related to the dependent variable. This is the case of the variable, "Not secondarily sterile," whose only significant relationship is with the variable "Age"--a rather trivial finding. Similarly, as shown in Table 22, the proportion of explained variance runs from as high as 63 percent for variable X_1, "Duration of marriage," to as low as 1.4 percent, in the case of variable X_4, "Not secondarily sterile." However, when the statistical control for the respondents' age is removed, the overall fit of the model is substantially reduced, with the highest value lying at 23.4 percent for the variable "Costs of regulation."[18]

Thus, in addition to the effects of age, personal and household socioeconomic characteristics seem to play an important role with regard to cost and the determinants of motivation. Other variables, such as "Region" and "Place of residence" also affect some dependent variables as they reflect differences in the socioeconomic and cultural environment. Two sets of variables--"Wife's education," "Husbands' education," and "Wife's religiosity"--appear to constitute the main explanatory variables, reflecting the importance of ideational change in the modernization of fertility behavior.

Other noteworthy relationships are the following: The variable "Demand for children" (measured by desired family size) is significantly related to "Wife's education," and its negative sign indicates that more educated women want fewer children. The magnitude of the coefficient shows an estimated difference of 0.92 fewer desired children, on average, between women with a college education and those with no formal schooling. "Wife's religiosity" also appears to have a significant effect on the demand for children. Women who attend religious services regularly desire 0.35 more children, on average, than women who never attend church. Other variables, in turn, albeit not significant as far as their coefficients are concerned, behave as expected. For example, "Husband's education" has a negative effect on desired family size. Another example is "Total household income," which is positively related to the "Demand for children," when other variables are controlled for. However, the most important effect is related to "Age." Its coefficient's positive sign indicates the presence of an autonomous process of change in the demand for children, implying an estimated reduction of about 1.1 desired children, on average, in the past 25 years.[19]

The equation for "Supply of children," C_n, has a structure similar to the one for "Demand of children" with several coefficients showing the same sign in both equations. Again, "Age" is the foremost determinant, confirming that potential family size increases with the wife's age--a trivial finding given that almost all of the intermediate variables used to construct the supply estimate are also related to that variable, as will be seen later.

---

[17] Please refer to Appendix B for details.

[18] Measured in the equation by "Number of methods known."

[19] Another possibility, of course, is that women tend to adjust their reported desired family size to their actual fertility behavior, and it is the latter that is reflected by the wives' age.

In addition to the effect of age, both "Wife's education" and "Husband's education" are significantly and negatively related to potential family size. Such effects, however, are much stronger than in the case of demand for children, since the estimated difference between the extremes of the educational ladder represents about 1.8 fewer surviving children among the more educated women, a value almost twice the size of the corresponding estimates for desired family size. In contrast, "Wife's religiosity" does not have a significant effect upon the supply of children, although its coefficient is also positive. Two noteworthy regional differences in the supply of children appear to be significant. Both the Rio/São Paulo Region and the Southeast Region--Brazil's most developed areas--show significantly lower average levels in potential number of surviving children than the base Region (North), with an estimated difference of about 0.55 fewer surviving children.

Turning now to the determinants of C_n, the intermediate variables other than the deliberate use of fertility control, the similarity in the equation's structure (the signs and significance of the coefficients) and the much closer fit observed for the proximate variable X_1, "Duration of marriage" indicate that the latter is the principal component in the model of socioeconomic determination of the supply of children. In this sense, what has been said in relation to "Potential family size," C_n, also applies to "Duration of marriage," that is, as the wife's and husband's education increase, the total duration of marriage is significantly reduced. The same phenomenon can be observed with regard to the contextual effect of regional socioeconomic differences. All regions show lower durations of marriage when compared with the Northern Region, but only Rio de Janeiro/São Paulo's coefficient is statistically significant (implying, other things being equal, 1.4 fewer years in the duration of marriage, on average, for that region).

The equation for "First" and "Second birth intervals" (X_2 and X_3) indicates a significant positive effect of "Age," confirming the change in marital fertility patterns previously discussed. The emerging patterns imply a continuous shortening of these lower-order birth intervals across time, a finding which is consistent with the observed change in reproductive behavior associated with the introduction of deliberate fertility control. That is to say, women tend to have fewer children, earlier, and with shorter spacing between births.

However, it could also be argued that the restriction of the sample to women with two or more children introduced a bias in favor of younger women with higher reproductive potential, that is, with shorter birth intervals. Hence, the importance of controlling for the wives' age lest the other estimated coefficients be biased. The positive sign of the coefficients for "Wife's" and "Husband's education," "Household income," and "Consumption scale" are also worth noting, as they indicate that better-off households tend to display longer first birth intervals, other things remaining constant. The results for the second birth interval, however, are less clear. In this case, education seems to exert a positive effect and household economic standing a negative one.

The equation for X_5, "Duration of breastfeeding," shows again the centrality of "Wife's education" in the socioeconomic determination of fertility behavior. The coefficient is significant, negative, and strong, implying an approximate difference of 4 fewer months of lactation between women with a college education and those with no formal schooling. Regional differences, however, seem to exert a stronger effect upon the duration of breastfeeding. The Northeast has an average duration significantly lower than any other region (about 3.8 fewer months vis-à-vis the base region). This is a remarkable finding, since it is the poorest region, precisely where the opposite results could be expected. Thus, the hypothesis of regional cultural idiosyncrasies at work cannot be ruled out.

It is also important to point out that the positive coefficient obtained for the variable "Age" suggests an autonomous decrease in lactation over time, a finding which seems to be coherent with the direction of change normally observed during the modernization process.

Quite expectedly, "Wife's education" emerges as the stronger determinant of variable X_7, "Child mortality," indicating that higher levels of schooling lead to lower child mortality risk. A seemingly anomalous result, in turn, was obtained for "Household income"--the relevant coefficient is significant but positive, implying higher mortality risks for better-off households. However, it should be noticed that the coefficient for the variable "Consumption scale" is as expected (i.e., negative) as are all other relevant coefficients (e.g., the negative effect of a couple's education or the positive effect of living in the Northeast). Thus, the results suggest that "Household income" may be tapping the underlying effect of unmeasured variables. As of now, however, there are no indications which other variables might be involved.

