The Economics and Sociology of Fertility: A Synthesis

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This chapter presents an analysis, the main outlines of which were first sketched in 1970 in a paper prepared for the United Nations Population Division (Easterlin 1970). A much fuller statement was presented in 1972 at the Princeton seminar whose proceedings comprise the present volume. The chapter constitutes almost a complete redrafting of that paper, presenting the analysis in more formal terms.

A chapter with such a long history necessarily places the author in debt to so large a number of individuals that adequate acknowledgment is impossible. I can list here only a few from whose comments I have particularly benefited in way or another, with apologies to those omitted: Glen G. Cain, John D. Durand, Stefano Fenoaltea, Henry A. Gemery, Adrienne Germaine, Ralph B. Ginsberg, Michael R. Haines, Allen C. Kelley, Ronald Lee, Peter H. Lindert, Jay R. Mandle, George S. Masnick, Karen O. Mason, William H. Newell, Robert A. Pollak, Robert Summers, Riad B. Tabbarah, Etienne van de Walle, Michael L. Wachter, and Barbara Wolfe. General acknowledgment should also be made of the helpful contributions of my colleagues in the Princeton seminar, and of several classes of graduate students in my course on economic-demographic interrelations. Finally, I want especially to acknowledge the help of my research assistant, Gretchen A. Condron, with whom I had continuously profitable discussions over several years, and assistance in production of the paper of Dana E. Lightman, Cynthia E. Schneider, and Betty A. Rippel. Lydia F. Christaldi drew the charts. The research on which the paper is based was supported in part in NICHD grant 1 RO1 HD-05427 and NSF grant GS-1563.

After decades outside the fold, population has become in recent years a legitimate subject of economic analysis. Nowhere is this change more exemplified than in the study of the causes of human fertility. There was a time when economists perfunctorily abandoned this subject to sociologists and demographers. Since Becker’s seminal article, however, recognition has grown of the possibility of incorporating this area
of human behavior into the theory of household decision making (1960: 209–231). Both theoretical and empirical work have increased at a respectable, if not overwhelming, rate.

Sociologists and demographers have viewed this incursion with mixed feelings. On the one hand, the possibility is enhanced of clarifying the persistently troubling problem of the role of economic considerations in human fertility. On the other hand, there is dismay at the tendency of economists to disregard the conceptual and empirical contributions of noneconomists, and by implication to assert the primacy and universality of what might be called the “economic theory of fertility,” stemming from Becker’s work.

Indeed, there are well-grounded empirical observations which must give pause to even the boldest exponent of the household decision-making approach. In Africa, for example, there are wide differences among populations in marital fertility, with some societies approaching levels of completed fertility as low as those observed in developed societies (Clark 1967: 24). A matter of differences in the demand for children due to cost or income factors? Of differential knowledge of methods of fertility control? It seems doubtful. There is little or no evidence of conscious efforts by most households to regulate fertility in these societies. How then can these differences be viewed as a matter of household choice?

The African data exemplify a more general conclusion that has emerged in recent years regarding fertility in premodern societies. As Bourgeois-Pichat has observed, it used to be thought that fertility in such societies was universally high and that modernization resulted in the emergence of noticeable fertility differences among societies. The evidence now becoming available, however, suggests that fertility differences among preindustrial societies are vastly greater than those among modernized societies (Bourgeois-Pichat 1967b: 160–163).

There is evidence too of significant short and long term fluctuations in fertility in premodern societies (Wrigley 1969: ch. 3). Moreover, sizeable and reliably documented increases in fertility have been observed during what might be called “early modernization” in places such as Jamaica, British Guiana, and parts of Africa (Haurau 1965: 801–828; Mandle n.d.; Olusanya 1969: 812–824; Roberts 1957: 262–285, 1969: 695–711). Similar increases may have occurred in the earlier experience of today’s developed countries (cf. Shorter 1971a). An effect of rising income on the demand for children? Possibly. But in some of these places there appears to be little evidence of noticeable income change among the mass of the population when fertility was rising (Mandle n.d.: ch. 8).

There are other reservations one may have about the economic analysis of fertility. For one thing, it is a notably sexless subject. This is not a mere quibble, for this omission has logical consequences for the theory. Without reference to sexual intercourse one is hard put to explain why households would engage in the “production” of children once the desired number is reached, and consequently why excess fertility would ever occur (Easterlin 1969: 136). Similarly, there is a notable scarcity in the economic analysis of fertility of references to physiological or biological factors that may influence fertility. There is also inadequate consideration of the nature of and evidence on the ways in which fertility is actually regulated.

 Doubtless these omissions reflect in part the empirical reference implicit in most economists’ work, namely, fertility behavior in the more advanced nations. But even for these nations, fertility among certain population subgroups, as well as nonmarital fertility, might well require reference to such considerations. When economists turn to less developed nations, fertility analysis does sometimes touch on matters such as fecundity. But such considerations are treated much less systematically than the core variables of price and income.

In contrast, sociologists start with what might be called the production side of fertility. The analysis typically proceeds from discussion of frequency of intercourse and the reproductive capacity of a population to specific methods of fertility regulation, such as abstinence, contraception, and abortion, by which births are kept below the biological maximum. Beyond this, the discussion moves on to motivational and other factors, but the framework becomes much less uniform from one writer to another.

It seems reasonable to suppose that an analysis which integrated the approaches of both sociologists and economists might clarify their relationship and help foster beneficial exchanges between scholars in the two disciplines. It might also have wider empirical applicability than either approach taken alone. Accordingly, this chapter proposes a framework which would combine the economics and sociology of fertility. In an earlier article, I made a start in this direction, emphasizing the contribution that sociology might make to the economics of fertility, chiefly through clarifying the process of taste formation (Easterlin 1969: 127–156). In retrospect, this argument, though valid, underrates the role of sociology, because it omits the extensive sociological literature dealing with supply considerations. The present treatment, I feel, represents more nearly a marriage of equals, though partisans of either discipline will doubtless come away feeling short-changed.
A valuable step in the direction of reconciling the two disciplines is provided by Riad Tabbah’s contribution (Tabbarah 1971: 257–277). In developing the present analysis, Michael L. Wachter’s contribution (1972) has played an important part. Wachter’s article was especially helpful in suggesting a formal and readily comprehensible expository framework. Other work that has been drawn on substantially includes that of Bourgeois-Pichat and Henry on natural fertility (Bourgeois-Pichat, 1965: 383–424, 1967a: 68–72, 1967b: 160–163; Henry, 1961a: 625–636, 1961b: 81–91, 1963: 333–350) and those of Freedman (1961–1962: 35–88), Davis and Blake (1956: 211–235), and Petersen (1969) on the sociology of fertility. Mention should be made too of Ansley Coale’s framework for fertility analysis (Coale 1971: 193–214, 1967: 205–209, 1969: 3–24, 1973). While Coale’s approach is not included in the present scheme, which focuses on marital fertility, extension of the present framework to incorporate the Coale approach is both possible and desirable, as shall be shown later.

First, the analysis presents the “simple” economics of fertility, and then the “simple” sociology of fertility. In such brief compass, it is not possible to do justice to either of these substantial subjects, and the treatment is necessarily heuristic and selective. Then the formal synthesis is discussed. Throughout these first three sections, the concepts and form of the framework are developed with a view to maximizing links to the empirical literature. To this end, reference is frequently made to relevant data both for developed and less developed areas. The concern is with marital, not total fertility. Following the theoretical exposition, the usefulness of the framework is illustrated by applying it to the interpretation of some real world situations—fertility behavior in premodern societies and the effect of modernization on fertility (the demographic transition). The chapter concludes by noting various qualifications and needed extensions of the analysis.

I
THE SIMPLE ECONOMICS OF FERTILITY: A DEMAND APPROACH

Among economists, Becker’s analysis of the demand for children based on tastes, prices, and income is the common ground from which fertility analysis starts (Becker 1960: 209–231, 1965: 493–517). Beyond this (or recent variants thereof), differences start to appear. The principal idea, stemming from the theory of consumer choice, is that the demand for children is based on the household’s balancing of its subjective tastes against externally determined constraints of price and income in a way that maximizes its satisfaction. Considerations of fecundity and contraception enter in regard to the possible “over-production” of children, but the primary emphasis is on demand factors, and these other concepts, along with child-spacing concerns, are not as systematically integrated into the theoretical framework.

The basic reasoning is as follows. Suppose households view children as a type of consumption good, yielding satisfaction like economic goods in general. Household desires for children can be conceived in terms of an indifference map with number of children on one axis and goods consumed by the parents on the other (see the I1, I2, and I3 curves of Figure 2–1a). Any given point on the map expresses the degree of satisfaction attaching to that particular combination of children and commodities. An indifference curve embraces all combinations that yield the same amount of satisfaction—curves further from the origin correspond to progressively higher levels of satisfaction. Formally, the indifference map for an individual household may be expressed by

\[ U = f(G_p, C), \]

where \( U \) is the utility of the parents, \( C \) is the number of children surviving to adulthood, and \( G_p \) is the quantity of goods consumed by the parents.

One can think too of a price tag attaching to children. This would consist of the appropriately discounted cost of the various expense items required to have and raise children, including the opportunity cost of the time devoted to child care, due allowance being made for the offset constituted by the work done by children. Together with household income and the prices of goods consumed by the parents, this establishes the household’s budget constraint (the ef line of Figure 2–1a). The budget constraint describes the set of combinations of \( G_p \) and \( C \) which are affordable given the household’s income and the prices prevailing in the market.

and C constituting the outer limit of those within financial reach of the household. Analytically, the budget constraint is given by:

$$Y = p_x C_x + p_c C_c,$$

where Y is the potential lifetime income of the household, and $p_x$ and $p_c$ are the prices of goods and children, respectively.

For simplicity, it is assumed that the household makes a single decision at the start of the reproductive union based on the discounted values of income and prices expected over the course of its life cycle. Given the limit to its choices imposed by the budget constraint, the household selects the combination of children and goods that will yield the largest subjective satisfaction. In Figure 2–1a, this is the combination $C_x, C_c$, given by the tangency of the indifference curve $I_0$, the outermost curve attainable, with the budget line ef. If the basic taste, income, and price determinants remained unchanged, and the estimates of them were correct, the household's reproductive career would consist of the implementation of this decision.

Observed behavior with regard to family size is thus the result of balancing subjective preferences against an externally imposed constraint based on prices and income. Variations in these basic determinants will cause differences in behavior among households at a given time or for a given household over time. If the level of the household's expected income were higher, the equilibrium combination would include both more children and more goods (assuming as is customary that children are "normal" goods), though the increase would not necessarily be proportionately the same (Figure 2–1b). If the relative price of children were higher, for example because, the price of child care items rose more than the average price of goods generally, the optimal combination would shift toward more goods and fewer children (Figure 2–1c). Finally, if subjectively the attractiveness of commodities rose relative to that of children, a similar shift would occur (Figure 2–1d). Thus, the number of children parents have would be expected to vary directly with household income and with the price of goods relative to children, and inversely with the strength of desires for goods relative to children. Changes in the basic determinants might occur in the course of the reproductive cycle of a household and lead to altered decisions and fertility behavior.

The dependent variable in the economic analysis of fertility is surviving children: parents are ultimately interested in grown offspring, not births. Birth behavior is linked to the demand for children through
the rate of infant and child survival. For households to achieve a given number of surviving children, the necessary number of births would be higher the lower the level of infant and child survival. Thus, we have for a given household

\[ B = \frac{C}{s} \tag{3} \]

where \( B \) is the total number of births, \( C \) is as defined in (1) above, and \( s \) is the probability of survival of a live birth to adulthood, say, age 20.

Even though tastes, prices and income (and thus \( C \)) remain unchanged, birth behavior might vary because of changes in the survival prospects of children. Other things being equal, the higher the survival prospects, the lower the number of births. The high rates of infant and child mortality observed in premodern compared with modernized societies are frequently cited to account for pronatalist practices in the premodern societies—high fertility helps to compensate for high infant and child mortality and thus enhances (but does not guarantee) the prospect of realizing the number of children demanded.

In the economic analysis of fertility, observed birth behavior may differ from that dictated by demand considerations because of a tendency for too many births. Usually this is viewed as caused by inadequate knowledge of contraception or because of inefficiency in its use. Thus contraceptive knowledge and practice eventually enter the analysis, although both the theoretical and empirical treatment of these factors is much less refined than that for the demand variable.

So far the presentation has implicitly assumed (as is usual in consumer demand theory) that the quality of the goods under discussion is given. Thus the decision to have more or fewer children refers to children of a given “quality,” that is, embodying a given set of inputs of time and goods. Allowance can be made for child quality by viewing it as an additional good along with number of children and goods consumed by the parents (Wachter 1972). The equilibrium decision would then involve a combination of \( G_p, C \), and child quality. An increase in income would be expected to raise not only the number of children but also child quality, while a rise in the relative prices of inputs required for children would lead to substitution against both child numbers and quality. Also subjective preferences relating to child quality might change. For example, increased concern for the quality of children might occur at the expense of feelings about the number of children, and lead to the selection of combinations in which child quality is more favored relative to child numbers.

While the analysis is straightforward, the concepts involved in the economics of the demand for children are, in practice, far from simple. The income concept, \( Y \), relevant to fertility decisions is the “full income” or “potential income” of the household (Easterlin 1969: 129). This takes account of the earnings potentials of both the husband, wife, and children over the course of the parents’ life cycle, as well as any nonlabor income available to the household. The usefulness of actual income observations as an approximation to this concept must be assessed in the light of the problem at hand. The husband’s income may be less biased as an indicator of household differences in potential income than family income, which includes earnings of the wife as well as other family members (Easterlin 1969: 155). But even the husband’s current income is not necessarily a reliable guide to household differences in potential income, as in the case where the observations relate to an early stage of the life cycle and do not adequately reflect differences in longer term income prospects—differences that would play a part in actual family size decisions.

The price of children, \( p_c \), is a price index which expresses the (properly discounted) cost at any given time of the market-basket of commodities and time required for child-bearing and child-rearing, relative to a price index of the items alternatively consumed by the parents, \( p_r \). The items comprising this market-basket (the quantities included in the index) embrace a child’s requirements up to adulthood for such things as food, shelter, clothing, education, and hospital and medical care (including that of the mother associated with pregnancy and birth) plus the labor time required for child-care, net of the child’s contribution of time for paid work and household chores. The prices are actual market prices. The relative price of children to a household would be expected to decrease with the number of children, because of influences such as economies of scale in consumption and the possibility of older children caring for the younger, resulting in a budget constraint convex to the origin.

Economists typically value child-care time in terms of the wife’s opportunity cost, usually assumed to be proportionate to the full-time rate of earnings of women actually in the work force (Mincer 1963: 67–82). The validity of this assumption is likely to vary with the problem under study. There is some minimum unavoidable amount of time

\(^2\) A number of the following points are discussed and illustrated more fully in (Easterlin 1969).
that a mother must typically give to child-care, and the wife's earning potential is relevant to evaluation of this time. But it is possible to obtain domestic help to cover a substantial part of child-care requirements. There may also be available for this purpose private or public child-care facilities, or elderly relatives and older children living in the household with low market earnings prospects. Another possibility is that mothers with low market opportunities might offer day care facilities for the children of others. In all such cases, use of the wife's wage rate to evaluate all child-care time is likely to exaggerate the cost of children if the wife is above the lowest wage level (see Hill and Stafford 1971 for pertinent data).

In view of the frequent mention of cost considerations in the fertility literature, it is surprising to find that conceptually meaningful estimates of the relative price of children are virtually nonexistent. If the true effect on fertility behavior of prices rather than tastes or income is to be estimated, measured time or space variations in the price of children should arise solely from the prices, and not the quantities in the index of the relative price of children. The extent of measured price variation will differ, of course, depending on the market-basket of quantities by which the prices are weighted, the "quality" of children. This is a common index number problem which may be handled by developing alternative price indexes, each relating to a given quality of children. Any given index, however, should be estimated for a fixed market-basket of child cost items. Otherwise, estimates of the price elasticity of demand for children, based on the co-variation of fertility and prices, would confound the effect of price changes with those of income and tastes, and lead to erroneous inferences, for example, about the likely impact of disincentive policies on fertility. Most data that are labeled "cost of children" are not conceptually appropriate, because they are typically estimates of expenditures on children and thus include the effect of quantity as well as price variations (United Nations 1956). Empirical research by economists has largely focused on a particular component of the price of children, typically the opportunity cost of the wife, or settled for qualitative judgments, for example, based on rural versus urban residence (Mincer 1963: 67-82; Phillips et al. 1969: 298-308). However, recent and ongoing work shows promise of providing new insights on this question (see Cain 1971: unpublished appendix; Espenshade 1972: 207-221; and especially Lindert 1973, which is by far the most thorough inquiry yet attempted). Probably the most defensible generalization at present is that the relative price of children is higher in nonfarm than in farm situations, due to differences in food prices, housing prices, the time children take away from a mother's paid work, and the time contributed by children to the household's activities (Lindert 1973: 37). This would imply that the relative price of children is less in less developed societies than in more developed societies. But there is need for more thorough empirical study of variations in the cost of children in time and space, and among various subclasses of the population.

Relatively little research has been done by economists on preferences and "tastes" for children, in the sense of a preference map expressing the household's estimation of the degree of satisfaction attaching to various possible combinations of children and other economic goods. However, there has been some work which has yielded empirical maps of indifference curves relating to different commodities (shirts versus shoes) and to household attitudes toward male versus female children (and implicitly different numbers of children) (Myers and Roberts 1968: 164-172; Roberts et al. 1971). These studies suggest the possibility of directly measuring tastes as defined in (1) above. In sociology, attitudinal data already available both on goods aspirations and ideal family size \(^2\) throw some light on preferences (Blake 1967: 139-174; Freedman et al. 1959; Ryder and Westoff 1971; Whelpton et al. 1966). Also relevant is research which has made progress toward estimating the respondent's intensity of feeling about different family size numbers (Goldberg and Coombs 1962: 105-129). One interesting result of research done on American attitudes is that for an overwhelming proportion of adults the ideal number is concentrated in the two to four child range (Freedman et al. 1965: 250-275). Families with no children or only one tend to be much less favored. Moreover, it seems possible that a mix of 2 boys and 2 girls represent a saturation point for many Americans.\(^4\)

In the absence of direct measures of tastes, indirect estimation is possible using a model of taste formation. The preference map at any time may be viewed as molded by heredity and past and current environment (Spengler 1966: 109-130). For example, tastes may be taken as a function of such factors as religion, color, nativity, place of residence, education, family economic background, and the number of siblings. These factors may be introduced into the demand function in lieu of direct readings on tastes.\(^5\) Ideally, the treatment of

\(^2\) Of the various queries on family size attitudes, that on "ideal" size probably elicits the least constrained response.

\(^4\) Attitudinal data sometimes reveal strong preferences as to the sex of the children (Freedman and Taskeshita 1969). This consideration may enter as an additional influence on tastes affecting the number of children demanded.

\(^5\) Some work is in progress along these lines (Ben-Forth, unpublished; Condran, unpublished; Wolfe, unpublished).
such factors would be based on a tested model of taste formation derived from multivariate analysis of preferences and their underlying determinants.

Despite limited research on preferences, there is reason to think that the preference for children relative to other goods may be greater in less developed societies than in developed. For example, comparing the goods aspirations of survey respondents in developed and less developed countries, Hadley Cantril has concluded: "People in highly developed nations have obviously a wide range of aspirations, sophisticated and expensive from the point of view of people in less-developed areas, who have not yet learned all that is potentially available to people in more advanced societies and whose aspirations concerning the social and material aspects of life are modest indeed by comparison" (Cantril 1965: 202; cf. D. Freedman unpublished papers and 1970: 25–48). On the other hand, expressions of family size preferences yield larger numbers in less developed countries (Glass 1962: 231–261; Mauldin 1965: 1–12). While these differences in response may be partly due to different income and price constraints which are implicitly taken into account, they may also reflect differences in basic subjective attitudes toward children versus goods.

The foregoing discussion of child preferences relates to completed family size, and not the spacing of children. Subsequently, the assumption will be made that prospective parents are not concerned about the spacing of births. The main reason for this assumption is to simplify the exposition, but it is pertinent to note that there is some empirical justification for the present emphasis on completed size, though to neglect spacing considerations entirely is, of course, extreme. For example, criticizing the emphasis that some advocates of family planning in less developed areas place on attention to spacing, Stycos says: "[T]he evidence indicates in various ways that women in the underdeveloped areas are more interested in stopping births. On the whole, women have relatively little interest in fertility control early in the pregnancy history. For reasons of prestige, marital legitimation solidifying otherwise unstable unions, etc., women in cultures where kinship is of special importance want a few children, or at least one or two sons, as soon as possible after marriage. Having discharged their obligation and achieved their status as fertile women, they subsequently become concerned about economic, rearing and health difficulties" (Stycos 1962: 488).

Moreover, even in developed countries, while attention to spacing is more common, spacing preferences may be rather ill-defined. A study of American fertility attitudes and behavior leads Westoff et al.,

to the hypothesis that control over child-spacing is not more common because "spacing values are often vague and of low intensity, thereby resulting in a half-hearted practice of contraception, or sometimes dispensing with it altogether," and a comparison of spacing preferences and actual birth intervals shows only a weak association (Westoff et al. 1961: 21–22). In general, it seems that attitudes toward spacing are much less well-developed than are preferences for completed family size, and that the fertility transition accompanying modernization typically involves attention first to limiting family size and only at a later stage to spacing of births. Nor should one exaggerate the precision with which either number or spacing preferences are held. In general, even in developed nations, households probably start with rather general notions of how many children would be desirable, and even rougher ideas, if any, of how far apart these children should be born. These attitudes may well be modified as a result of on-going experience.

Compared with the taste, income, and price variables, the infant and child survival rate, s, is a fairly straightforward concept. Even for this, however, it is necessary to stress a point bearing on all the variables in the economic analysis of fertility, namely, that the relevant magnitude is the value of the variable as perceived by the parents at the time of decision making. This means that the observed real world value may not necessarily correspond to that on which the child-bearing decision is actually based. For example, infant and child mortality may decline, but awareness of this may not come until late in the reproductive period when parents find more children surviving than was anticipated. Indeed, if catastrophic events disproportionately influence people's judgments, then reproductive behavior may be geared to the worst rather than average mortality conditions. Similarly, income or cost considerations may be incorrectly anticipated by the household in a way producing a systematic bias. Because of this, actual empirical estimation of such variables may need to take cognizance of the manner in which perceptions are formed, possible lags between real world changes in fertility determinants and perception of those changes, and the way in which uncertainty may affect behavior as a result of differing attitudes toward risk taking versus risk aversion.

II

THE SIMPLE SOCIOLOGY OF FERTILITY: A PRODUCTION APPROACH

Sociologists, in contrast to economists, start with what might be called the production side of fertility. The analysis typically proceeds from discussion of frequency of intercourse and the reproductive capacity
of a population, to specific methods of fertility regulation such as abstinence, contraception, and abortion, by which births are kept below the biological maximum. Good representative presentations are those of Freedman and Petersen (1961–1962: 35–68; 1969). The initial emphasis is on a complete accounting for the immediate factors ("intermediate variables") through which any influence on fertility must ultimately operate. The Davis-Blake (1956: 211–235) framework in one form or another is the usual basis for organizing this discussion.

As one proceeds beyond this, the sociology of fertility becomes less uniform from one writer to another, though not less extensive. Along with other underlying determinants, demand considerations of the sort emphasized by economists are introduced in discussing family size and child spacing attitudes. Such factors, influencing the motivation for fertility regulation, along with knowledge of and access to various methods, are seen as influencing fertility through one or another of the intermediate variables of fertility control. The present treatment of the sociology of fertility places production considerations in the forefront, not because sociologists disregard attitudinal or motivational factors—far from it—but because there is much more consensus in the sociological literature on the framework used in the production aspects of the subject.

The point of departure of the sociology of fertility may be represented analytically by:

\[ B = N - R, \]

where, for a given marital union,

\( B \) is the cumulative number of live births,

\( N \) is natural fertility, the cumulative number of live births that would occur in the absence of any voluntary control of fertility, and

\( R \) is a summary measure of the practice and efficiency of fertility regulation, expressed in terms of births averted.

It holds, definitionally, that observed fertility varies directly with natural fertility and inversely with the effective degree of fertility regulation. Table 2–1 identifies the factors included under natural fertility and fertility regulation classified by stage of the reproductive process. Sociologists will recognize this as a rearrangement and a slight modification of the "intermediate variables" of the Davis-Blake (1956: 211–235) framework. The Davis-Blake variables relating to marriage practices have been omitted, since the concern here is with marital fertility.

The factors in the Davis-Blake framework have been divided between those relating to natural fertility and those relating to techniques of fertility regulation. As will be explained shortly, the critical consideration in this regard is that of motivation of the couple. Only if a couple sees the purpose as that of controlling fertility is a given practice classified as a technique of fertility regulation. Thus abstinence due to a desire to limit numbers falls under column 3, as a technique of fertility regulation, but abstinence due to illness or absence of one spouse from the household, which has an unintended effect on fertility, is classified as a component of natural fertility in column 2. Presumably, this distinction is what Davis and Blake had in mind when using the terms "voluntary" and "involuntary," which have been retained in the presentation in Table 2–1.

As shown in Table 2–1, the principal components of natural fertility are frequency of intercourse, involuntary limits on fecundity, and foetal loss due to involuntary causes. Contrary to what one might suppose, natural fertility may vary widely among real world populations. Hypothetical calculations for a population of women who marry early, complete their fecund period, and practice no fertility regulation suggest a maximum natural fertility averaging about thirteen live births over the whole reproductive period. The largest observed figures are somewhat below this. For example, in the United States among the Hutterites, a devout rural community which makes no effort to regulate fertility, the total number of births over the reproductive period of married women averages somewhat over ten. In many populations, however, natural fertility is considerably less than this, since there can be substantial variation in one or more of the components of natural fertility identified above. One of the foremost authorities on natural fertility, Bourgeois-Pichat, (1965: 383–424) develops on the basis of available data a fifty-six class typology for natural fertility based on varying assumptions as to coital frequency, permanent sterility, proportion of ovulations fecundable, and temporary sterility. (He also has an additional cross-classification in terms of five types of marriage patterns.) He does not give actual estimates for each class, but it seems clear that by combining assumptions adverse to fertility one might
obtain an average estimate of natural fertility for a society as low as three or four births per married woman.

The available information suggests that natural fertility is typically lower among less developed populations than those which are more developed. Involuntary abstinence tends to be greater and coital frequency correspondingly lower among less healthy and less well-nourished populations. Permanent sterility, as indicated by data on childlessness, is often greater. Temporary sterility is enhanced by the practice of lactation, which is typically more prevalent in poorer societies. To judge from evidence on stillbirths, involuntary foetal mortality is greater in less-developed countries, probably because of problems of health and nutrition.

The concept of "natural" fertility is something of a misnomer, since the name leads one to suppose that natural fertility is entirely a biological or physiological phenomenon. Actually, as the anthropological literature demonstrates, cultural practices may play an important part in determining natural fertility. An example is the belief that sexual intercourse should be avoided while a mother is nursing. Two societies identical in biological and physiological characteristics might differ in natural fertility because this cultural belief led to a higher prevalence of involuntary abstinence in one society than in the other. It seems useful therefore to distinguish two channels of influence on natural fertility—one, biological; the other, cultural. Included under the former would be factors that influence natural fertility through biological or physiological mechanisms, such as genetic influences on fecundity or the effect of disease and malnutrition on coital frequency and the ability to carry a foetus to full term. Venereal disease in particular tends to lower natural fertility by inducing temporary or permanent sterility. Under the latter would be various social customs or events that inadvertently affect coital frequency, fecundity, or foetal mortality. As an example, reference has already been made to a social taboo on intercourse during lactation, which insofar as an end is perceived, is usually justified in terms of the health of the child or mother. In some societies this may be reinforced by the mother's returning to her parents' home while she is nursing. Another example is the custom in India of very young brides remaining in their parents' homes for several years after marriage. Another is the practice of wives returning

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As recent research by the van de Walle (1972: 688-701) shows, failure to recognize the existence of this taboo may lead researchers erroneously to ascribe reduced fertility to temporary sterility associated with lactation (a biological mechanism), whereas the true cause is this taboo operating via the frequency of intercourse (a cultural mechanism).
to the parents' home or making a retreat to a convent when "hard times" occur. Cultural influences on natural fertility are not confined, however, to social customs. If there are differences among societies in sexual desire (aside from the influence of illness) this would alter natural fertility via its effect on coital frequency. The "desire for coition" (Easterlin 1969: 127–156) thus enters the analysis as a factor influencing N.

Under the cultural head would also be included circumstances which might result in the physical separation of partners, such as wars and the movement of men in response to employment opportunities. Sometimes such factors may affect natural fertility through the biological side as well. For example, wars or natural catastrophes, such as floods or earthquakes, may operate through the physiological side by way of personal injury and through the cultural side via separation of partners.

To turn to R, which measures the scope and efficiency of fertility regulation, techniques for voluntary regulation of fertility may operate at all stages of the reproductive process and on virtually all of the components of natural fertility (Table 2–1, column 3). At the stage of intercourse, coital frequency may be reduced through voluntary abstinence. At the next stage, the probability of conception may be eliminated or reduced by sterilization (i.e., vasectomy) or the use of contraception. At the gestation stage foetal mortality may be increased through induced abortion. The techniques range from time-honored methods which may be assumed to be known to virtually all populations (abstinence, withdrawal, and at least crude methods of induced abortion) to modern and sophisticated ones such as the oral pill and IUD. Some techniques require market transactions, and some do not.

The existence of a practice in a given society which reduces fertility below the biological maximum is not in itself evidence that fertility regulation, as defined here, exists, that is, that R is greater than zero. This is because natural fertility, as we have seen, is affected by social

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**ECONOMICS AND SOCIOLOGY OF FERTILITY**

customs and circumstances which may involve practices like those which show up under R. For example, abstinence may be practiced either because of an intercourse taboo during lactation or because a couple wishes to restrict family size. In the first case, it falls under N, in the second, R. As has been noted, the critical issue in determining whether or not a given fertility-affecting practice is included under R is not the existence of the practice, but the intent lying behind its use. If use of the practice reflects a wish on the part of the individual household to regulate fertility, then the practice is classified under R, otherwise it falls under N.10 The variable R thus relates to practices of fertility regulation which arise from household decisions governed by fertility concerns. This treatment corresponds to the general distinction made by sociologists between the "manifest" and "latent" functions of a given social practice, corresponding roughly to the intended and unforeseen consequences of the practice. In the present case, only if the manifest function of a practice is to control fertility is it properly included in R. A clear-cut distinction between voluntary and involuntary influences is not always possible. Ambiguity arises, for example, in the case of fatigue reducing coital frequency and extended lactation lowering fecundity.11 As a practical matter, however, the line can probably be drawn in most cases.12

As in the case of natural fertility, the measurement of R is itself a current area of research. The most recent efforts on this score are those aimed at quantifying the effectiveness of family planning programs in terms of "births averted" (Ross 1972: 7ff.). In principle, such a measure should, in time, provide a concise summary figure for R as defined here. In the meantime, there is a considerable amount of qualitative evidence on the scope and efficiency of fertility regulation which is informative, even if not as conceptually suited for the present purpose as one might like. This evidence shows wide societal differences in the extent and

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10 A recent paper by Srinivasan (1972) employs the same distinction as that used here. He differentiates between fertility regulation due, on the one hand, to biological and social mechanisms operating through natural fertility, and that due, on the other hand, to "deliberate individual control."