Finally, the equation for "Costs of regulation" shows once again the central role played by the variables "Wife's education" and "Religiosity" in the determination of fertility behavior. Both coefficients are significant at the conventional level of 5 percent. In addition, the effect of "Wife's education" is expectedly positive (the higher the level of schooling, the larger the number of methods known); and that of "Religiosity" is negative, indicating cultural resistance to contraceptive knowledge. "Religiosity" alone shows a negative sign, with all others variables contributing to reduce the costs of fertility regulation.

VIII. CONCLUSIONS

This report closely follows Easterlin's empirical applications of his "synthesis framework."[20] In general, the results demonstrate the adequacy of his theoretical frame for explaining fertility behavior and change in a context such as Brazil's.

Some of the findings reported here, however, are at slight variance with his results for Colombia and Sri Lanka. Easterlin viewed his previous work in these countries as an empirical test of his framework in which "the principal innovation...is the measure of motivation for fertility control. This is the algebraic excess of the potential number of surviving children (derived from household-level estimates of natural fertility and child survival) over desired family size (as reported by respondents). This measure performs best in explaining the use of control in competition with a number of alternative motivation measures examined" (Easterlin and Crimmins, 1982, p. 33).

As estimated with the Brazilian DHS data, the motivation measure (C_n - C_d) shows a statistically significant regression coefficient with the expected positive sign, implying an effect on fertility control, which is more important than that related to the costs of regulation. However, contrary to Easterlin's findings, the results for Brazil indicate that an alternative measure of motivation--"Potential supply of surviving children" (C_n)--performs better than the difference (C_n - C_d), as a predictor of the use of fertility control, increasing the proportion of explained variance from around 20 percent to almost 33 percent.

The introduction of both C_n <u>and</u> C_d as distinct dimensions of motivation found that the latter measure had the expected negative sign and was significant at the 5 percent level, increasing slightly the explanatory power of the model. Thus, the overwhelming importance of C_n indicates that in Brazil, probably due to the widespread use of contraception both for spacing and stopping births, the duration of contraceptive use is mainly determined by household potential fertility, which, in turn, is a function of the total time of exposure to sexual intercourse. It should be recalled, however, that regulation costs, i.e., attitudes toward and knowledge of contraception, also play a significant role in the determination of contraceptive use.

Easterlin's framework permits the identification of the mechanisms though which modernization affects fertility. Two main sociocultural factors emerged from the analysis of the Brazilian DHS survey: One was wife's education and the other, wife's religiosity, both indicating the importance of ideational change in the process of fertility transition. Traditional values, as measured by women's religiosity, increase both desired family size and the costs of fertility regulation. As expected, however, this factor does not affect the couple's potential family size.

Wife's education operates through a more complex causal flow. On one hand, it tends to increase natural fertility as it reduces the length of breastfeeding and improves children's survival odds. On the other hand, it exerts a negative net effect on potential family size, given its relationship to postponement of marriage, thus reducing women's total sexual exposure time. Consequently, education plays a somewhat ambiguous role in the determination of a couple's motivation, since it tends to decrease potential <u>and</u> desired family sizes. The results

[20] See Easterlin and Crimmins (1982, 1985).

reported here suggest that it exerts a stronger effect on potential family size, implying that an unanticipated consequence of raising education may be a reduction in the motivation for fertility control. In addition, wife's education also has a negative impact on the costs of regulation, as it increases knowledge of contraception, thus making more complex its causal links to fertility behavior and change.

The complex paths through which such mechanisms operate indicate the need for caution in making policy recommendations. In this respect, it is important to understand the processes that might alter household potential fertility. Recent changes in nuptiality patterns--expressed by an increasing number of consensual unions and the dissemination of sexual freedom values--seem to operate in the direction of increasing early exposure to intercourse. At the same time, favorable attitudes toward and greater knowledge of contraception, including sterilization at an earlier age, might balance the aggregate effect of earlier entry into unions, especially because consensual unions tend to last less time than formal marriages (Henriques, Silva, Singh, and Wulf, 1989).

By the same token, attention should be paid to the ideational dimension of fertility behavior. Since both the wife's education and religiosity are important factors in the dissemination of fertility-related values and ideas, increasing women's participation in various spheres of action and discussion--such as neighborhood associations, special education programs, health assistance centers, and even labor unions and political parties--should be consequential for the process of fertility transition.

Finally, it is important to recognize that the balance between the supply of and demand for children ($C_n - C_d$) rests on ambiguous desires. This is particularly true of Brazil's fertility transition. In a sense, the economic and social crisis of the 1980s pushed women into the labor force and increased contraceptive use to counterbalance the family's loss of purchasing power.

Labor force participation and contraception, however, are also central to women's rights and an integral part of modern society. Brazil's new constitution has greatly expanded women's rights in the workplace. The time is now ripe to bring reproductive rights to the forefront of public debate.

REFERENCES

Alencar, J. A. de. n. d. "A esterilização feminina no Brasil." Relatório de Pesquisa 40/88, LNCC/CNPq. Mimeographed.

Arruda, J. M. et al. n. d. Pesquisa Sobre Saúde Materno-Infantil e Planejamento Familiar, Amazonas--1982. Rio de Janeiro: BEMFAM.

Arruda, J. M. et al. 1987. Pesquisa Nacional Sobre Saúde Materno-Infantil e Planejamento Familiar--Brasil, 1986. Rio de Janeiro: BEMFAM.

Barroso, C. 1984. "Esterilização feminina: Liberdade e opressão." Revista de Saúde Pública 18: 170-180.

Berquó, E. 1980. Algumas Indagações sobre a Recente Queda da Fecundidade no Brasil. Teresópolis: CLACSO, VI Reunião do Grupo de Trabalho sobre o Processo de Reprodução da População.

Berquó, E. 1982. "Os corpos silenciados." Novos Estudos CEBRAP 3: 46-49.

Berquó, E. S. and M. A. Loyola. 1984. "União dos sexos e estratégias reprodutivas no Brasil." Revista Brasileira de Estudos de População 1,1/2.

Bongaarts, J. 1978. "A framework for analyzing the proximate determinants of fertility." Population and Development Review 4,1: 105-132.

Bongaarts, J. 1982. "The fertility-inhibiting effects of intermediate fertility variables." Studies in Family Planning 13,6/7: 179-189.

Bongaarts, J. 1983. "The proximate determinants of natural marital fertility." Determinants of Fertility in Developing Countries: A Summary of Knowledge. Eds. R. Bulatao and R. D. Lee with the assistance of P. E. Hollerbach and J. Bongaarts. New York: Academic Press.

Bongaarts, J. 1985. "What can future surveys tell us about the proximate determinants of fertility?" International Family Planning Perspectives 11,3.

Carvalho, J. A. M. de, P. de T. A. Paiva, and D. R. Sawyer. 1981. The Recent Sharp Decline in Fertility in Brazil: Economic Boom, Social Inequality and Baby Bust. New York: The Population Council, Working Documents, No. 8.

Casterline, J. B. et al. 1984. "The proximate determinants of fertility." World Fertility Survey Comparative Studies, No. 39. Voorburg, Netherlands: International Statistical Institute.

Davis, K. and J. Blake. 1956. "Social structure and fertility: An analytic framework." Economic Development and Cultural Change 4,4: 211-235.

Easterlin, R. A. 1975. "An economic framework of fertility analysis." Studies in Family Planning 6: 54-62.

Easterlin, R. A. and E. M. Crimmins. 1982. "An Exploratory Study of the 'Synthesis Framework' of Fertility Determination with World Fertility Survey Data." WFS Scientific Reports, No. 40. Voorburg, Netherlands: International Statistical Institute.

Easterlin, R. A. and E. M. Crimmins. 1985. The Fertility Revolution--A Supply-Demand Analysis. Chicago: The University of Chicago Press.

Easterlin, R. A., K. Wongboonsin, and M. S. Ahmed. 1988. "The demand for family planning: A new approach." Studies in Family Planning 19,5.

Gaslonde, S. and E. Carrasco. 1982. "The impact of some intermediate variables on fertility: Evidence from Venezuela's National Fertility Survey, 1977." WFS Occasional Papers, No. 23. Voorburg, Netherlands: International Statistical Institute.

Henriques M. H. 1980. "Uniõs legais e consensuais: Incidencia e fecundidade na America Latina." Boletim Demográfico 10,3: 21-62.

Henriques, M. H., N. do Valle Silva, S. Singh, and D. Wulf. 1989. Adolescentes de Hoje, Pais do Amanhã: Brasil. New York: The Alan Guttmacher Institute.

Hobcraft, J. and R.J.A. Little. 1984. "Fertility exposure analysis: A new method for assessing the contribution of the proximate determinants to fertility differentials." Population Studies 38,1: 21-45.

Jain, A. and A. Hermalin. 1979. "Lactation and natural fertility." Natural Fertility. Eds. H. Leridon and J. Menken. Liege: Ordina Editions, quoted in Bongaarts (1985), p. 88.

Lightbourne, R. E. 1985. "Individual preferences and fertility behaviour." Reproductive Change in Developing Countries: Insights from the World Fertility Survey. Eds. J. Cleland and J. Hobcraft. London: Oxford University Press.

London, K. A. et al. 1985. "Fertility and family planning surveys: An update." Population Reports 8.

McCleland, G. 1983. "Family size desires as measures of demand." Determinants of Fertility in Developing Countries: A Summary of Knowledge. Eds. R. Bulatao and R. D. Lee with the assistance of P. E. Hollerbach and J. Bongaarts. New York: Academic Press.

McDonough, P. and A. de Souza. 1980. The Politics of Population in Brazil: Elite Ambivalence and Public Demand. Austin: University of Texas Press.

Melo, H. P. de. 1982. Sequelas do Aborto: Custos e Indicações Sociais. São Paulo: Fundação Carlos Chagas/Instituto Nacional da Assistência Médica e Previdência Social.

Merrick, T. 1985. "Recent fertility declines in Brazil, Colombia, and Mexico." World Bank Staff Working Papers, No. 692. Washington, D.C.: The World Bank.

Merrick, T. and E. Berquó. 1983. The Determinants of Brazil's Recent Rapid Decline in Fertility. Washington, D. C.: National Academy of Science Press.

Mosley, W. H., L. Werner, and S. Becker. n. d. "The dynamics of birth spacing and marital fertility in Kenya." WFS Scientific Reports, No. 30. Voorburg, Netherlands: International Statistical Institute.

Nakamura, M. S. et al. 1979. São Paulo Contraceptive Prevalence Survey: Final Report. Campinas: Pontifícia Universidade Católica.

Ross, J. A., S. Hong, and D. H. Huber. 1986. "Worldwide trends in voluntary sterilization." International Family Planning Perspectives 12: 34-39.

Rodrigues, W. et al. 1981. Pesquisa Sobre Saúde Materno-Infantil e Planejamento Familiar, Piauí, 1979. Rio de Janeiro: BEMFAM/Secretaria de Saúde do Estado do Piauí.

Rodrigues, W. et al. 1982. Pesquisa Sobre Saúde Materno-Infantil e Planejamento Familiar, Rio Grande do Norte 1980. Rio de Janeiro: BEMFAM/Secretaria de Saúde do Estado do Rio Grande do Norte.

Rodrigues, W. et al. 1983a. Pesquisa Sobre Saúde Materno-Infantil e Planejamento Familiar, Pernambuco, 1980. Rio de Janeiro: BEMFAM/Universidade Federal de Pernambuco.

Rodrigues, W. et al. 1983b. Pesquisa Sobre Saúde Materno-Infantil e Planejamento Familiar, Paraíba, 1980. Rio de Janeiro: BEMFAM.

Rodrigues, W. et al. 1983c. Pesquisa Sobre Saúde Materno-Infantil e Planejamento Familiar, Bahia, 1980. Rio de Janeiro: BEMFAM.

Rodrigues, W. et al. 1984. Pesquisa Sobre Saúde Materno-Infantil e Planejamento Familiar, Região Sul, Brasil, 1981. Rio de Janeiro: BEMFAM.

Short, R. 1984. "Breastfeeding." Scientific American 250,4.

Silva, N. do Valle. 1979. "Padrões de nupcialidade no Brasil: 1940-1970." Boletim Demográfico 9,4: 5-25.