11 Ambiguity also occurs in the case of infanticide, as, for example, in the case of increased infant mortality due to neglect associated with other family pressures.

12 The emphasis here on the intent lying behind a given fertility-limiting practice is not an analytical quibble, for it bears on such questions as the prospective efficacy of a family planning program. In the abstinence example above, if the practice arises from an intercourse taboo during lactation (and thus operates via N), the household is not potentially in the market for an improved means of fertility regulation. On the other hand, if the practice is undertaken with the purpose of reducing family size (and thus operates via R), there is an implicit demand for an alternative method of fertility control. Obviously, the response to a family planning program would be different in the two circumstances.
types of fertility regulation practiced (Davis and Blake 1956: 211–235; Nag 1968; Petersen 1969). Thus, Davis and Blake (1956: 233) suggest that primitive and peasant societies tend to have somewhat greater voluntary abstinence than do industrial societies. Sterilization, with a few exceptions, tends to be of limited importance in most societies. Contraception, including both old and new methods, is much more widely practiced in industrial societies. Induced abortion varies considerably among developed societies. In preindustrial societies, according to Davis and Blake (1956: 229), “abortion is widely practiced . . . being the individual’s principal means of limiting fertility,” but documentation for this is not easy to obtain.

Possibly, some generalizations may be established regarding the pattern of adoption of voluntary fertility control. Thus, Requena (1969: 478–479) suggests a shift in Chile from induced abortion as the principal fertility control technique initially used to a more modern stage of “use of effective contraceptives.” Srinivasan offers a challenging and wide-ranging hypothesis regarding “phases of fertility regulation”: “Every population undergoing a demographic transition also experiences a transition in the nature by which it regulates fertility . . . . The stages of transition of fertility regulation methods can conveniently be classified into phases. Biological, Natural, Premodern, and Modern” (Srinivasan, 1972: 8).

A limited amount of research has also been done on the efficiency of contraceptive use (cf. Tietze 1962b: 357–369). The usual measure is the failure rate per 100 years of use

\[
\text{number of accidental pregnancies} \times \frac{1200}{\text{total months of use}}
\]

(Petersen 1969: 190). Unfortunately, possible generalizations about contraceptive efficiency must be based on data confined largely to the United States, and little can be said about the comparative situation in different societies. Among the more efficient methods (so far as the data go) are the oral pill, IUD, condom, diaphragm, and withdrawal (Petersen 1969: 191). But efficiency also varies depending on the extent to which a household has reached or exceeded the number of children it desires. For households which have achieved desired family size, virtually all methods of contraception are used with considerable efficiency, and differences among methods in efficiency are considerably less than for households which fall short of their family size goals (Ryder and Westoff 1971).

Sociological discussion of the determinants of fertility regulation typically involve three types of considerations—motivation, attitudes, and access. In general, fertility regulation is viewed as varying directly with the degree of motivation, favorableness of attitudes, and extent of access. The motivation for fertility regulation is seen to stem from concerns about having too many children or having them too soon, and leads into discussion of such things as “social norms about what family size ought to be” (Freedman 1961–1962: 35–68) and the appropriate spacing of children. It is at this stage that many of the economist’s demand considerations enter the analysis, though in rather different form.

Attitudes toward fertility regulation embrace both very broad notions of the acceptability of family planning in general, as well as feelings about the appropriateness of quite specific practices, such as abortion. In terms of Ronald Freedman’s (1961–1962: 35–68) analysis, this subject relates to “social norms about each of the [Davis-Blake] ‘intermediate variables.’” The limited practice of voluntary abstinence within marriage reflects the universally high disutility associated with this form of fertility regulation, and illustrates that variations in subjective attitudes toward different methods depend in part on the extent to which use of a method is directly associated with the act of intercourse. One of the arguments for the oral pill as an independent stimulus to greater fertility regulation is that the act of taking the pill is independent of the time of intercourse. Attitudes may also be affected by the reversibility of a method and whether it involves surgical procedures, as in the case of sterilization. Variations in attitudes reflect too the social acceptability of different methods (e.g., induced abortion may be condoned in one society and not in another; among Catholics only the rhythm method of contraception is approved, and so forth).18

Thus both personal and social conditions enter into the formation of attitudes toward fertility regulation.

The question of access pertains to the availability (including cost) of contraceptive knowledge and supplies, including abortion services. These are the considerations emphasized by advocates of family planning services when attributing inadequate contraception among, say, the poor, to “lack of access” to effective contraception.

On most of these matters, some survey research evidence is available. Motivation is inferred from statements on the extent to which households “want no more children” or “have more children than they want” (Berelson 1966: 655–668; Freedman 1963: 220–245; Freedman and Takeshita 1969; Mauldin 1965: 1–12). (Another approach that has been

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18 The discussion by Davis and Blake (1956: 211–235) of considerations affecting the relative prevalence of abstinence, contraception, and abortion in less developed societies touches on a number of factors affecting fertility control attitudes.
used in demographic analysis is to difference data on total births, adjusted for mortality, and reports on family size desires.) Some comparative data on excess fertility concerns in the period around 1960 have been brought together by Parker Mauldin (1965: 7; see also Nortman 1971: 1-48). The figures are for percentages of persons reporting they do not want more children and cover fourteen countries—eleven in Asia, plus Puerto Rico, Jamaica, and Hungary. Commenting on these data, Mauldin observes: "The most striking thing... is the large proportion of people in every society who want to limit family size. This is particularly true for those already having a moderately large family, for example, 4 or more living children. Even in developing countries, typically, two-thirds or more of the persons having 4 or more living children say that they do not wish to have more children" (Mauldin 1965: 6).

Data relevant to attitudes are obtained in response to questions as to whether respondents "approve" or "disapprove" of fertility regulation in general and of each of a number of specified methods of fertility regulation (though such questions suffer from not ascertaining the intensity with which these feelings are held). Since the surveys embrace a variety of methods, and knowledge of different methods varies among societies, it is not easy to generalize about intersocietal differences in attitudes. One might suppose that attitudes toward fertility regulation are more positive in developed societies. Yet inquiries in less developed areas into attitudes toward the idea of family planning typically yield surprisingly favorable responses (Mauldin 1965: 1-12). Moreover, in some developed societies, abortion as a method of fertility regulation is frowned on, and this is perhaps less generally true in lower income societies. At present, the extent of intercountry differences in attitudes must be left an open question. There are, of course, wide differences in the practice of fertility regulation, but this does not necessarily imply corresponding differences in attitudes; attitudes may be equally favorable in two societies, but differences in other factors may lead to greater practice of fertility regulation in one.

With regard to access, surprisingly little comparative evidence on costs is available: the price of condoms and oral pills, the costs involved in fitting a diaphragm or inserting an IUD, or the price of an induced abortion or vasectomy. Family planning programs, of course, typically operate via subsidized or free provision of one or more methods of fertility regulation. It is possible that in some societies induced abortions may be much cheaper (though perhaps riskier) than in others.

In contrast to the situation regarding costs, there is, in the case of knowledge about fertility regulation, a fair amount of information from sociological surveys. In general, the state of knowledge is better in more developed societies, particularly with regard to contraception. "Typically it is assumed, and with reason, that in developed countries almost everyone has some knowledge about birth control methods... In the developing countries when questions about knowledge of contraceptive methods are asked, the numbers of persons giving answers that show they know about contraceptives is often so low that almost any vague answer is accepted as positive information" (Mauldin 1965: 6). On the other hand, it would be a mistake to suppose that there is no knowledge whatsoever of contraception in these societies. Traditional methods such as coitus interruptus are generally assumed to be widely known. The extent to which such practices appear to have been adopted during the demographic transition in now-developed societies supports this assumption.

III
SYNTHESIS

This section integrates the economic and sociological analyses of the two preceding parts. The discussion is framed in terms of the individual family, the "representative household," so to speak. The dependent variable is the completed fertility of a married couple. To simplify the exposition, the following assumptions are made: (1) There is only one technique of fertility regulation; (2) prospective parents are not concerned about the spacing of births; (3) there is no child adoption market; (4) no techniques are available for enhancing fertility; and (5) there is no uncertainty about the independent variables over the planning horizon. The quality of children and the work/leisure allocation of time are also taken as given, so that the problem of choice focuses on number of children versus goods for the parents. By the latter is meant how well off the parents themselves can live materially, considerations of children aside. These assumptions and their implications will be taken up subsequently, especially in the concluding section.

The approach adopted is that employed in static economic analysis. Given the values of the basic fertility determinants, the problem is first to determine the equilibrium solution for the number of children (C) and births (B) over the reproductive cycle of the household, and, then, the effect on the equilibrium of changes in the basic determinants. As will be seen, the extent of fertility regulation (R) and the amount of excess fertility (X) are simultaneously determined along with C and B.

The analysis builds on the concepts developed earlier, including
formal counterparts of the sociological notions regarding fertility control of motivation, attitudes, and access, just discussed. As is usual in economic analysis, the basic determinants are viewed as relating to the perceptions of the decision makers, and are conceived in an ex ante (forward-looking) rather than ex post (realized) sense.

Equilibrium determination of C, B, R, and X. We can take as given at any point in time the subjective preferences of the parents for goods and children (their utility function), along with their perceptions of their potential income (Y), the relative price of children (p./\bar{p}_c), the prospects for child survival (s), and their natural fertility (N). In keeping with the economic analysis of fertility, one may draw up an indifference map and budget constraint of the type discussed in connection with Figure 2–1. These are shown in Figure 2–2 as, respectively, the broken line set of indifference curves, I_1, I_2, ..., and the budget constraint line ef. The shape of the indifference curves would embody “social norms about what family size ought to be,” as discussed in the sociological literature (Freedman 1961–1962: 39). To this we now add provision for the production side of fertility behavior, based on the foregoing discussion of the sociology of fertility. This may be done by transforming natural fertility into its counterpart in terms of number of children:

\[ C_n = sN, \quad (5) \]

where \( C_n \) is the number of surviving children the parents would have in the absence of any voluntary control of fertility, and \( s \) and \( N \) are defined in (3) and (4) above.

For example, if \( N \) were 12 and two out of three babies survived to adulthood \( (s=\frac{2}{3}) \), then \( C_n = 8 \). In Figure 2–2, a vertical line is erected at \( C_n \) to represent the parents’ perception of the production side of the decision. \( C_n \) is therefore a production constraint much like the income constraint represented in the household’s budget line.

Before proceeding to the next step, where formal allowance will be made for the factors influencing the adoption of fertility regulation, it is instructive to contrast two equilibrium positions representing opposite extremes. One is the situation in which no fertility regulation is practiced, because, let us suppose, the economic cost is prohibitively high. In this case the equilibrium outcome would be given by the intersection of \( I_1 \) and \( C_n \), and parents would have the maximum possible number of children. The other is the case of the “perfect contraceptive” society (Bumpass and Westoff 1970: 1177–1182)—fertility regulation is
completely costless, not only as far as market prices are concerned, but also in regard to subjective concerns. Under these circumstances the equilibrium outcome would be $C_d$, the point at which $I_1$ is tangent to ef. This value, $C_d$, probably corresponds roughly to what survey respondents report as “desired family size.” Essentially it is the number the children the parents would have if there were no subjective or economic problems involved in regulating fertility. While it is unrealistic to suppose that fertility regulation could ever be completely costless, one can imagine fertility control developments which would progressively reduce the cost to lower and lower levels, with the $C_d$ outcome forming the limiting case.

We are now ready to take explicit account of the considerations influencing the adoption of fertility regulation. The sociologists’ concept of motivation is already implicit in the analysis. In terms of economic theory, it is the distance, $C_n - C_d$, the number of unwanted children that parents would have if fertility were unregulated. The consequence of unregulated fertility would be to shift parents downward from the $I_1$ to $I_1$ indifference curves in Figure 2–2. It is this prospective loss in welfare attendant upon unwanted children that provides the motivation for regulating fertility. The greater the distance, $C_n - C_d$, the greater the potential loss in welfare, and the higher the motivation for regulating fertility.

Because of obstacles to regulating fertility, it does not follow that parents, even though they have the motivation, would immediately adopt fertility control and go to the equilibrium position, $C_d$. Let us distinguish, in keeping with the sociological literature, between impediments to fertility regulation deriving from subjective attitudes and those arising from lack of access (inadequate knowledge or high costs).

The subjective costs of fertility regulation, which embody what sociologists term “social norms about . . . the intermediate variables” (Freedman 1961–1962: 39) and are partly captured in their empirical studies of fertility control attitudes, may be conceptualized by rotating the indifference map so that the slope of the indifference curve through any given point is increased (technically, the marginal rate of substitution is raised). The increased slope means that when fertility regulation involves subjective costs, parents will require more goods than before to induce them to have fewer children. This is because having fewer children imposes on parents the psychic costs of fertility control, and an additional goods incentive is now necessary to compensate them for incurring these costs. A simple analytical formulation (analogous to that frequently used by economists in the treatment of embodied technology or inferior quality goods) (Burmeister and Dobell 1971: ch. 3) is

$$U = f(\alpha C, C),$$

$$1 \leq \alpha > 0$$

where $\alpha$ is a summary measure of the disutility attaching to fertility regulation, and $U$, $C$, and $C$ are as defined in (1).

If $\alpha = 1$ there is no subjective disutility of fertility regulation and (6) reduces to (1). As $\alpha$ decreases, the subjective disutility of fertility regulation increases, and the indifference map rotates to a position like that shown by the solid $I_2$, $I_3$ . . . curves in Figure 2–2. If subjective concerns were the only obstacle to fertility regulation, the equilibrium solution would now be $C_d$, the tangency of the $I_2$ curve with ef. Parents would have fewer children than the $C_n$ number of the unregulated situation, but more than the $C_d$ amount they would like if there were no psychic costs of fertility regulation.

The economic costs of fertility regulation embrace the considerations covered in the sociologists’ concept of “access.” In contrast to the subjective or psychic costs of fertility regulation, which influences the indifference map, the economic costs alter the budget constraint—both by shifting and rotating it. Following Wachter (1972), we may distinguish two types of economic costs—a fixed sum, $p$, representing the outlay initially required to obtain information on how to regulate fertility, and a variable amount, $p$, needed for the actual purchase of supplies or services, including the opportunity cost of the time required to obtain them (for example, loss of wages due to absence from work). The fixed cost, $p$, can be viewed, in effect, as a flat sum reduction in income, and thus a downward parallel shift in the budget constraint. It is represented in Figure 2–2 by the distance $\delta$. This amount must be paid if fertility regulation is to be practiced at all, and any equilibrium other than $C_n$ attained. Once this is paid, the maximum goods that can be had with any given number of children is less than before (and correspondingly, for the maximum number of children attainable with any given quantity of goods).

The variable economic costs of fertility regulation have the effect of decreasing the slope of the budget constraint, rotating it counterclockwise about the point $b$ in Figure 2–2. Assuming natural fertility has a
fixed positive value, the total variable costs are zero at $C = C_n$, the situation in which no fertility regulation is practiced, and a maximum in the situation of childlessness ($C = 0$). The excess of the vertical distance $af$ at $C = 0$ over $db$ at $C = C_n$ represents the total variable cost of fertility regulation necessary to attain childlessness ($C = 0$) and is equal to $p_n$, the variable cost per child averted, multiplied by $C_n$, the total number of children averted. When economic costs attach to the practice of fertility regulation, the maximum amount of goods the parents can obtain for themselves is reduced from $of$ to $oa$. The combination ($G = 0a$, $C = 0$) is one extreme on the budget constraint now applicable to the parents' decision. As one moves rightward from this point in Figure 2-2 to combinations involving more and more children (and thus, progressively fewer children averted), the total variable costs of fertility regulation become smaller and the vertical distance separating $ab$ from $df$ correspondingly less. The new budget constraint defining the outer limit of the combinations within financial reach of the household becomes $abd$ and is characterized by a smaller slope than the old budget constraint $df$.

In sum, in allowing for the economic costs of fertility regulation, the effect of the fixed costs is equivalent to that of a reduction in income, while that of the variable costs is equivalent to a rise in the price of goods. The effect of the variable costs, $p_n$, thus parallels on the market side that of the disutility of fertility regulation, $\alpha$, on the side of subjective preferences. The former raises the economic or market costs of goods, the latter raises the subjective cost of goods.

When account is taken of the fixed and variable costs of fertility regulation, the budget constraint relevant to the parents' decision becomes, formally,

$$Y = p_4 C_n + p_3 C + p_2 (C_n - C) + p_1$$  \hspace{1cm} (7)

where $p_1$ is the fixed (information) cost of fertility regulation ($p_1 > 0$ for $C < C_n$, and $p_1 = 0$ for $C = C_n$),

$p_2$ is the variable cost of fertility regulation per child averted, and

the other concepts are as previously defined.

The equilibrium solution, taking account of both the subjective and economic costs of fertility regulation, becomes $C_2$, the tangency of $I_1'$ with $abd$. As one might expect, the addition of economic costs of fertility regulation causes parents to have even more children than when there were only subjective costs attaching to fertility regulation, and to be still farther from the desired family size, $C_d$. The excess of $C_2$ over $C_d$ is, in effect, the cost parents pay in terms of unwanted children for their reluctance to incur the costs of fertility regulation. The distance $C_1 - C_0$ is the number of unwanted children attributable to subjective costs, and $C_2 - C_1$, to economic costs. The distance between the equilibrium number of children $C_2$ and the number that would result in the unregulated fertility situation, $C_n$, is a measure of the scope and effectiveness of the parents' practice of fertility regulation, in terms of the number of children averted.

To this point the dependent variable has been number of children. We can transform these results into births by taking account of the survival rate of babies, as in (3) above. Thus if $C = 4$ and the chance of survival to adulthood is 2 out of 3, six births will be needed. Correspondingly, the measure of unwanted children and of the extent of fertility regulation can be transformed from numbers of children into births. Thus we may define

$$X = \frac{C - C_d}{s},$$  \hspace{1cm} (8)

$$R = \frac{C_n - C}{s},$$  \hspace{1cm} (9)

where $X$ is excess fertility, the number of unwanted births,

$R$ is a births averted measure of the scope and efficiency of fertility regulation, and

the other variables are as previously defined.

The graphical representation of these concepts is shown at the foot of Figure 2-2—the distance $C_2 - C_d$ corresponds to $sX$, and $C_n - C_2$, to $sR$.

The synthesis is now complete. The basic data are, on the side of subjective attitudes, the utility function for goods and children and the subjective disutility of fertility regulation, $\alpha$. These define the two indifference maps, $I_1$ and $I_2$ . . . and $I_1'$, $I_2'$ . . . . The budget constraint, if there were no overproduction problem, is $ef$, and depends on the potential income of the household, $Y$, and the relative price of children, $p_C/p_B$. The supply of children if fertility were unregulated is given by natural fertility, $N$, and the survival rate of infants to adulthood, $s$. Based on the natural supply of children, the fixed and variable market costs of fertility regulation, $p_f$ and $p_v$, and the initial budget constraint, a new budget constraint $abd$ is established, which is ap-
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applicable to the situation of prospective overproduction. The household balances its subjective preferences, including attitudes toward fertility control, against this external constraint to arrive at the equilibrium number of children, C, and, taking account of s, the equilibrium number of births, B. The decision with regard to C establishes at the same time the horizontal distances X and R, and, correspondingly, X and R. Unwanted fertility and the practice of fertility regulation, as measured by births averted, are simultaneously determined along with numbers of births and surviving children in the equilibrium outcome. The present analysis thus makes explicit the complementary nature of the economics and sociology of fertility. The sociologist's emphasis on the nature and determinants of fertility regulation (R) by which births are kept below the natural fertility level (N) and the economist's emphasis on the decision to have children, come together to yield as concurrent outcomes of the same forces, the number of children, including unwanted children, and the extent of fertility regulation.

Since the equilibrium situation involves some excess fertility and a correspondingly limited use of fertility regulation, it may seem irrational for households to suffer from unwanted children when the means of birth control are "at hand." But this view fails to take account of the subjective and economic costs that influence the fertility regulation decision. To individuals in a decision-making position, excess fertility is the price that is paid to put off the psychological disquiet and economic costs that are perceived as attending a premature venture into fertility restriction.

One may ask whether it is meaningful to speak of an excess fertility condition prevailing "in equilibrium." Equilibrium means, by definition, that in the absence of change in the underlying determinants, the given outcome will persist through time. In economic theory, an excess supply condition is usually viewed as inconsistent with equilibrium, because it would set in motion corrective market forces that would change the equilibrium outcome. How can one reconcile excess fertility then with an equilibrium condition? The answer is that excess fertility means in this case that there are persons who have unwanted children and who are potential traders with others in an excess demand situation (such as those with problems of sterility and subfecundity). However, there is effectively no market in which those in an excess supply situation can deal with those in a condition of excess demand. A market for baby or child adoption is the one potentially relevant to solving the imbalance. Extension of the present framework to analysis of the adoption market would be possible, and desirable, for the existence of a substantial adoption market would seemingly have pro-

fertility consequences. From the viewpoint of explaining real world fertility, however, an adoption market is typically of such limited empirical significance that the most useful working assumption seems to be the present one, namely, that no such market exists. As a result, the usual market adjustment is blocked, and a situation is created in which an excess fertility condition prevails as part of the equilibrium outcome.

The effect of a family planning program. The effect on the equilibrium of changes in the underlying determinants may now be considered. The economic analysis of the effects of changing tastes, incomes, and prices, presented in Figures 1b-1d, would be applicable in the present case as well. The results, however, would be affected by the values of the determinants newly added to the analysis. (For example, the demand curve relating children, C, to their price would be derived in the same way as previously, but shifts in the demand curve would now occur because of changes, not only in Y and the utility function, but also in \( \alpha \), \( p_h \), \( p_b \), s, and N.) In what follows, the discussion focuses on the effects of the determinants newly added to the analysis. As is customary, the effect of a change in any one determinant will be analyzed on the assumption that all other determinants are held constant.

Family planning programs usually work chiefly in two ways. First, they improve access to the means of fertility regulation by widening and cheapening the provision of various types of fertility regulation and disseminating knowledge about fertility control. Second, they promote more favorable attitudes to the use of fertility regulation by breaking down individual and social taboos. In regard to access, the effect of a new program corresponds to a reduction in the economic costs of fertility regulation, \( p_h \) and \( p_b \). Assuming that before the program one were at C, in Figure 2-2 and that the program reduced the economic costs to zero, the equilibrium would be shifted from C to C'. So far as attitudes are concerned, a reduction of subjective costs caused by the program would increase \( \alpha \), rotating the indifference curves counterclockwise. At the extreme, in which there were no subjective or economic costs, the equilibrium would be that of a "perfect contraceptive" society, C, in Figure 2-2.

The effect of a family planning program is thus seen to be to reduce the number of children people have, C, concurrently increasing the practice of fertility regulation, R.\(^{14}\) As illustrated so far, C is unaffected by the program, and the reduction in C takes place at the expense of excess fertility, X, with unwanted children becoming, at the

\(^{14}\) A qualification to this statement is brought out in the subsequent discussion of Figure 2-3.
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extreme, zero. This is the predominant view as to how such programs operate, and it is the interpretation stressed by Kingsley Davis (1967: 730-739) in his skeptical appraisal of the ability of family planning programs to solve the "population problem." In terms of our framework, Davis' argument is that family planning programs reduce C by reducing X, but do not make a dent on C0. Since, according to Davis, existing evidence on family size desires in many less developed countries implies rather high fertility and thus high population growth rates, there is need for policies that would operate also on C0—his own emphasis appears to be on influencing C0 by raising the relative price of children pC/pX.

However, as Davis recognizes, it is not entirely correct to assert that family planning programs have no effect on C0. Some programs do include as part of their "educational" budget, a component which aims to publicize the desirability of small families. If effective, this would alter utility functions in a way that would lower C0, thereby increasing Cn - C0, the motivation for fertility regulation. With the supply prices of family planning services given, the rise in motivation would increase R and lower C. Thus Cn would no longer be a fixed floor setting the minimum level to which fertility can fall. In this case, the contrast often drawn between family planning programs, on the one hand, and motivation, on the other, as influences on the adoption of fertility regulation is blurred, since the program affects motivation as well as the supply of services and attitudes toward them. The likely effectiveness of expenditures on motivation is, of course, often questioned (though adequate research is lacking), and in practice the bulk of family planning expenditure is actually focused, not on family size attitudes (C0), but on the provision of family planning services (working through p1 and pB) and attitudes toward fertility control (a).

The effect of an innovation in fertility regulation. A new method of fertility control such as the oral pill or IUD would affect fertility along the lines typically attributed to a family planning program, and therefore requires only brief mention. By providing new information about fertility regulation or through its impact on outlays directly needed for fertility control, a new method would reduce p1, pB, or both. Also, a new method may in various ways influence subjective attitudes, raising a. It provides a new option to the public that may meet objections to current methods (for example, by separating the act of fertility control from that of intercourse). It also increases general publicity about fertility control, and may make for a reassessment of some of the existing methods.15 With the state of motivation (Cn - C0) given, a new

method, through one or more of these channels, would tend to increase the extent and/or efficiency of fertility regulation, R, and correspondingly lower both actual and excess fertility, B and X.

Ordinarily, one would expect a new method not to alter family size desires, C0, but simply to make it easier for parents to come closer to realizing those desires by avoiding unwanted children. In a recent paper, however, Larry L. Bumpass argues that the oral pill and more recent fertility control innovations in the United States are likely to affect family size norms (1973: 67-89). He argues that for the typical American woman, motherhood is no longer inevitable, because of the greatly increased efficiency of fertility regulation. She is thus free as never before to consider childlessness as a realistic possibility, and hence is more likely to choose this course. This argument provides an example of how an innovation in fertility regulation might alter C0 by shifting the utility function in a manner unfavorable to children.

The demand curve for fertility regulation. The relation between the price of fertility regulation, pB, and its use, R, may be formalized in terms of a demand curve, following procedures analogous to those used in deriving the demand curve for children. A reduction in pB increases the slope of the budget constraint ab in Figure 2-2. The result is to shift the equilibrium position leftward, reducing C and X, and correspondingly increasing R. Holding the other determinants constant, one may thus generate a series of observations on pB and R, measured in births averted, by rotating the ab curve clockwise. This yields a demand curve of the typical negatively sloping type, showing that the consumption of fertility control would increase, other things being held constant, as the price of fertility control declined. In principle, one may calculate from this a price elasticity of demand for fertility regulation. One may also conceive of shifts in the demand curve for fertility regulation, arising from changes in the other determinants. For example, more favorable attitudes toward fertility regulation (an increase in a), would lead to greater consumption of fertility regulation at any given price, shifting the demand curve to the right. A similar result would follow from an increase in the motivation for fertility control, Cn - C0, due to changes in one or more of the factors lying behind either Cn or C0. To the extent that a family planning program or innovation in fertility regulation cheapened the direct outlays required per child

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15 A somewhat related phenomenon is the effect of experience with one method in causing more favorable attitudes toward others. It is frequently reported, for example, that women who give up the IUD tend not to abandon fertility regulation, but to switch to another method. This could be due in part to reduced reluctance, as a result of the actual experience of fertility regulation, to try a method which was formerly resisted.
averted (that is, lowered $p_n$), consumption of fertility regulation would be increased by a downward movement along the demand curve. To the extent these developments resulted in more favorable attitudes or increased motivation they would shift the demand curve to the right, increasing consumption at any given price.

The effect of an increase in natural fertility. So far the analysis has implicitly assumed that the number of children in a natural fertility regime would exceed the number desired; that is, $C_a$ would be greater than $C_d$. Brief reference was made, however, to the possibility that because of sterility or subfecundity, a household might be unable to realize its family size desires. This situation of “excess demand,” that is, more children wanted than can be produced, might actually typify a society if there were a high incidence of involuntary sterility due, for example, to venereal disease. Very high family size desires would also enhance the possibility of an excess demand condition. In considering the effect of variations in natural fertility on the equilibrium outcome, it is instructive to start with a situation in which the number of children that would be produced if fertility were unregulated falls short of the number desired. To simplify the graphical presentation, it will be assumed throughout this section that there are only economic costs of fertility regulation, and no subjective costs (that is, that $\alpha = 1$).

Figure 2–3a shows the effect of excess demand conditions. Let us suppose that initially the number of children, if fertility were unregulated, would be $C_{n1}$, less than the desired number $C_d$ yielded by the tangency of the I$_1$ indifference curve and the budget constraint, ef. In this situation the best the household can do is have $C_{n1}$ children, which will put it on the I$_1$ indifference curve. Any smaller number of children would leave the household on a lower indifference curve, making it even worse off. Any larger number of children up to $C_d$ would increase the household’s welfare, but it is unable to reach such positions because it cannot produce any more than $C_{n1}$. The situation shown is analogous to that of the effects of rationing, which forces households to accept welfare positions inferior to the free market solution.

In this situation there is no point to modifying the budget constraint for the economic costs of fertility regulation, since there is no motivation for the household to reduce fertility. On the contrary, the situation shown is one which would lead to a demand for ways of raising fertility or to adopt children. To the extent such options existed they would raise the equilibrium outcome, but they are disregarded in the present analysis on the grounds that they are typically quantitatively unimportant. This situation illustrates the one described by Tabbaharah where a family planning program would meet with no response be-

Figure 2–3  Fertility Determination Under Excess Demand Conditions

cause of lack of motivation (1971: 274; see also Tabbaharah 1964: 187–196). Surveys might find attitudes seemingly favorable to the idea of family planning and even actual knowledge of a method, but no practice. Obviously, positive motivation ($C_n$ greater than $C_d$) is a necessary (but not sufficient) condition for a family planning program to be effective.

Formally, the equilibrium outcome for the situation where $C_n < C_d$, 91
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is given by:

$$\begin{align*}
C &= C_n = sN, \text{ and} \\
B &= \frac{C}{s} = N.
\end{align*}$$

(10)  
(11)

Note that in this case the birth rate is the same as the natural fertility rate.

Variations in natural fertility will produce corresponding changes in C and B, as long as $C_n$ remains less than $C_n$. For example, as shown in Figure 2-3b, if increased natural fertility shifts $C_n$ to $C_{n'}$, then the equilibrium number of children will change in the same way, and births will move proportionately, the exact numerical change in B depending on the value of s. Moreover, the effect of changes in the variables of income, prices, and tastes which operate through $C_4$ by shifting the budget constraint or indifference map is uncertain. If $C_4$ continues to be greater than $C_n$ after these variables change, then fertility will remain unaffected. It is only when $C_4$ falls below $C_n$ that changes on the demand side will tend to influence C. Even in this case, whether C will be affected depends on the magnitude of the excess of $C_n$ over $C_4$, and the costs of fertility regulation. However, the conclusion that fertility may be unaffected by movements in the budget constraint depends upon the $C_n$ function being a vertical line of the type shown in Figure 2-3. Subsequently, in applying the framework to premodern fertility, a more realistic form of the $C_n$ function is recognized, where changes in the budget constraint do affect observed fertility (see Figure 2-5).