Titmuss, R. 1966. Essays on the Welfare State. London: Routledge and Kegan Paul.

Vaessen, M. 1984. "Childlessness and infecundity." WFS Comparative Studies No. 31: Cross-Sectional Summaries. Voorburg, Netherlands: International Statistical Institute.

Warren, C., R. S. Monteik, J. T. Johnson, and M. W. Oberle. 1988. "Tubal sterilizations: Questioning the decision." Population Studies 42,3: 407-418.

APPENDIX A: The Measurement of Bongaarts' Model Components

APPENDIX A: The Measurement of Bongaarts' Model Components

The methods described below follow approximately the proposal by Casterline et al. (1984). The Total Fertility Rate (TFR) is defined as:

$$TFR = 5 \sum_a f_a$$

where f_a is the fertility rate for the five-year age group a for the year preceding the survey, as calculated from birth histories. Age groups a (a = 1, ... , 7) correspond to the usual five-year groups 15-19, 20-24, ... , 40-44 years of age.

The Index of Marriage, C_m, is defined as:

$$C_m = \frac{TFR}{TMFR} = \sum_a f_a / \sum_a g_a$$

where g_a are the age-specific marital fertility rates, based on within-union births only. It should be noted that in the absence of direct measures for g_a, such rates can be estimated by $g_a = f_a / m_a$, where m_a is the proportion of married women in age group a. This was the procedure used in section IV, when dealing with marital fertility. Following Bongaarts, g_a for the first age group (15-19) was calculated as 75 percent of the corresponding value for the age group 20-24.

The Index of Contraception, C_c, is given by:

$$C_c = \frac{\sum g_a}{\sum g_a / (1 - p_a)} - \frac{\sum g_a}{\sum g_a / (1 - \sum u_{am} \cdot e_m / ft_a)}$$

where p_a is the proportion protected among fecund women, which in turn is defined by u_{am} = the proportion of currently married women aged a, who were currently using contraceptive method m; e_m = the contraceptive effectiveness of method m; and ft_a is the proportion fecund at age a. The contraceptive effectiveness weights are derived from Laing (1978):

Method	Use-effectiveness
Sterilization	1.00
Intrauterine device	0.95
Pill	0.90
Other	0.70

and the proportion fecund ft_a are obtained from Vaessen (1984):

Age group	Proportion fecund
15-19	0.99
20-24	0.99
25-29	0.98
30-34	0.95
35-39	0.91
40-44	0.78

It should be noted that $\sum g_a / (1 - p_a)$ can be defined as the potential marital fertility, in the absence of

It should be noted that $\Sigma\, g_a / (1 - p_a)$ can be defined as the potential marital fertility, in the absence of contraceptive protection, since $1 - p_a$ is the proportion fecund contraceptively unprotected in age group _a_.

The Index of Induced Abortion, C_a, is defined only for the total number of married women, since no estimates of age-specific abortion rates can be derived from the data. Thus, C_a is defined as suggested by Bongaarts (1982):

$$C_a = \frac{\text{TFR}}{\text{TFR} \cdot 0.4\,(1 + u) \cdot \text{TA}}$$

where TA is the total abortion rate among married women, and _u_ is the prevalence of current contraceptive use.

The Index of Postpartum Infecundability, C_i, is:

$$C_i = \frac{\Sigma\, g_a / (1 - p_a)}{\Sigma\, g_a\, [\,(1 - p_a)\, k_a]}$$

where $k_a = r_a / (q_a + i_a)$ and i_a = age-specific postpartum amenorrhea durations, estimated from the mean duration of breastfeeding B_a as follows:

$$i_a = 1.753\exp.\,(0.1396\, B_a - 0.001872\, B_a^{\,2});$$

r_a and q_a represent the length of the birth interval in months without the effects of lactational postpartum amenorrhea and without the effects of lactational and non-lactational postpartum amenorrhea, respectively. These parameters reflect the variation in mean waiting-time to conception, being empirically derived by Hobcraft and Little from data from the 1975 WFS survey in the Dominican Republic:

Age group	r_a	q_a
15-19	18.5	17.0
20-24	17.0	15.5
25-29	20.0	18.5
30-34	20.0	18.5
35-39	23.0	21.5
40-44	38.0	36.5

APPENDIX B: Definitions of Variables

APPENDIX B: Definitions of Variables

Variable	DHS Variable	Definition and Measurement
B = Children ever-born	212	Number of children ever-born alive
X_1 = Marriage duration	104 504	Difference between current age and age at first marriage
X_2 = First birth interval	503 217	First birth interval in months. Difference between date of first birth and date at marriage
X_3 = Second birth interval	217	Second birth interval in months. Difference between date of first birth and date at marriage
X_4 = Not secondarily sterile	352 408 328	Two category variable: 1 = fecund; 0 = sterile. If currently pregnant, respondent is fecund. If respondent reports fertility impairment, she is sterile. If respondent is not a current user of contraception and reports no births in the past five years, she is sterile.
X_5 = Length of breastfeeding	421	Number of months breastfed in the last birth interval
X_6 = Proportion of pregnancy wastage	226 212	Number of spontaneously wasted pregnancies, divided by the sum of wasted pregnancies, plus abortions, plus number of live births
X_7 = Proportion of child mortality	207 212	Number of children dead divided by total number of children ever-born
U = Years since first use of fertility control	309 311 323 503 217	If first method ever used was sterilization, date of sterilization is the date of first use. If another method was the first method used, the date of birth of the child after which was first used plus 12 months is the date of first use. If the woman used fertility control before any children were born, date at first use is the date of marriage. Years since first use is the difference between the date of interview and the date of first use.
Regulators/non-regulators	305	Reported ever-use of any method of contraception or abortion, 1 = yes (regulators); 0 = no (non-regulators)
C_n = Potential surviving children	-	(N X S), where N is determined by equation in Table 15 and S is (1 - X_7)

C_d = Number of children desired	619	Answers to the question "If you could choose exactly the number of children to have in your whole life, how many would that be?"
C = Number of living children	212 207	Reported number of living children ever-born minus dead children
Wants no more children	605	If respondent is fecund and wants no more children, wants no more = 1; else = 0
Number of methods known	301	Number of methods of fertility control known to the respondent and reported without special prompting. Sum of "1" responses on variables listed
Efficacy of methods known	301	Sum of methods known, as above, each weighted by its efficacy
Place of residence	-	Place of residence: 0 = rural; 1 = urban
Wife's education	106	Number of years of schooling
Husband's education	702	Same as above
Religiosity	719	Church attendance, going from 0 = never to 4 = at least once per week
Household income	706 705 715	Total household income
Exposure to mass media	108 109 110	Cumulative sum of answers to questions as to whether the wife usually (at least three times per week) reads newspapers, listens to the radio, or watches TV (answers coded 1 = yes; 0 = no)
Consumption scale	-	Cumulative scale indicating number of items in the household (where 1 = presence; 0 = absence). The items are: adequate water supply; adequate sewage disposal; presence of TV sets, radios, autos, maids, vacuum cleaners, and laundry machines.
Age	104	Woman's age in years

APPENDIX C: Tables

Table 1 Total fertility rate for total, urban, and rural population, Brazil and macro-regions, 1940-1984

Brazil and macro-regions	Total fertility rate					
	Total population					
	1940	1950	1960	1970	1980	1984
Brazil	6.16	6.21	6.28	5.76	4.35	3.53
North	7.17	7.97	8.56	8.15	6.45	--
Northeast	7.15	7.50	7.39	7.53	6.13	4.96
Southeast	5.69	5.45	6.34	4.56	3.45	2.96
South	5.65	5.70	5.89	5.42	3.63	3.04
Center-West	6.36	6.86	6.74	6.42	4.51	3.38
	Urban population			Rural population		
	1970	1980	1984	1970	1980	1984
Brazil	4.54	3.63	3.03	7.72	6.40	5.32
North	6.62	5.24	4.04	9.59	8.04	--
Northeast	6.44	4.94	4.00	8.45	7.66	6.47
Southeast	3.83	3.17	2.70	7.14	5.46	4.99
South	4.06	3.20	2.79	6.86	4.55	3.62
Center-West	5.31	3.97	3.06	7.71	5.98	4.57

Table 2 Age-specific fertility rates, Brazil and DHS regions, 1986 (Rates expressed per woman; estimates based on last year births)

Brazil and DHS regions	Total	Age-specific fertility rates 15-19	20-24	25-29	30-34	35-39	40-44
Brazil	3.40	0.069	0.189	0.174	0.126	0.084	0.038
Rio	2.24	0.053	0.125	0.118	0.071	0.081	0.000
São Paulo	2.63	0.052	0.210	0.102	0.121	0.041	0.000
South	3.07	0.067	0.149	0.158	0.123	0.053	0.063
Southeast	2.73	0.065	0.115	0.174	0.128	0.047	0.017
Northeast	5.04	0.087	0.242	0.252	0.181	0.171	0.074
North/C-West	4.01	0.084	0.272	0.269	0.065	0.037	0.074

Table 3 Proportionate distribution of fertility and the mean age at childbearing, Brazil, 1970, 1980, and 1986

Age groups	1970	1980	1986
15-19	5.4	7.6	10.2
20-24	21.3	23.8	27.8
25-29	26.2	26.6	25.6
30-34	22.2	20.9	18.5
35-39	16.7	14.3	12.4
40-44	8.3	6.8	5.6
Mean age	29.9	28.9	28.1

Table 4 Distribution of age-specific fertility rates, f(a); proportion of currently married women, m(a); and age-specific marital fertility rates, g(a), by age groups, Brazil, 1986.

Age group	f(a) per 1,000 women	m(a)	g(a) per 1,000 women
15-19	69	0.133	(276.9)
20-24	189	0.512	369.1
25-29	174	0.718	242.3
30-34	126	0.825	145.5
35-39	84	0.817	102.8
40-44	38	0.827	45.9

Table 5 Children ever-born to currently married women, Brazil, 1986

Age groups	Number of children ever-born alive 0	1	2	3	4	5	6	7	8	9	10+	Av-erage
15-19	36.2	48.5	10.5	4.3	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.8
20-24	16.8	39.8	29.1	8.9	2.4	1.9	0.6	0.4	0.0	0.0	0.0	1.5
25-29	7.2	24.8	28.7	19.6	9.0	5.2	3.1	1.3	0.6	0.5	0.1	2.4
30-34	4.0	11.6	26.4	21.1	12.9	10.1	5.7	3.4	1.7	1.9	1.2	3.3
35-39	3.6	5.1	19.5	22.0	15.9	9.8	7.9	5.7	2.8	2.3	5.3	4.2
40-44	4.6	6.1	14.2	18.6	11.5	9.5	5.9	7.7	6.6	4.6	10.7	5.0
Total	8.5	19.1	23.4	17.6	10.0	7.0	4.4	3.3	2.1	1.7	2.9	3.1

Table 6 Married women, 15-44 years old, using contraception by method used and region of residence

Contraceptive method	Region of residence Rio de Janeiro	São Paulo	South	South-east	North-east	North-Center-West
Female sterilization	33.0	31.4	18.3	25.7	24.6	42.0
Male sterilization	0.2	2.4	0.4	0.8	0.2	0.5
Pill	25.5	24.3	41.0	23.5	17.3	12.4
Withdrawal	2.9	6.7	7.7	2.7	4.3	2.4
Periodic abstinence[a]	5.4	3.3	3.1	6.5	4.5	2.9
Condom	1.8	3.1	1.7	2.0	0.5	0.5
Other	2.0	2.2	2.1	2.5	1.6	1.4
Total	70.9	73.5	74.4	63.7	52.9	62.1
Effectiveness(e)	0.914	0.905	0.887	0.901	0.909	0.980

[a]Rhythm and Billings

Table 7 Estimates for use-effectiveness, e(m), and prevalence, u(m), Brazil, 1986

Method (m)	Use-effectiveness e(m)	Prevalence u(m)	e(m).u(m)
Sterilization	1.00	27.7	27.7
IUD	0.95	1.0	1.0
Pill	0.90	25.2	22.7
Other	0.70	12.3	8.6
Total	--	66.2	59.9

Table 8 Use-effectiveness and degree of protection provided by contraception, by age, Brazil, 1986