To return to Figure 2-3b, let us imagine that $C_n$ continues to rise beyond $C_{n'}$, with the other fertility determinants remaining unchanged, until it reaches a level greater than the desired number of children, $C_4$. We have now shifted from an excess demand to an excess supply situation—if fertility were unregulated, the number of children would exceed the number desired. Under these circumstances, will measures necessarily be taken to regulate fertility?

The answer to this question is no. Whether fertility control will voluntarily be adopted depends on the one hand, on the strength of the motivation (the excess of $C_4$ over $C_4$), and, on the other, on the costs of fertility regulation. The lower the motivation and the higher the costs, the less likely it is that fertility control will be adopted in an excess supply situation.

Figure 2-4 illustrates two possibilities—one in which regulation is not adopted, even though $C_n$ is greater than $C_4$, and one in which it is. The nonadoption case is that in which natural fertility would produce $C_{n''}$ children. Because motivation for fertility regulation exists, the relevant budget constraint is abd, as in Figure 2-2. This budget constraint is tangent to the $I_1$ indifference curve at $C_4$ children. This is the best situation attainable for the household if it regulates fertility. The household has the option, however, of not controlling fertility at all, in which case it would have a larger number of children, $C_{n''}$ and end.
up on the \( I_4 \) indifference curve. The latter represents a more satisfactory welfare situation than the \( I_3 \) curve, and hence would be preferred by the household. Thus the existence of motivation for fertility regulation is logically consistent with nonadoption. Even though unwanted children reduce the household's welfare (thereby providing motivation for fertility regulation), the costs of regulating fertility may be so great that adoption of fertility control would leave the household even worse off, despite the fact that it would have fewer children. In the present case, the costs are by assumption wholly economic costs. The existence of subjective costs would provide an additional offset to the motivation to adopt fertility control.

If \( C_n \) continues to rise, with the other fertility determinants unchanged, we can imagine a situation emerging in which natural fertility would produce \( C_{na} \) children, and the relevant budget constraint is \( a'b'd' \). In this situation the household's best outcome, if fertility were regulated, is \( C_s \) children. This would place the household on the \( I_2 \) indifference curve, a position superior to the outcome under unregulated fertility, \( C_{na} \), which would put the household on the \( I_1 \) indifference curve. The prospective overproduction of children is now so great as to portend a loss in welfare exceeding that associated with the costs of fertility regulation—the motivation to control fertility exceeds its costs. The equilibrium solution becomes \( C_s \) children, less, not only than \( C_{na} \), but even than the \( C_{ns} \) outcome of the previous natural fertility situation.\(^{16}\)

Reviewing the successive equilibrium solutions as natural fertility increases so that the potential output of children grows from \( C_{nl} \) to \( C_{na} \), other things constant, one observes the following. At first, the equilibrium number of children would increase, but beyond some point fertility control would be induced and the equilibrium number would fall. The rise in natural fertility is thus partly self-correcting. As long as an excess demand condition exists, the rise in natural fertility results in a corresponding increase in the equilibrium fertility rate. As natural fertility continues to rise, however, a potential excess supply of children develops and eventually mounts to a point at which the motivation to regulate fertility outweighs its costs.

Note that the correct measure of the motivation to regulate fertility is \( C_{ns} - C_s \), the number of unwanted children the household would have if fertility were unregulated, not \( C_{ns} - C_{na} \), the number of unwanted children the household actually has. The latter is the excess fertility measure typically reported in population surveys. In Figure 2–4 the motivation to adopt fertility regulation is greater in the \( C_{ns} \), than in the \( C_{na} \), situation, and this is correctly reflected in a \( C_{ns} - C_s \) measure. A measure of how many unwanted children people actually have would incorrectly imply lower motivation in the \( C_{ns} \) situation (\( C_{ns} - C_s \) is less than \( C_{na} - C_s \)).

The point at which fertility control is induced as \( C_n \) continues to increase might be thought of as a "threshold," separating the unregulated from the regulated fertility situation (Kirk 1971: 123–147; United Nations Department of Economic and Social Affairs 1965). However, different combinations of the basic fertility determinants might establish the same threshold. For example, high natural fertility and a high \( C_s \) due, say, to a low relative price of children, might yield the same \( C_{ns} - C_s \) threshold as low natural fertility and a low \( C_s \) due to a high relative price of children. There is no particular value of a fertility determinant, therefore, which necessarily corresponds to the threshold situation from one society to another—the threshold situation depends on how any one determinant combines with the others to establish the value of \( C_{ns} - C_s \).

One can see too how the values of the costs of fertility regulation (\( a \), \( p \), and \( p_h \)) would affect the threshold level. The more nearly a society's initial conditions approach a perfect contraceptive society the sooner would adoption of fertility regulation occur as potential excess fertility (\( C_{ns} - C_s \)) mounted, and the lower would be the actual values of excess fertility (\( X \)) that occurred. In contrast, suppose a society were initially in an excess demand situation with no extant practice and high costs of voluntary fertility regulation. If a rise in \( C_n \) were to shift such a society from an excess demand to excess supply situation, adoption of fertility regulation would occur more slowly than in the preceding case. One argument for family planning programs is that the introduction of such services in this situation would result in more rapid adoption of fertility regulation by lowering costs, and correspondingly yield lower observed values of \( C \) and \( X \). The rise of \( C_{ns} \) above \( C_s \) would create a demand for fertility regulation, which the introduction of family planning services would aim to satisfy.

This analysis also brings out the possibility of interdependence between the \( N \) and \( R \) variables of the sociology of fertility. A change in \( R \)—that is, the adoption of fertility regulation—is in the case illustrated in Figure 2–4 caused by a change in \( N \). As a result, an increase

\(^{16}\) The \( C_s \) function cannot intersect the X-axis to the right of point \( a \), since this would imply that parents with no goods for themselves would be able to produce children. A representation of the \( C_s \) function which takes account of this appears subsequently in Figure 2–5.
in natural fertility, rather than raising observed fertility as would be predicted if the possibility of interdependence were overlooked, may actually lower it by inducing the adoption of fertility control.

The effect of an increase in the probability of survival to adulthood. The foregoing discussion of the effect of a change in natural fertility is also relevant to that of an improvement in mortality conditions. The immediate factor through which a change in natural fertility exercised its effect was C_n. The shifts in C_n that were analyzed in Figures 2–3 and 2–4 could have been due to an increase in s as well as to an increase in N. The argument then would be that in an increase in the probability of survival to adulthood occurring under excess demand conditions would raise the equilibrium value of C. However, as the increase continued and excess supply conditions emerged, a threshold would eventually be crossed, beyond which fertility regulation would be induced and C would decline.

There is one respect, however, in which the effect of a change in s differs from that of a change in N or, indeed, in any of the other fertility determinants. Because s enters the analysis not only as a component of C_n (equation 5) but also as the link between C and B (equation 3), a change in s does not have the same proportionate effect on C and B, as do the other determinants.

A numerical example based on the analysis of the preceding section may illustrate the point. Suppose that N increases from 4 to 16, while all other fertility determinants (including s) are constant. If one assumes a shift from the excess demand to excess supply condition following the sequence in Figure 2–3 and 2–4, the course which C and B might follow would be as follows:

<table>
<thead>
<tr>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
<th>(4)</th>
<th>(5)</th>
<th>(6)</th>
</tr>
</thead>
<tbody>
<tr>
<td>C_n</td>
<td>s</td>
<td>N</td>
<td>(1)×(2)</td>
<td>C_n</td>
<td>C</td>
</tr>
<tr>
<td>C_s1</td>
<td>.5</td>
<td>4</td>
<td>2</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>C_s2</td>
<td>.5</td>
<td>8</td>
<td>4</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>C_s3</td>
<td>.5</td>
<td>12</td>
<td>6</td>
<td>4</td>
<td>6</td>
</tr>
<tr>
<td>C_s4</td>
<td>.5</td>
<td>16</td>
<td>8</td>
<td>4</td>
<td>5</td>
</tr>
</tbody>
</table>

Note that C and B move up and down in the same proportion.

Now let us imagine that s increases in a way that produces the same sequence of C_n values, while the other fertility determinants (including N) remain unchanged. In this situation one would expect the successive equilibrium values of C to be the same as previously, as shown below:

Both columns 3 and 5 are the same in the two cases. However, column 6 is noticeably different. As shown in the first two lines, in a situation of excess demand and consequently unregulated fertility, a rise in survival rates would increase C, thus narrowing the shortfall of actual children compared with the desired number of children, but would not alter the birth rate. Furthermore, an increase in the survival rate which pushed the household across the adoption threshold (lines 3 and 4) would result in a larger proportionate decline in B than C. This is because the downward pressure which the increase in s exerts on C through raising motivation (increasing C_n−C_n) is, in the case of B, further enhanced by the fact that the increase in s reduces the number of births needed to achieve any given number of children. Thus, while s and N tend to have the same effects on C, they influence B somewhat differently. In an excess demand situation, an increase in natural fertility leads to a rise in both C and B, but an increase in s leads only to a rise in C, and not in B. As the situation changes to one of excess supply, increases in N and s operate to induce declines in both C and B, but the effect of s on B is greater.

Sometimes public programs to improve health and mortality conditions are viewed as aggravating the "population problem" and draining resources that might otherwise go into family planning programs to reduce fertility. The present analysis brings out the complementary nature of health and family planning programs. On the one hand, health programs, by shifting households into an excess supply situation, create the motivation for fertility regulation, without which a family planning program would be ineffective. On the other hand, as was pointed out earlier, given the motivation, fertility regulation is likely to be more rapidly adopted if family planning services are present, lowering the costs of fertility control.

A problem in explaining recent declines in fertility in places such as Taiwan and Korea is to determine how much family planning programs have actually contributed to the fertility decline vis-a-vis other factors, such as an increase in s, which have raised the motivation for fertility

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17 See the discussion of this issue in (Taylor 1968: 4).
regulation (Freedman and Takeshita 1969). A similar issue is posed by Gösta Carlson in his well-known article on the historical experience of Sweden, "The Decline of Fertility: Innovation or Adjustment Process?" (1966: 149–174). The "adjustment process" which Carlson has in mind is the response that occurs when a drop in infant mortality pushes households across (or further to the right of) a fertility control threshold as in Figure 2–4. He contrasts this with an explanation of the fertility decline in terms of "innovation," presumably in methods of fertility regulation—in our terms, of changes in \( p_a, p_a, \) or \( c_a \). Carlson argues that the evidence for Sweden favors an interpretation of that country's fertility decline as an adjustment process resulting from an increase in \( s \), rather than one arising from an innovation on the side of fertility regulation.

**Summary.** Table 2–2 brings together the relationships developed in this part, and lists the definitions of the concepts, the empirical counterparts of which were indicated in the two preceding parts. As has been seen, determination of the equilibrium values of \( C \) and \( B \) differs according to whether \( C_a \) is greater than \( C_b \) (an excess supply situation), or is less (an excess demand situation), and the table is divided accordingly. The absence of demand equations for the excess demand case in panel II does not mean that demand conditions are irrelevant. The value of \( C_a \), which together with \( C_b \) establishes whether the situation is one of excess demand or supply, depends upon demand considerations. Moreover, as will be seen shortly in the discussion of premodern fertility, if a more realistic shape of the \( C_a \) function is recognized, the budget constraint plays a more important role than panel II suggests.

**IV**

**Application to Interpretation of Premodern and Modern Fertility**

So far we have considered the theoretical effects of a one-time change in a given fertility determinant on observed fertility, all other factors held constant. Real world problems of fertility explanation rarely involve only one fertility determinant. Rather they reflect the concurrent operation of a number of factors sometimes working in opposing directions on fertility. In this section, the theoretical analysis is further illustrated by applying it to the interpretation of premodern fertility and the transition to modern fertility levels. An important implication of the analysis is that the dominant factors in fertility explanation may be different in premodern and modern circumstances.

<table>
<thead>
<tr>
<th>Table 2–2. Summary of Basic Relationships and Concepts</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>I.</strong> ( C &gt; C_a )</td>
</tr>
<tr>
<td>[ U = f(\alpha, C_a, \delta) ]  ( 1 &gt; \alpha &gt; 0 )</td>
</tr>
<tr>
<td>[ Y = p_a C_a + p_a C + p_a (C_a - C) + p_a ]</td>
</tr>
<tr>
<td>where ( p_a = 0 ) for ( C = C_a )</td>
</tr>
<tr>
<td>( p_a = k &gt; 0 ) for ( C &lt; C_a )</td>
</tr>
<tr>
<td>( C_a = \frac{C}{s} )</td>
</tr>
<tr>
<td>( B = \frac{C}{s} )</td>
</tr>
<tr>
<td>( R = \frac{N-B}{s} = \frac{C_a - C}{s} )</td>
</tr>
<tr>
<td>( C_a = C ) for ( \alpha = 1 ), ( p_a = p_k = 0 )</td>
</tr>
<tr>
<td>( X = \frac{C - C_a}{s} )</td>
</tr>
<tr>
<td><strong>Reference</strong></td>
</tr>
<tr>
<td>Eq. (6)</td>
</tr>
<tr>
<td>Eq. (7)</td>
</tr>
<tr>
<td>Eq. (5)</td>
</tr>
<tr>
<td>Eq. (3)</td>
</tr>
<tr>
<td>Eq. (4), (9)</td>
</tr>
<tr>
<td>text</td>
</tr>
<tr>
<td>Eq. (8)</td>
</tr>
<tr>
<td><strong>II.</strong> For ( C \geq C_a )</td>
</tr>
<tr>
<td>( C = C_a = \frac{C}{s} )</td>
</tr>
<tr>
<td>( B = \frac{C}{s} = N )</td>
</tr>
<tr>
<td><strong>Reference</strong></td>
</tr>
<tr>
<td>Eq. (10)</td>
</tr>
<tr>
<td>Eq. (11)</td>
</tr>
</tbody>
</table>

**III. Concepts**

- \( U \) is the utility of the parents;
- \( C \) is the cumulative number of children surviving to adulthood;
- \( C_a \) is the number of goods consumed by the parents over their lifetime;
- \( \alpha \) is a summary measure of the disutility attached to the principle of fertility regulation, in general, and to specific regulatory practices;
- \( \delta \) is the potential income of the household;
- \( p_a \) and \( p_1 \) are the prices of goods and children, respectively;
- \( p_a \) is the fixed (information) cost of fertility regulation;
- \( \rho_k \) is the variable cost of fertility regulation per child averted;
- \( N \) is the number of live births that would occur in the absence of any voluntary control of fertility;
- \( s \) is the probability of survival of a live birth to the age of 20;
- \( C_a \) is the number of surviving children the parents would have in the absence of any voluntary control of fertility;
- \( B \) is the cumulative number of births;
- \( R \) is the scope and efficiency of fertility regulation, measured in terms of births averted;
- \( C_a \) is the desired number of surviving children in a perfect contraceptive society;
- \( X \) is excess fertility, the excess of the actual number of births over the desired number.
In the present exposition, for simplicity, primary attention will be given to \( C_n \), the number of surviving children, as the dependent variable. The fertility determinants are grouped into three sets—those affecting \( C_n \), the number of surviving children parents would have in an unregulated fertility regime; those affecting \( C_n \), the desired number of children in a perfect contraceptive society; and those affecting the costs of fertility regulation, both subjective and market. A critical issue is whether \( C_n \) exceeds \( C_d \); that is, whether there is a prospect of unwanted children and hence a motivation to regulate fertility.

**Premodern fertility.** As one reads through the literature on fertility in premodern societies, the impression grows that in many of these societies there is little evidence of the conscious practice by the population of methods to limit family size (Henry 1961b: 81–91; Lapham and Mauldin 1972: 29–52; Mauldin 1965: 1–12; Nag 1968; Srinivasan 1972). This does not mean that fertility is at its biological maximum; on the contrary, there are usually various practices that have the latent or indirect function of regulating fertility. But from the viewpoint of the individual these practices are not motivated by concern about family size. In these societies both mortality and fertility are high and fluctuate widely. Under these circumstances, the primary concern of the typical household regarding reproduction is whether it will be able to have as many children as it wants, whether it will have too many. Surveys of attitudes toward family size in Africa, for example, frequently show preferences for larger families than those actually realized (Caldwell 1968; Pool 1970: 12–17).

In terms of the present analytical framework, the situation tends toward that illustrated in Figure 2–3. The household is unsure whether the potential output of surviving children, \( C_n \), will be equal to the number desired, \( C_d \), and its situation thus approximates one of excess demand rather than of excess supply. There is little or no motivation to limit fertility; rather, the primary interest (the "rational" concern) in regard to family size may be in ways of raising fertility. Under these conditions, completed family size will depend on potential output, \( C_n \), and will vary with changes in the underlying determinants of \( C_n \). To the extent this is so, the explanation of premodern fertility movements and differentials calls for inquiry primarily along the lines followed by sociologists and other students of the social and biological determinants of natural fertility.

Consider, for example, the striking fertility differentials in Africa, mentioned at the start of this chapter. One factor which has gained prominence as an important cause is the differential incidence of venereal disease and associated sexual promiscuity. For example,

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Romiuk concludes from a study of the data for districts of the Congo: "... [T]he evidence points definitely to the existence of a sequence of events one would logically expect to occur. The birth rate is low because of the high incidence of sterility; the latter is caused by venereal disease, the incidence of which varies with the degree of sexual promiscuity" (Romiuk 1968: 214–224; see also 1968: 241–339). If this is correct, we see here an illustration of a fertility differential ascribable to the natural fertility variable, \( N \).

Another example of the real-world influence of natural fertility conditions is provided by Knodel's study of three parishes of Bavaria in the late nineteenth century (1968: 297–318). In this case differences in natural fertility arise, among other things, from differences in the practice of lactation. In a parish where breast-feeding is practiced, the fertility of women who marry young is lower than in the two parishes where there is little resort to breast-feeding. There is no evidence that differences in lactation are due to differences in the desire to regulate fertility. Rather, differences in the use of lactation appear to have their roots in cultural traditions passed on from one generation to the next.

In discussing Figure 2–3, it was pointed out that if \( C_n \) exceeds \( C_d \) and the \( C_n \) function is a vertical line, then variations in the instance, price, and income determinants emphasized in the theory of household choice would not affect fertility behavior. However, it is unrealistic to suppose that \( C_n \) is unaffected by the parents' living level, as is implied by a vertical \( C_n \) function. A more plausible shape is shown in Figure 2–5. The \( C_n \) function in this figure implies that below some minimum level of parents' consumption, natural fertility would be zero. Starvation conditions, for example, would drastically lower frequency of intercourse and heighten the likelihood of spontaneous abortion if conception did occur. As the parents' living conditions improved from very low levels, natural fertility would progressively increase, though the increments would become gradually less until eventually a point were reached at which further living level changes left natural fertility unaffected. This is the relationship portrayed by the \( C_n \) curve of Figure 2–5. Starting with a positive intercept on the Y-axis, it shows an initial positive relation between \( C_n \) and \( G_p \), but eventually reaches a vertical phase in which \( C_n \) is unaffected by further advances in \( G_p \).

Given the \( C_n \) function, observed fertility would then depend on the...
position of the budget constraint, as shown by the Figure 2-5. Formally, the determination of completed family size would depend on two relationships:

the natural fertility function, $\hat{C} = f(G_p)$, and the budget constraint, $Y = p_2 G_p + p_3 C$.

The budget constraint is written in the form given in (1) above rather than (7), because fertility control costs are irrelevant in an excess demand situation. Given the income and price parameters, one may solve for the values of $G_n$, the parents' living level, and $C$, completed family size. Changes in the income or price parameters would change completed family size—an increase in income or a reduction in the cost of children, other things being constant, would increase observed natural fertility and completed family size. A change in tastes would not affect fertility unless $C_d$ fell below $C_n$.

The budget constraint and $C_n$ function of Figure 2-5 would produce a positive income-fertility relationship. However, this relationship and the underlying mechanisms differ from that discussed in the usual economic analysis of fertility behavior. The usual relationship relates to how many children people want and is shown by the dotted line "expansion path" in Figure 2-5, which traces the course of the tangencies between the budget constraint as income rises and the (given) indifference map. In contrast, the present relationship relates to how many children a household can produce and reflects the effect of income, not on the demand for children, but on the potential supply. Failure to recognize this could lead to a mistaken interpretation of an observed income-fertility association as a demand relation (the expansion path) rather than a supply relation (the $C_n$ function). In the supply case, the underlying mechanisms are such things as the effect of nutrition on reproductive capacity or the operation of the social custom of young wives returning to their parents' home when "times are hard." Similar supply circumstances might underlie a positive association between income and fertility at a point in time within a premodern society. To cite one such possibility, higher income may be associated with greater reliance on "wet nursing." As a result, the typical higher income wife would have a shorter period of temporary sterility and higher natural fertility, giving rise to the observed positive association. Clearly, while it is important to establish the nature of the empirical association between income and fertility, as Ronald Lee does in the present volume, it is also desirable to ascertain the mechanism re-
sponsible for it. If it is the demand mechanism emphasized in the economic analysis of household behavior, then there is an implicit demand for fertility regulation, whereas, if it is a supply mechanism, there is no such implicit demand.

The attention given in the last few paragraphs to the income-fertility relationship in premodern societies is not intended to imply that income, or, more generally, a society's economic condition, is the only or even predominant factor determining natural fertility. As is clear from the earlier discussion of natural fertility, there are many factors potentially relevant. In Figure 2-5 the effect of such factors would be reflected in shifts in the Cₙ function. For example, given the e²? budget constraint, a shift from Cₙ to Cₙ due, for example, to better health resulting from new medical knowledge, would raise fertility from Cₙ to Cₙ. Observed behavior can thus be thought of as a composite of shifts in the Cₙ function, on the one hand, and movements along the Cₙ function due to changes in income or prices, on the other. In either case observed fertility would correspond to natural fertility, and the primary task of research would be to determine the factors underlying changes in natural fertility, economic or noneconomic. While a more realistic treatment of the Cₙ function leads to recognition of fertility movements due to changes in the budget constraint, the original conclusions still hold about the importance of research on natural fertility in premodern societies and the difference from modern societies in the process of fertility determination.

The present discussion has focused upon the typical household, that representative of the mass of the population. At any given time there would be differences among individuals and groups in a society in the demand and supply situation regarding children. A high status group, for example, might be in a position of excess supply, while the bulk of the population were in a situation of excess demand. The present suggestion that conditions in premodern societies tend in an excess demand direction applies, of course, primarily to the situation of the population in general.

The shift to modern fertility levels. The leading extant interpretation of the shift from high to low fertility in modernizing societies is the theory of the demographic transition (Notestein 1953; for recent evaluations, see Coale 1973; Durand 1967: 32–45). In this scheme, a shift to low fertility follows with a lag a similar shift to low mortality levels, and is associated in a general way with the process of urbanization and industrialization.

The present framework suggests a more comprehensive view of the factors influencing the movement to lower fertility levels. In this inter-pretation, the demographic transition model appears as one of various possible real world patterns. The emphasis here is on the numerous possible channels through which the process of modernization may shift the representative household from a situation under premodern circumstances approximating an excess demand for children to one in a modern society of excess supply. This shift engenders within the household a new type of concern in regard to reproduction, that of limiting numbers, and a corresponding motivation to regulate fertility.

The presentation below first sketches various hypothetical ways in which the motivation for fertility regulation might emerge in the course of modernization, and illustrates the interaction to determine completed family size of the three sets of fertility determinants mentioned above—those affecting Cₙ, C₀, and the costs of fertility regulation. It then states more fully the nature of modernization and develops explicitly a number of possible channels through which modernization principally impinges on reproductive behavior. Finally, mention is made of the way in which the principal determinants may vary from one real world situation to another.

Figure 2-6 charts some hypothetical trends during modernization in the equilibrium values of Cₙ, C₀, and other variables, as determined in the manner described in the preceding part. In the figure the solid Cₙ curves refer to the desired number of surviving children of the representative household in a perfect contraceptive society, as determined by tastes, prices, and income; the broken line Cₙ curves, to the number that parents would have in a natural fertility regime, as a result of the underlying biological and cultural determinants, and the state of infant and child mortality; and the dotted C curves to the actual number of surviving children. In all of the diagrams, the progress of economic and social modernization is assumed to be correlated with time, and corresponds to a rightward movement along the X-axis. The diagrams represent only the general nature of the possible relationship during modernization; no implication is intended regarding specific magnitudes.

As we have seen, the motivation for fertility regulation varies directly with the algebraic difference between the number of children parents would have in a natural fertility situation and the number they would like to have if fertility regulation were costless, in effect, on the prospective number of unwanted children, the excess of Cₙ over C₀. In the upper panel of Figure 2-6, this is shown by the solid line at the bottom of each diagram; in the lower panel this line has been omitted.

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20 I owe the idea for this form of presentation to Riad Tabbarah (1971: 257–277), who used a chart similar to Figure 6c in a seminar presentation of his analysis.
to simplify the presentation—the applicable one in Figures 2-6d–2-6f is that shown in Figure 2-6c. In all of the diagrams in Figure 2-6, the initial situation, that on the Y-axis, is one in which there is no motivation for fertility regulation, because parents are unable to produce as many children as they would like to have. More generally, all positions to the left of point m are excess demand situations. In these circumstances there would be a demand, not for ways of reducing fertility, but of raising it, and also for children to adopt. This representation is thus generally in keeping with the premodern circumstances just discussed, but it is, of course, vastly over-simplified. For example, a more realistic diagram might show Cn fluctuating widely in premodern conditions and the early stages of modernization, and then trending upward as the fluctuations dampen. The average level of Cn might even exceed Cd, but because of the sharp fluctuations in Cn there would be sufficiently frequent intervals of deficient output of children to create a general state of uncertainty among the bulk of the population as to the likelihood of realizing desired family size.

Figures 2-6a–2-6c illustrate alternative ways in which the motivation to regulate fertility might emerge and grow in the course of modernization, causing the Cn–Cd curve to cross the X-axis and move upward to the right. Figure 2-6a shows a situation in which the moving force is a rise in natural fertility (due, for example, to improved health of mothers), while desired family size remains constant. Figure 6b illustrates the contrasting situation in which Cn is constant but desired family size shifts from above to below Cn (as a result, for example, of an increase in the relative cost of children), leading to the appearance of unwanted children. Figure 6c shows a shift from excess demand to excess supply conditions due to changes in both Cd and Cn.

As has been noted, while motivation is a necessary condition for fertility regulation, it is not a sufficient condition. Whether in a given excess supply situation fertility control will actually be used depends on the strength of the motivation compared with the subjective and market costs of fertility regulation. Figures 2-6d and 2-6e illustrate the two extremes with regard to costs of fertility control. In both diagrams, to the left of point m parents are not able to have as many children as they would like to have. As a result, in this range the actual number of children they have, shown by the dotted C line, is equal to the maximum amount they can produce, as indicated by the Cn curve, and rises as potential supply increases. We have here the premodern circumstances of fertility determination described above. As one moves to the right of point m in both diagrams, a problem of unwanted children emerges, creating the motivation to regulate fertility. In Figure

Figure 2-6 Hypothetical Trends in Fertility Variables Associated with Economic and Social Modernization
2–6e, it is assumed that the costs of fertility regulation are prohibitive. Thus the actual number of children continues to follow the potential output curve, $C_m$, and unwanted children increase. The number of unwanted children is shown by the vertical distance between $C$ and $C_0$, marked $sX$. Figure 2–6e, on the other hand, represents the perfect contraceptive society—subjective and market costs of fertility regulation are zero. As soon as the motivation to regulate fertility occurs, parents immediately do so. The actual number of children falls short of the maximum possible, and follows the $C_0$ curve, turning downward in the case shown. The extent of fertility regulation, measured in children averted, is shown by the vertical $sR$ distance between $C_0$ and $C$.

In any real world situation, fertility control costs would be neither zero nor prohibitive. The likely course of the actual number of children for a given level of fertility costs is shown in Figure 2–6f. Initially as the potential output curve, $C_m$, edges above the desired number of children, $C_0$, to the right of point $m$, the motivation to regulate fertility is not great enough to offset the costs, and the actual number of children continues to be governed by the $C_0$ curve, with unwanted children increasing as shown by $sX$. As the rightward movement continues, however, a point is reached at which the loss in welfare due to unwanted children begins to exceed that associated with the costs of fertility regulation. In effect, a threshold of fertility regulation as discussed in connection with Figure 2–4 above is reached. This threshold is labeled $h$ in the diagram. Fertility control is introduced and the $C$ curve turns downward in the direction of the $C_0$ curve, with fertility regulation practiced to the extent shown by the vertical distance $sR$. As long as costs of fertility control are positive, however, there will continue to be some unwanted children, indicated by $sX$. Given the $C_n$ and $C_0$ curves, the effect of a reduction in the costs of fertility regulation would be to shift point $h$ leftward, and for any given excess of $C_n$ over $C_0$, to reduce unwanted children, $sX$, and increase the amount of fertility regulation, $sR$.

**Links between modernization and the principal fertility determinants.** We have, then, a general representation of the manner in which fertility regulation as a common practice may emerge in the course of modernization, and the way in which the principal fertility determinants interact. But what are the specific modernization developments affecting $C_m$, $C_0$, and the costs of fertility regulation?

Modernization, as used here, refers to the transformation in economic, social, and political organization and in human personality observed in a growing number of nations chiefly, but not exclusively, in the West, since the mid-18th century (Coleman 1968: 395–402; Easterlin 1968a: 395–408; Kuznets 1966; Lerner 1968: 386–395). Among the complex of changes embraced by modernization, several seem especially important in bringing about the shift to modern conditions of child-bearing. Historically, these have been: (1) innovations in public health and medical care; (2) innovations in formal schooling and mass media; (3) urbanization; (4) the introduction of new goods; and (5) per capita income growth. More recently in a few countries another aspect of modernization—family planning programs—has perhaps also played a noticeable role in influencing reproductive behavior.

Table 2–3 presents a summary view based on the present framework of the channels through which reproductive behavior is influenced by these various aspects of modernization. The aspects of modernization are listed on the left hand side, and the supply and demand factors immediately relevant to fertility determination, at the top, as column headings. An entry in a cell indicates that the specified item on the left influences the fertility determinant at the top in the direction shown. For example, the negative sign in column 1 of row 4a indicates that, other things being equal, the introduction of new consumer goods during modernization tends to reduce the strength of preferences for children relative to goods. In drawing up Table 2–3, an attempt has been made to identify on the basis of the literature what seem to be the most important links between modernization and reproductive behavior rather than all hypothetically possible connections. Thus the absence of an entry in a cell does not necessarily mean that no relation whatever exists, but simply that it is probably not of very great quantitative importance.

The reasoning underlying the specific cell entries is as follows. Improved public health and medical care in the course of modernization impinges on the reproductive situation of the family by tending to increase the potential supply of children in two ways. First, it is likely to increase the natural fertility of women, because, for example, healthier women are more likely to carry a fetus to full term (Bourdieu-Picart 1967: 68–72). Second, even if natural fertility were unchanged, infants are more likely to survive to adulthood and the potential supply of children would be correspondingly increased. These relationships are indicated in Table 2–3 by the positive signs in columns 4 and 5 of row 1.