Age groups	Proportion users (u_i)	Proportion protected all women $u_{im} \cdot e_m$	Effectiveness users $u_{im} \cdot e_m / u_i$	Proportion fecund ft_i	Proportion fecund users $u_{im} \cdot e_m / ft_i$
15-19	0.475	0.417	0.879	0.99	0.422
20-24	0.553	0.479	0.866	0.99	0.484
25-29	0.678	0.610	0.900	0.98	0.623
30-34	0.743	0.680	0.915	0.95	0.716
35-39	0.693	0.641	0.925	0.91	0.705
40-44	0.662	0.607	0.909	0.78	0.778

Table 9 Average durations of various components of postpartum sterility, Brazil and DHS regions, 1986

	Postpartum sterility (duration in months)		
Regions	**Breastfeeding**	**Amenorrhea**	**Abstinence**
Rio de Janeiro	8.6	3.8	3.8
São Paulo	9.1	3.7	2.7
South	9.7	4.2	3.6
Southeast	13.2	5.7	2.6
Northeast	7.5	3.7	2.7
North/Center-West	12.8	6.6	4.3
Brazil			
Mean	9.2	4.2	3.0
Median	5.4	2.4	1.6

Table 10 Average breastfeeding and postpartum sterility reported for the last child born, by age of the mother, Brazil, 1986

	Average duration (in months)	
Age	**Breastfeeding**	**Postpartum sterility**
15-19	2.87	2.58
20-24	4.17	3.04
25-29	5.31	3.49
30-34	6.57	4.05
35-39	6.91	4.20
40-44	7.28	4.39
Total	5.66	3.64

Table 11 Working table for the estimation of the index of marriage, C_m, Brazil and DHS Regions, 1986

Age	Region						
	Rio	São Paulo	South	South-east	North-east	North/ Center-West	Brazil
15-19	(0.191)	(0.259)	(0.192)	(0.165)	(0.279)	(0.332)	(0.239)
20-24	0.254	0.345	0.256	0.220	0.372	0.443	0.318
25-29	0.163	0.146	0.196	0.225	0.320	0.329	0.226
30-34	0.086	0.135	0.138	0.151	0.224	0.071	0.148
35-39	0.084	0.047	0.044	0.064	0.189	0.045	0.093
40-44	0.000	0.000	0.069	0.021	0.087	0.067	0.044
Total	0.778	0.932	0.895	0.846	1.471	1.257	1.068
TM	3.890	4.660	4.475	4.230	7.355	6.285	5.340
TFR	2.240	2.630	3.065	2.730	5.035	4.005	3.400
C_m	0.576	0.564	0.685	0.645	0.685	0.637	0.636

Table 12 Working table for the estimation of the index of contraception, C_c, by age

Age	g_a	$(1 - p_a)$	$g_a / (1 - p_a)$
15-19	0.239	0.578	0.413
20-24	0.318	0.516	0.616
25-29	0.226	0.377	0.599
30-34	0.148	0.284	0.521
35-39	0.093	0.295	0.315
40-44	0.044	0.222	0.198
Total	1.068	--	2.662

Table 13 Bongaarts' indices for Brazil and selected Latin American and Caribbean countries

Country	Marriage C_m	Contraception C_c	Infecundability C_i	TFR	FR (potential)
Colombia	0.602	0.633	0.846	4.27	13.2
Costa Rica	0.567	0.432	0.908	3.17	14.3
Dominican Rep.	0.689	0.697	0.852	5.39	13.2
Ecuador	0.656	0.709	0.782	4.98	13.7
Guyana	0.733	0.722	0.890	4.75	10.1
Haiti	0.646	0.862	0.726	5.15	12.7
Jamaica	0.739	0.641	0.851	4.52	11.2
Mexico	0.684	0.730	0.842	5.93	14.1
Panama	0.618	0.508	0.850	3.84	14.4
Paraguay	0.626	0.711	0.811	4.56	12.6
Peru	0.629	0.755	0.769	5.35	14.6
Trinidad & Tobago	0.702	0.569	0.887	3.18	9.0
Venezuela	0.635	0.580	0.865	4.36	13.7
Brazil	0.636	0.401	0.911	3.40	14.6

Source: United Nations, op. cit., pp. 168-169

Table 14 Correlations, means, and standard deviations of proximate determinants of fertility for continuously married women with two or more live births, Brazil, 1986

Variable	Correlations									Mean	Std. dev.
Duration of marriage	1.00									10.80	5.45
1st birth interval	0.18	1.00								14.99	13.18
2nd birth interval	0.03	0.01	1.00							30.89	22.13
Non-sterile	0.00	0.00	-0.05	1.00						0.98	0.12
Dur. breastfeeding	0.17	-0.05	-0.03	0.02	1.00					6.21	8.66
Pregnancy losses	0.07	0.12	0.08	-0.01	0.02	1.00				0.07	0.13
Child mortality	0.08	-0.05	-0.15	-0.01	-0.08	-0.03	1.00			0.08	0.15
Use of contraception	-0.05	0.05	0.10	0.08	-0.03	-0.04	-0.18	1.00		0.90	0.30
Dur. contraception	0.54	0.11	0.20	0.07	0.05	0.04	-0.13	--	1.00	88.89	58.91
Parity	0.69	-0.09	-0.31	0.00	0.08	-0.02	0.31	-0.23	0.07	3.84	2.44
Variable	X_1	X_2	X_3	X_4	X_5	X_6	X_7	U_1	U_2		

Table 15 OLS regression for proximate determinants of fertility, continuously married women with two or more live births, Brazil, 1986

Parameter	U = Duration of contraception: ß metric (std. error)	U = Duration of contraception: ß* standardized	U = Use/nonuse: ß metric (std. error)	U = Use/nonuse: ß* standardized
X_1: Duration of marriage	0.411 (0.008)	0.919	0.326 (0.008)	0.730
X_2: 1st birth interval	-0.039 (0.003)	-0.211	-0.038 (0.003)	-0.204
X_3: 2nd birth interval	-0.027 (0.002)	-0.241	-0.031 (0.002)	-0.285
X_4: Not secondarily sterile	0.337 (0.293)	0.071	0.036 (0.323)	0.002
X_5: Duration of breastfeeding	-0.019 (0.004)	-0.069	-0.015 (0.005)	-0.055
X_6: Pregnancy losses	-0.466 (0.276)	-0.025	-0.499 (0.304)	-0.027
X_7: Child mortality	2.244 (0.251)	0.138	2.734 (0.276)	0.169
U: Deliberate fertility control	-0.014 (0.001)	-0.333	-1.081 (0.136)	-0.133
Constant	1.688 (0.307)	--	2.719 (0.352)	--
R^2	0.748		0.693	
F	425,200		323,840	

Table 16 Means and standard deviations of estimated natural fertility (N) and present parity (B) by fertility regulation, Brazil, 1986

Statistics	Non-regulators		Regulators	
	Natural fertility	Present parity	Natural fertility	Present parity
Mean	5.79	5.81	4.66	3.64
Standard deviation	2.91	3.60	2.22	2.19
Number of cases	103		1,054	

Table 17 Means and standard deviations of proximate determinants of fertility by fertility regulation, Brazil, 1986

Variables	Regulators		Non-regulators	
	Mean	Standard deviation	Mean	Standard deviation
Parity	3.69	2.19	5.81	3.60
U : Duration of contraception*	98.03	58.22	0.00	0.00
X_1: Duration of marriage**	10.63	5.27	12.33	6.90
X_2: 1st birth interval*	15.18	13.11	12.98	14.18
X_3: 2nd birth interval*	31.56	22.59	25.27	16.67
X_4: Not secondarily sterile	0.99	0.11	0.95	0.22
X_5: Duration of breastfeeding*	6.04	8.59	7.42	9.14
X_6: Pregnancy losses	0.07	0.13	0.09	0.13
X_7: Child mortality	0.07	0.14	0.16	0.18
Number of cases	1,054		103	

(*) In months; (**) In years

Table 18 Correlations between duration of contraceptive use and several measures of motivation to regulate fertility for the total population and the population of regulators, Brazil, 1986

Variable	Durat. of use	$(C_n - C_d)$	Wants no more	$(C - C_d)$	C_n	C_d	C	Mean	Std. dev.
Duration of use	-	0.379	0.189	0.064	0.505	0.060	0.133	89.30	58.81
$(C_n - C_d)$	0.453	-	0.340	0.853	0.665	-0.573	0.487	1.163	2.435
Wants no more	0.223	0.359	-	0.318	0.247	-0.172	0.220	0.782	0.413
$(C - C_d)$	0.132	0.845	0.340	-	0.479	-0.585	0.651	0.285	2.396
C_n	0.641	0.682	0.262	0.465	-	0.232	0.791	4.308	2.052
C_d	0.136	-0.543	-0.176	-0.586	0.244	-	0.234	3.145	1.870
C	0.286	0.500	0.242	0.646	0.787	0.240	-	3.429	1.999
Mean	98.03	1.186	0.782	0.222	4.272	3.086	3.308		
Standard deviation	54.23	2.339	0.413	2.244	2.025	1.765	1.873		

Table 19 Correlations between measures of motivation and costs of regulation for the total population and the population of regulators, Brazil, 1986

	Total population		Regulators	
Variables	**Number of methods**	**Efficacy of methods**	**Number of methods**	**Efficacy of methods**
Duration of use	0.204	0.210	0.087	0.094
$(C_n - C_d)$	-0.053	-0.049	-0.065	-0.077
Wants no more	0.058	0.070	0.064	0.077
C_n	-0.114	-0.106	-0.102	-0.097
C_d	-0.053	-0.052	-0.031	-0.031

Table 20 OLS regression for duration of contraceptive use for the total population and the population of regulators: Brazil, 1986[1]

	Total population							
Coefficients	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
Motivation								
$(C_n - C_d)$	9.440 (0.391)	9.428 (0.390)						
Wants no more			25.253 (0.177)	24.880 (0.174)				
C_n					15.314 (0.534)	15.286 (0.533)	15.656 (0.546)	15.627 (0.545)
C_d							-1.639* (-0.05)	-1.636* (-0.05)
Costs of regulation								
Nº of methods	7.337 (0.225)		6.329 (0.194)		8.605 (0.264)		8.557 (0.262)	
Efficacy		9.273 (0.230)		8.003 (0.198)		10.781 (0.267)		10.722 (0.266)
Constant	61.078	60.215	54.686	54.213	3.111	2.388	6.905	6.177
R^2	0.194	0.196	0.073	0.075	0.324	0.325	0.326	0.328
F	137.33	139.29	44.960	46.040	272.82	275.13	183.86	185.41

1 Metric and standardized coefficients (in parenthesis) are significant at conventional levels, except where an * indicates that they are significant at the 5 percent level.

Table 21 OLS regression for duration of contraceptive use for the total population and the population of regulators: Brazil, 1986[1]

	Regulators							
Coefficients	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
Motivation								
$(C_n - C_d)$	10.667 (0.460)	10.662 (0.459)						
Wants no more			28.617 (0.218)	28.453 (0.216)				
C_n					17.590 (0.657)	17.574 (0.656)	17.727 (0.662)	17.711 (0.661)
C_d							-1.644* (-0.21)	-1.641* (-0.21)
Costs of regulation								
Nº of methods	3.529 (0.117)		2.213 (0.073)		4.652 (0.154)		4.648 (0.154)	
Efficacy		4.538 (0.121)		2.875 (0.077)		5.864 (0.157)		5.859 (0.157)
Constant	76.546	75.951	70.101	69.792	11.234	10.754	12.649	12.163
R^2	0.218	0.220	0.055	0.055	0.435	0.435	0.435	0.436
F	142.68	143.56	29.65	29.95	392.36	261.76	183.86	262.68

1 Metric and standardized coefficients (in parenthesis) are significant at conventional levels, except where an * indicates that they are significant at the 5 percent level.