Also, better public health and medical care may raise per capita income, because a healthier, more energetic population is likely to be more productive (Malenbaum 1970: 31–54). Increased per capita income, in turn, influences a number of fertility determinants over and
<table>
<thead>
<tr>
<th>Family Size</th>
<th>Demand for children, ( C )</th>
<th>Income ((I))</th>
<th>Prices ((P))</th>
<th>Market regulation</th>
<th>Costs of fertility regulation</th>
<th>Subjective cost ((s))</th>
<th>Natural fertility ((N))</th>
<th>Survival prospects ((g))</th>
<th>( U = f(C_w, C) )</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Better public health and medical care a</td>
<td></td>
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<td></td>
<td></td>
<td>+</td>
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<tr>
<td></td>
<td>Growth in formal education and mass media a</td>
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<td>2</td>
<td>Urbanization a</td>
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<td>3</td>
<td>New goods b</td>
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<td>4</td>
<td>Per capita income growth</td>
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<tr>
<td>5</td>
<td>To the extent this item also increases per capita income, additional effects as shown in row 5 would occur.</td>
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ECONOMICS AND SOCIOLOGY OF FERTILITY

Beyond the effects of better health just mentioned. However, to simplify the table, only the effects directly attributable to public health and medical care improvements are shown, not those that might indirectly be induced through the effect of better health on per capita income. As indicated in footnote a to Table 2-3, a full accounting for the effects of improved public health and medical care would take account as well of the indirect consequences via per capita income growth shown in row 5. The same treatment has been followed in Table 2-3 with regard to the next two aspects of modernization, improved education and urbanization, each of which may raise per capita income as well as influencing reproductive behavior directly. The effects shown in the row for each of these factors exclude any indirect consequences they may have via increased per capita income. Correspondingly, in principle the full range of effects of each of these factors comprises, not only that shown on its respective row but also that shown in row 5 for per capita income growth.

The growth of formal education and associated expansion in mass media, even disregarding any effects via per capita income growth, is one of the most pervasive factors influencing completed family size. As shown in Table 2-3 it operates on all three of the principal fertility determinants—demand, supply, and the costs of fertility regulation. The impact on potential supply may be touched on first, since the reasoning is much like that in regard to the effect of public health and medical care improvements. Formal education and expanded mass media may improve health conditions by diffusing improved knowledge with regard to personal hygiene, food care, environmental dangers, and so on. They may also break down traditional beliefs and customs and thus undermine cultural practices, such as an intercourse taboo, which have had the latent function of limiting reproduction. In these ways they tend to enhance the potential supply of children by raising natural fertility and/or increasing the survival prospects of babies; hence the positive signs in columns 4 and 5 of row 2.

Education and the mass media also tend to lower the costs of fertility regulation, as shown by the negative signs in columns 6 and 7. They may provide information not formerly available on various means of fertility control, reducing the expense in time and money previously required, and may alter cultural norms adverse to the use of fertility control, thus lowering the subjective costs of fertility regulation by challenging traditional beliefs and encouraging a problem-solving approach to life.

Finally, formal education and the expansion of the mass media tend to reduce the demand for children by shifting tastes in a manner...
unfavorable to children and decreasing the price of goods relative to children (row 2, columns 1 and 3). With regard to the relative price of children, if better education improves the income-earning possibilities of women, then the alternative cost of the mother's time required in child-rearing is increased. While some offset to this may be available, for example, through the help of domestics or older family members, there is doubtless some net positive effect on the cost of children and thus a tendency toward a reduction in desired family size. In addition, compulsory education may increase the relative cost of children by reducing the possible contribution of child labor to family income.  

Tastes for children, more specifically, the intensity of the desires for children relative to goods, are affected negatively by education because children, and the lifestyle associated with them, are essentially an "old" good, while education and the mass media present images of new lifestyles competitive with children. In a recent survey in Taiwan, Deborah S. Freedman (unpublished paper: 17) has found that "the more a couple has been exposed to modern influences, as indicated by their education and exposure to mass media, the more likely it is to want modern goods and services" (cf. also 1970: 25-48). Another possibility, receiving much emphasis today, is a "liberated" lifestyle for women, involving greater market work and less family activity. Education and mass media may lead to higher standards with regard to child-care and child-rearing, creating greater emphasis on the "quality" of children at the expense of numbers. (Note that this is a taste, not a "cost" effect, since it works through a change in subjective attitudes and not in market phenomena). In these ways, education and the mass media increase the subjective attractiveness of expenditures competitive with having more children, and thus tend to lower desired family size.

These developments are part of a more general shift in attitudes that takes place during modernization. This shift is brought about not only by education and the mass media, but also by the population's increasing urbanization and participation in other modern institutions like the factory and agricultural cooperative. A valuable summary description of this development is provided by Inkeles: "We believe our evidence shows unmistakably that there is a set of personal qualities which reliably cohere as a syndrome and which identify a type of man who may validly be described as fitting a reasonable theoretical conception of modern man. Central to this syndrome are: (1) openness to new

Schultz and others have particularly stressed the costs effects of education (see Schultz 1971: 148-174).

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tive influence, tending in itself to lower the survival prospects of children (row 3, column 5). The reasoning here is that concentration in densely populated areas increases exposure to disease and tends, other things being unchanged, to raise mortality. The result would be a lower number of surviving children from a given number of births. (This effect may be less applicable under the more modern public health and medical conditions in urban areas in many of today’s less developed nations than in the historical experience of the developed countries).

Finally, urbanization tends to reduce both the subjective and market costs of fertility regulation, in ways much like those of formal education and expanded mass media (row 3, columns 6 and 7). In higher density urban situations, access to fertility control knowledge is likely to be greater, and market costs consequently reduced. Subjective costs too are likely to be less, because of the role of the urban environment in breaking down traditional attitudes, among them the reluctance to try new ways of doing things.

Another facet of economic modernization is the continuing introduction of new goods (Rosovsky and Ohkawa 1961: 478–501). The association between increased consumption of modern goods and reduced fertility has been noted in recent studies of Taiwan (D. Freedman unpublished paper; R. Freedman and Takeshita 1969). In terms of the present framework, the introduction of new goods tends to lower the demand for children by shifting tastes in an adverse manner, as shown by the negative sign in row 4a, column 1. In general, the enjoyment of new goods tends to require lifestyles other than those centering on children, since new goods are typically substitutes for, rather than complementary with, children. Thus, holding other factors constant, the relative strength of household desires for goods unrelated to children is increased, and desired family size, decreased. At any given level of income, households would tend to shift expenditure toward new purposes and away from old goods, including in the latter, having and raising children.

Among the new goods associated with modernization are some specifically related to fertility control. Historical examples are the modern condom and improved methods of induced abortion; more recently, the oral contraceptive pill and IUD. Such developments typically reduce the market costs of fertility regulation by providing cheaper methods. They may also lower the subjective costs of fertility regulation by providing less objectionable options to the household. For example, an advantage claimed for both the pill and IUD compared with most other methods is that they separate the contraceptive act from that of inter-

course. Allowance for the effects of new methods of fertility control is made in Table 2–3 by the negative signs in columns 6 and 7 of row 4b.

We come finally to the effects of per capita income growth, whether due to the aspects of modernization in rows 1–3 of Table 2–3, or other factors, such as the adoption of modern techniques of production. In economic analyses of fertility the effect of per capita income change typically stressed is a positive effect. On the assumption that children are normal goods, one would expect, other things being equal, that higher income would encourage households to want more children, just as higher income encourages greater consumption of goods generally. This influence is shown by the positive sign entered in row 5, column 2.

But there is another and counteracting effect of per capita income growth on the demand for children, operating via tastes, as shown by the negative sign in row 5, column 1 (Banks 1954; Easterlin 1969: 127–136; Leibenstein 1973). Because of the substantial upward trend in living levels during economic development, each generation typically comes from a more prosperous background than that of the preceding generation. Because of this, the views of each successive generation as to the material requisites of the “good life” tend to be progressively higher. Goods which to one generation may have been luxuries become necessities to the next—the automobile is a case in point. This “inter-generational taste effect,” as it might be called, tends to raise the minimum living level which parents feel is necessary before they can “afford” to have children. In terms of Figure 2–2, there is a floor to the curvilinear indifference map at the minimum required living level. Below this floor the indifference lines become horizontal, signifying that welfare depends only on the parents’ goods and having children adds nothing to satisfaction. With the progress of economic growth this “subsistence” floor shifts upward and the marginal rate of substitution decreases at any given point above the floor, indicating that children are becoming less attractive relative to goods. In effect, a third (“subsistence level”) constraint is added to the analysis of Figure 2–2 along with the budget line and production constraints.

Thus while per capita income growth increases the resources available to households, it also affects the consumption aspirations which individuals acquire in their economic socialization. Moreover, since the escalation in consumption aspirations is itself a reflection of actual income growth, this means that the adverse taste effect of such growth

22 See the evidence on goods aspirations in developed and less developed countries in Hadley Cantril’s book (1965: ch. 10) cited earlier.

23 This treatment is like that used in linear expenditure systems with minimum requirement levels (see McElroy 1969; Stone 1954: 511-527).
tends to be strong enough, on the average, to wash out the positive income effect. This effect operates within generations as well as between them. Some empirical evidence is provided by Deborah S. Freedman's analysis of Taiwan: "In sum, the findings of this study suggest that the emergence of non-traditional family goals—namely, the achievement of new modern consumption standards—which may conflict with supporting a large family, influences couples to desire fewer children and can have an appreciable influence on the use of contraception to achieve family size goals. The steadily increasing income levels in Taiwan have not encouraged couples to have more children. Instead, these higher incomes have served to develop new wants—particularly for the new kinds of goods and services development has made available and these new wants, in turn, have encouraged couples to take positive steps to limit family size" (Freedman unpublished paper: 39–40).

The foregoing effects of per capita income growth operate via the demand for children. As has been noted, per capita income growth may also affect the potential supply of children, especially in the early stages of modernization. In terms of personal consumption experience of the population, per capita income growth typically comprises, among other things, substantial advances in food, clothing, and shelter. The consequent improvement in resistance to disease and reduction in exposure to disease is likely to raise the fecundity of women and increase prospects of infants surviving to adulthood. These influences are shown in Table 2-3 by the positive signs entered in columns 4 and 5 of row 5.

The discussion above suggests a number of ways in which modernization may produce trends in Cn and Ca of the sort shown in Figure 2-6, and a decline in the costs of fertility regulation. By way of summary, Figure 2-6f provides a convenient basis for illustrating how these influences may come together to induce a shift to low fertility levels.

The supply influences in columns 4 and 5 of Table 2-3 are reflected in Figure 2-6f in the upward movement of the Cn curve, which eventually levels off as modern health and living levels are established. It is assumed that the several factors in Table 2-3 operating to increase Cn outweigh in the long run the one tendency to decrease Cn.

The demand influences in columns 1-3 of Table 2-3 are shown by the downward movement of the Ca curve in Figure 2-6f. The net balance of the demand influence is taken to be negative, despite the positive sign for the income effect, since as was noted, the latter tends to be balanced out, on the average, by the inter-generational taste effect. In the diagram, the Ca curve is initially horizontal while the Cn curve is rising. This might occur in a society where, for example, the introduction of public health measures substantially preceded the other aspects of modernization.

As one moves to the right in Figure 2-6f the balance of supply and demand forces gradually shifts from one in which the typical family produces less children than it wants to one (as point m is passed) where it produces more. As the excess of potential supply over demand continues to mount, the motivation to limit fertility grows. Eventually, it outweighs the given level of fertility control costs. At this point the fertility control threshold h is crossed. Actual family size, C, which has previously been moving upward with the potential output curve now turns downward, as intentional prevention of births is initiated. The extent of fertility control, measured in terms of number of children averted, is shown by the vertical distance sR, while the number of unwanted children is given by the vertical distance aX.

The reduction in fertility control costs during modernization shown in Table 2-3, columns 6 and 7, would, other things being equal, shift the threshold point h to the left, increasing fertility regulation and reducing the number of unwanted children at any given time t. In a perfect contraceptive society with zero fertility control costs, the threshold point h would be identical with point m, that is, prevention of births would occur immediately on the emergence of excess supply conditions, and the C curve beyond point m would be identical with the Cn curve, as shown in Figure 2-6e.

As noted previously, until the threshold of fertility regulation has been reached, completed family size is governed solely by the factors determining Cn, specifically natural fertility and child survival prospects. Since modernization typically exerts a positive impact on each of these factors, there is consequently a tendency for actual family size to increase during the early phases of modernization (Colley 1965; Hurault 1965: 801–828; Mandle n.d.; Olusanya 1969: 812–824; Roberts 1969: 695–711 1957: 262–285; Shorter 1971). In this early stage of modernization, while desired family size and the costs of fertility regulation may be changing in a negative direction, these factors are unlikely to influence actual family size, because the typical household has not yet felt a motivation for fertility control sufficient to overcome the costs. Here is an example of the situation in which the establishment of a family planning program would meet with little or no response, because there is insufficient motivation among the public to regulate fertility (Tabbarah 1964: 187–196; 1971: 257–277). Nevertheless, decreases in desired family size and the costs of fertility control would move the threshold of fertility regulation closer.

Eventually, as modernization progresses, the typical family moves
across the threshold of fertility regulation, and fertility turns downward. In part, as just noted, this may be due to a gradual reduction in desired family size and in the costs of fertility regulation. In part, it is caused by the increase in potential supply itself, which increases motivation for fertility control by raising progressively the family’s prospective number of unwanted children. In this sense, developments raising the supply of children are partly self-correcting, since, as they continue, they tend eventually to induce the adoption of fertility regulation and thereby a reduction in family size. Moreover, with regard to the effect of an increase in child survival prospects, a downward influence on fertility is exerted over and above that working through completed family size. For households to achieve a given number of surviving children, the necessary number of births would be lower, the better the prospect of infant and child survival. Because of this, one would expect the downward movement in fertility due to increased child survival prospects to be proportionately greater than that in completed family size once fertility regulation is adopted, as shown in the numerical illustration of the preceding part.

The variability of experience. The foregoing sketch attempts to bring together the variety of factors operating to induce a fertility decline during modernization. There is, of course, no necessity for these factors to operate simultaneously or with equal force in all situations. Indeed, by making different assumptions regarding changes in the basic fertility determinants, it is possible to generate with the present framework a variety of patterns of change from high to low fertility. For example, the typical demographic transition pattern—a shift from high to low mortality preceding a corresponding movement in fertility—may be most simply generated, if, with other fertility determinants given, one assumes mortality is sharply reduced in a situation of initially high mortality and fertility. The accompanying increase in child survival prospects, and perhaps also in natural fertility of mothers due to better health, would raise $C_n$, shifting the typical household into an excess supply situation of the type shown to the right of point m in Figure 2-6a. As the prospect of unwanted children continued to grow, the typical household would, in time, reach and cross the fertility control threshold $h$, and fertility rates would start to move downward, thus following with a lag the decline in mortality.

Other patterns of fertility decline can be generated by assuming different changes in the underlying fertility determinants. Coale has remarked on situations in which the fertility decline accompanied or preceded the mortality decline (1969: 3–24). Such a pattern might arise from changes in the economic and social structure which give rise to unwanted children by shifting $C_n$ below a given $C_n$, in the manner shown to the right of point m in Figure 2-6b.