Table 22 OLS regressions of supply and demand for children and costs of regulation on socioeconomic and cultural variables for the population with two or more children: Brazil, 1986 (N = 1,025)

Variables	C_d	RC	C_n	X_1	X_2	X_3	X_4	X_5	X_6	X_7
1. Place of residence	-0.153 (0.038)	0.251 (0.063)	-0.132 (-0.030)	0.026 (0.002)	0.012 (0.000)	5.318 (0.111)	-0.010 (-0.038)	-1.207 (-0.065)	0.011 (0.036)	-0.008 (-0.027)
2. Wife's education	-0.054* (-0.119)	0.125* (0.277)	-0.105* (-0.210)	-0.281* (-0.216)	0.178 (0.054)	0.423 (0.078)	0.000 (0.002)	-0.237* (-0.111)	0.000 (0.007)	-0.005* (-0.131)
3. Husband's education	-0.011 (-0.026)	0.032 (0.076)	-0.043* (-0.090)	-0.076* (-0.062)	0.315* (0.102)	0.279 (0.054)	0.000 (0.000)	0.034 (0.017)	-0.002 (-0.054)	-0.002 (-0.063)
4. Religiosity	0.088* (0.077)	-0.071* (-0.063)	0.035 (0.028)	0.009 (0.003)	-0.497 (-0.060)	-0.178 (-0.013)	0.000 (0.001)	0.001 (0.000)	0.001 (0.007)	0.000 (-0.001)
5. Household income	0.018 (0.047)	0.010 (0.028)	0.013 (0.031)	0.042 (0.039)	0.104 (0.039)	-0.271 (-0.061)	-0.000 (-0.006)	0.010 (0.006)	0.000 (0.015)	0.003* (0.093)
6. Rio/São Paulo	-0.386 (-0.098)	0.287 (0.073)	-0.530* (-0.122)	-1.447 (-0.128)	-1.437 (-0.051)	4.354 (0.092)	-0.004 (-0.017)	-1.233 (-0.067)	-0.017 (-0.059)	0.000 (0.001)
7. South	0.012 (0.003)	0.459 (0.101)	-0.314 (-0.062)	-0.440 (-0.034)	-0.615 (-0.019)	11.341* (0.207)	0.008 (0.028)	-1.557 (-0.073)	-0.018 (-0.052)	-0.021 (-0.061)
8. Southeast	0.048 (0.009)	0.378 (0.076)	-0.562* (-0.101)	-0.960 (-0.067)	1.632 (0.045)	6.836 (0.113)	0.020 (0.062)	-1.006 (-0.043)	0.030 (0.079)	-0.003 (-0.008)
9. Northeast	-0.223 (-0.056)	0.167 (0.042)	-0.371 (-0.084)	-0.808 (0.070)	-0.222 (-0.008)	1.242 (0.026)	0.013 (0.049)	-3.841* (-0.205)	0.008 (0.026)	0.038 (0.121)
10. Exposure to mass media	0.033 (0.017)	0.090 (0.045)	-0.011 (-0.005)	-0.064 (-0.011)	-0.780 (-0.055)	0.430 (0.018)	0.002 (0.013)	0.498 (0.054)	-0.005 (-0.036)	-0.001 (-0.009)
11. Consumption scale	-0.057 (-0.062)	0.079 (0.087)	0.046 (0.045)	0.132 (0.050)	0.728* (0.110)	-0.037 (-0.003)	0.006 (0.093)	-0.239 (-0.056)	0.007 (0.099)	-0.006 (-0.084)
12. Age	0.045* (0.142)	0.017 (0.053)	0.228* (0.653)	0.665* (0.733)	0.369* (0.162)	0.442* (0.117)	-0.002* (-0.078)	0.152* (0.103)	0.002* (0.089)	-0.001 (-0.027)
Constant	2.282	0.291	-1.750	-7.686	0.082	6.015	1.012	5.135	-0.009	0.137
R^2	0.073	0.236	0.529	0.630	0.089	0.074	0.014	0.043	0.034	0.088
F	6.512	25.534	92.759	140.523	8.065	6.600	1.141	3.721	2.899	7.930
R^2 exc. variable age	0.055	0.234	0.141	0.141	0.065	0.062	0.008	0.034	0.027	0.087

(1) Metric and standardized coefficients (in parenthesis); (*) Significant at 5 percent or less.

The research project reported on in this issue is "An Analysis of Reproductive Behavior in Brazil." For further information on this work, write to the principal investigators, Nelson do Valle Silva, Laboratório Nacional de Computação Científica, Conselho Nacional de Desenvolvimento Científico e Technológico, Rua Lauro Muller 455, Rio de Janeiro, Brasil; Amaury de Souza, Rua São Joao Batista, No. 20, 22270 Rio de Janeiro, Brasil; or to Maria Helena F. T. Henriques, Gunaydin Apartaman, Blok A.D. 5, Cevdet Pasa Cad. 142, Bebek, Istanbul, Turkey.

Demographic and Health Surveys Further Analysis Series

1. "Health and Population Studies Based on the 1987 Thailand Demographic and Health Survey"
   Institute of Population Studies, Chulalongkorn University
   December 1989

2. "Population Studies in Sri Lanka and Indonesia Based on the 1987 Sri Lanka Demographic and Health Survey and The 1987 Indonesia National Contraceptive Prevalence Survey"
   March 1990

   "Traditional Contraceptive Use in Sri Lanka: A Cross Survey Analysis"
   Soma Silva, Victor de Silva, and A.T.P.L. Abeykoon, The Family Planning Association of Sri Lanka

   "Fertility Transition in Indonesia: Trends in Proximate Determinants of Fertility"
   Sri Moertiningsih Adioetomo, Ayke S. Kitting, and Salman Taufik, Demographic Institute, Faculty of Economics, University of Indonesia

   "Correlates of Method Choice in Indonesia"
   John W. Molneaux, Charles Lerman, E. Srihartati P. Pandi, and Sono Trisno Wibisono, Badan Koordinasi Keluarga Berencana Nasional

3. "Breastfeeding and Diarrhea in Brazilian Children"
   Fernando C. Barros and Cesar G. Victora
   Department of Social Medicine, Universidade Federal de Pelotas
   March 1990

4. "Selection, Change, and Discontinuation of Contraceptive Methods in Trinidad and Tobago"
   Norma Abdulah, Institute of Social and Economic Research, the University of the West Indies
   March 1990

5. "Family Formation Patterns and Child Mortality in Mexico"
   José Luis Bobadilla, Loraine Schlaepfer, and Javier Alagón
   Instituto Nacional de Salud Pública, Centro de Investigaciones en Salud Pública
   March 1990