As these examples show, there is no necessity for any one aspect of modernization such as mortality decline to exhibit an invariant timing pattern in relation to actual fertility. Coale, (1967: 205–209; 1969: 3–24; 1973) Durand, (1967: 32–45), and many others have emphasized that the fertility movements actually observed as different countries modernize are highly variable, and for good reasons.24 The initial premodern conditions, such as levels of vital rates and fertility control costs, differ among countries. So too may the historical trend in a particular aspect of modernization, such as the rapidity with which the movement toward universal elementary education takes place. Again, the various factors may come together in different combinations; for example, in one case economic development may substantially lead to social modernization, and in another, the opposite may be true. Also the period of history plays a part—in today’s less developed nations there are influences which were absent from the earlier experience of the now-developed nations.

The traditional generalization about the “demographic transition,” with its emphasis on the underlying role of urbanization and industrialization, is based largely on the particular modernization experience of northwestern Europe. Even for this area, as the careful work of Coale (1969: 3–24; 1973) and his associates (Liv Bacci 1971; van de Walle and Knodel 1967: 47–55) is now showing, the generalization is not well-founded. It is even less valid for the overseas areas settled by Europe. For example, early mortality conditions in the United States were quite different from and more favorable than those in northwestern Europe (Greven 1970; Lockridge 1966: 318–344). Moreover, the movement to low fertility in the United States was especially due to declines in the fertility of the rural population (Easterlin 1972: 121–183; Grabill et al. 1958: 17). Eastern Europe, an area deserving much more study, exhibits yet another contrast with northwestern Europe, starting with much higher vital rates, and exhibiting marked declines among low literacy peasant populations before World War II. (The possible role of land scarcity in inducing rural fertility declines in both the United States and Austria-Hungary has been noted (Demeny 1968: 502–522; Easterlin 1972: 121–183; Yasuba 1962). In a number of today’s less developed nations, advances in public health and education are occurring at an earlier time in relation to economic

modernization than was true of the now-developed nations. Moreover, new influences are at work that were previously absent, for example, government family planning programs, mass media in the form of television, and new modes of fertility regulation such as the IUD (Tabah 1967: 969–1030; van de Walle and Knodel 1967: 47–55). To judge from the data presented by Freedman and his associates, the fertility decline so far in Taiwan is largely attributable to the factors underlying the potential supply of children and the costs of fertility regulation, rather than to changes in desired family size (Freedman 1972: 281–296; Freedman and Takeshita 1969). Perhaps this will prove to be representative of the early phases of the fertility adjustment in today's less developed nations, due to the special timing of social modernization relative to economic development.

Substantial differences in historical patterns of fertility change may arise, not only from variations in the long term trends, but from differential fluctuations as well. In premodern conditions substantial variations in fertility occur in connection with movements in natural fertility due to epidemics, famines, and similar events (Wrigley 1969 and ch. 3 below). As has been noted, the establishment of modern health conditions and living levels may give rise to a temporary surge in actual fertility as fecundity rises. In modern societies, pronounced fluctuations have been observed in conjunction with migration movements and economic conditions. In regard to the latter, it has been observed that while the taste and income effects of income growth may cancel out over the long term, they do not necessarily do so over shorter periods, and disparities between the two may be responsible for the post-World War II baby booms observed in the United States and elsewhere (Easterlin 1968b, 1973; Simon 1969: 327–341).

One must recognize too that at any given time various groups in a society are in different circumstances, and different factors may be responsible for changes in their fertility. For example, whereas the effect of an increase in the survival prospects of children might be especially felt by those in the older reproductive ages, a change in the factors underlying desired size might have a greater effect on those in the younger ages.

Instead of the demographic transition model, what is needed, therefore, is an analytical framework sufficiently flexible to accommodate explanation of the wide variety of historical and ongoing trends, fluctuations, and differentials in the shift from premodern to modern fertility levels. The present framework is an attempt to supply this need.

Rationality and the changing nature of fertility determination. A number of scholars have argued that modernization results in a fundamental change in the mechanisms determining fertility. For example, Bourgeois-Pichat states: "Fertility in preindustrialized societies seems to be strongly determined if not controlled in the sense we give to this word today. It is determined by a network of sociological and biological factors and when the network is known, the result can be predicted. Freedom of choice by couples is almost absent. The couples have the number of children that biology and society decide to give them."

"One of the main features of the so-called demographic revolution has been precisely to change not only the level of fertility but also change its nature. Having a child has been becoming more and more the result of free decision of the couple. And this change in the nature of fertility may be more important than the change in its magnitude. Fertility has left the biological and social field to become part of behavioral science. . . ."

"For fertility we had for a long while a lot of customs carefully molded in the course of time which almost completely determined the size of families. These customs are still there but they are for the most part useless, as fertility is now under the will of people." (Bourgeois-Pichat 1967: 163). A similar distinction is that made by E. A. Wrigley (1969: 192) between "social sanctions" which operate to restrict fertility in a preindustrial situation and "family sanctions" which operate in a modernized society. K. Srinavasan's (1972) classification, previously mentioned, of fertility regulation into phases of biological and social controls, on the one hand, and "deliberate individual control," on the other, provides another illustration.

While there are doubtless differences between the view presented here and those underlying such statements, the present analysis lends general support to the idea of a basic change in the nature of fertility determination during modernization. Although the framework for fertility analysis given here is equally applicable to premodern and modern conditions, the principal determining factors are different in the two situations. The threshold point h in Figure 2–6f may be thought of as the dividing line between premodern and modern fertility determination. To the left of point h, fertility is "regulated" by a variety of social and biological mechanisms working through natural fertility. It is not yet viewed by the household as involving a potential problem of unwanted children, and is in effect outside the standard household decision-making calculus. The modernization process, which shifts the typical household to a position to the right of point h, creates a fundamental change in the circumstances of family reproduction, moving the.
household from a situation where child-bearing is a matter "taken for granted" to one posing difficult problems of individual choice regarding the limitation of family size. To the left of point h, although there is a demand for children, the usual demand mechanisms emphasized in the economic theory of fertility are typically not operative. As we have seen, however, fertility may be affected by economic variables operating through supply conditions. The explanation of fertility in such a situation calls for inquiry along the lines followed by sociologists and other students of natural fertility. To the right of point h, the household decision-making approach comes into its own. Even here, of course, sociology still has an important part to play, particularly in the investigation of taste formation. To dramatize this contrast, the sections to the left and right of point h in Figure 2-6h have been labeled respectively "social control" and "individual control," following Bourgeois-Pichat's terminology. Such sweeping distinctions are never fully satisfactory. Social sanctions are operative in both premodern and modern circumstances, while the idea that there is no individual choice whatsoever in a premodern society is too strong. Moreover, no society shifts en masse at a single point of time from the "social" to "individual" control situations. The real world process would inevitably be characterized by timing differences between various groups in the population.

The proposition that there is a change in the basic nature of fertility determination should not be confused with the notion that modernization leads to the emergence of rationality in the area of human reproduction. In the present analysis, premodern reproductive behavior is rational in the sense that the means are appropriate to the end. Given a conception of the problem as one of having enough surviving children, maximization of output within the existing set of biological constraints and established social practices makes sense. The process of modernization alters not the rationality of the individual, but the nature of the problem from one of having too few children to one of having too many. Perception by individual households of this change in the nature of the problem and the devising of means of cope with it would hardly be expected to be instantaneous—hence the persistence of high fertility under circumstances where it is no longer needed. But this lag in the adjustment of fertility is a temporary one and is understandable, given the turn-around that has taken place in the nature of the problem, and is no evidence of irrationality.

It is possible that the emergence of a pressure for fertility limitation is one of the first forms in which modernization comes to impinge directly on the mass of the population. The appearance of a problem that had not previously existed—that of limiting family size—and thereby of a need for decision making of an entirely new sort, creates a pressure for attitudinal changes in a fundamental and immensely personal area of human experience. From this viewpoint the "population problem" may have positive consequences, by contributing to modernized attitudes that may more generally favor economic and social development. The presence of appropriate family planning services may facilitate this shift and ease the psychological pressures on individuals by increasing the likelihood of resort to "modern" techniques of fertility regulation rather than cruder traditional methods.

V

EXTENSIONS OF THE FRAMEWORK

In this section, we note some limitations of the framework developed here. The discussion focuses first on the need to move from analysis of marital fertility to the fertility of all women, by extending the framework to include nonmarital fertility and marriage behavior. It then notes some needed extensions of the marital fertility analysis itself, along with a few more general research implications.

The components of the fertility rate of all women. The foregoing analysis relates to the fertility of married women. The cumulative birth rate of all women is a weighted average of the fertility rates for married and unmarried women, where the weights are the relative proportions of married and unmarried women. The recent and ongoing studies of Ansley Coale (1971: 193–214; 1967: 205–209; 1969: 3–24; 1973, Livi Bacci 1971; van de Walle and Knodel 1967: 47–55) and his co-workers have provided valuable data on these three components of fertility (in somewhat different form) for a number of European nations and their political subdivisions. Their work points up the need for a general theory of marriage and fertility that will provide a basis for systematic analysis of these data.

For this purpose the present framework needs to be extended to cover the explanation of nonmarital fertility and the distribution of women by marital status. Nonmarital fertility can be analyzed with essentially the same framework as that developed here for the study of marital fertility; marital status, however, involves new considerations. No attempt will be made to go thoroughly into either of these here, but a few observations may be made. While the present remarks relate to a simple twofold classification by marital status, for some purposes a more elaborate scheme might be desirable. For example, for Latin American countries the proportion of consensual unions and...
the fertility rate for this class might be distinguished as separate categories of analysis, as is done by G. W. Roberts (1969: 695–711).

Nonmarital fertility. With regard to the explanation of nonmarital fertility, the framework developed for marital fertility is applicable but with some shift in analytical emphasis. In the case of natural fertility, one would expect the role of social taboos, particularly as they relate to extramarital sexual relations, to be of greater importance relative to biological factors for nonmarital than for marital fertility, and correspondingly to merit even greater analytical attention. For example, the rise in teen-age illegitimacy rates in the United States since 1940 is popularly attributed to greater frequency of intercourse among young unmarried persons due to a "sexual revolution" that has vastly relaxed social constraints on premarital intercourse. Certainly, in explaining the universally low levels of nonmarital fertility in the world, the underlying importance of such taboos in one form or another is important (Davis 1956: 214–215). This does not mean, however, that biological factors can be neglected. In fact, in regard to the uptrend in United States teen-age illegitimacy, Phillips Cutright (1972: 24–31) has presented data indicating that biological aspects of natural fertility have been important.25

A second respect in which the analysis of nonmarital fertility differs in emphasis from that of marital fertility is that the desired number of children is likely to be zero. Actually, as will be noted subsequently, this is too strong an assertion, but let us suppose for the moment that it were correct. Then, in terms of Figure 2–6, the C_d line would be horizontal at a value of zero, coterminous with the X-axis, and the trend in observed nonmarital fertility would depend on the C_n curve and the trend in subjective and market costs of fertility regulation. The C_n curve would presumably be at a much lower level than for marital fertility, because of the operation of social taboos on extramarital intercourse. The simple economic analysis of the demand for children which works through C_d would be irrelevant to the explanation of nonmarital fertility.

This, in fact, is the position taken in a valuable recent study by Shorter, Knoedl, and van de Walle of the long term decline in nonmarital fertility in Europe since the nineteenth century. The authors note the close parallel between the trends in marital and nonmarital fertility, and argue that the economic pressures sometimes cited to account for the decline in marital fertility cannot be used to explain the trend in nonmarital fertility: "J. A. Banks' explanation of the decline in marital fertility as a consequence of rising middle class stan-

25 Tietze (1972: 6) has raised some questions about Cutright's analysis.

standards of living and of simultaneous greater educational aspirations of parents for their children is much less plausible when applied to the decline in nonmarital fertility. It is unlikely that higher incomes moved unwed mothers to curb their illegitimate fertility so as to plan better the educational future of their bastards on hand. Possibly improvements in the standard of living during the last quarter of the nineteenth century restricted illegitimate fertility through some other mechanism. But an ad hoc rummaging about for alternate linkages to an 'economic prosperity' model is unlikely to result in any generalizable kind of explanation" (Shorter et al. 1971: 393). The authors suggest that the decline in nonmarital fertility was due to "obscure changes in the attitudes towards reproduction, and in the knowledge and acceptability of contraception and abortion," and that there is little evidence that the decline was due to a reduction in the frequency of nonmarital sexual activity during this period, the factor through which changing social constraints would have operated (1971: 382, 393). In terms of our framework, the emphasis is on changes in the costs of fertility regulation, and not C_n, the factor reflecting frequency of intercourse.

However, this view minimizes too much the possible relevance of economic considerations. For one thing, the argument regarding nonmarital fertility is used to question the bearing of economic factors on the trend even in marital fertility. Speaking of the declines in both marital and nonmarital fertility, the authors state: "Perhaps quite different and independent circumstances lay behind the drop in each, so that arguments explaining fertility limitation among married couples need not apply to a similarly successful limitation among unmarried couples. But in view of the extraordinary parallelism in the movement of these two facets of general fertility, this seems unlikely" (Shorter et al. 1971: 392). The present framework, however, suggests a mechanism whereby economic factors might cause a decline, not only directly in marital fertility but also indirectly in nonmarital fertility as well. Suppose, for example, that a decline in the demand for children among married couples due, for example, to the reasons given by Banks, generated a greater demand for fertility regulation, and in response to this, a substantial expansion occurred in the supply of abortion services, lowering their market cost and increasing their social acceptability. The reduced costs of fertility control would make it easier for unmarried as well as married women to terminate pregnancy, and thereby reduce nonmarital fertility. Thus a decline in nonmarital fertility might arise from the same basic circumstances that caused a decline in marital fertility. This argument does not contradict the emphasis that the article's authors place on the costs of fertility regulation in explaining.
the nonmarital fertility decline, but shows that changes in these variables might ultimately be linked to demand considerations bearing on marital fertility. This is not to argue that this was in fact the case, but merely to illustrate how the present framework lends itself to analysis of nonmarital fertility and to clarification of the possible channels through which economic factors may exert their influence.

When account is taken, therefore, of the possible interdependence between marital and nonmarital fertility, the factors emphasized in the economic theory of fertility may prove to be relevant to the explanation of nonmarital fertility. Economic circumstances may also assume more importance when another type of interdependence is recognized, that between nonmarital fertility and the distribution of women by marital status. There is evidence that some unmarried persons initiate intercourse in the expectation of eventually getting married (Kanter and Zelnick 1972: 9–18). If pregnancy occurs, and if at the same time young men are suddenly confronted with adverse economic circumstances, then marriage expectations may not be realized and the illegitimacy rate may consequently rise. With regard to American experience, it is possible that economic pressures may have operated to discourage marriage somewhat in the 1960’s, and in this way have contributed to the rise in illegitimacy (Easterlin 1973). But whether or not this was the case, this example illustrates another way that economic factors may influence nonmarital fertility through the interdependence between nonmarital fertility and other fertility components.

**Distribution by marital status.** In view of the empirical evidence on the importance of variations in marriage behavior in fertility differences, and the fact that marriage constitutes an area of decision making largely separate from fertility, it is surprising how little effort has been devoted to the theory of marriage behavior (Coale 1971: 193–214; 1967: 205–209). The present comments can do no more than note briefly a few of the considerations, economic and noneconomic, that need inclusion in such an analysis. It is obvious, however, that the lack of a theory of marriage behavior is one of the biggest gaps in the explanation of human fertility patterns.

Economic factors, in some respects similar to those included in the analysis of fertility, are relevant to marriage behavior. In his impressive documentation of the comparatively late marriage patterns of Western Europe, Hajnal (1965: 133–134; cf. also Davis and Blake 1956: 215–218) speculates that the rate at which land became available for the founding of new families may have been a controlling factor. Included in his discussion is the idea that some "typical" level of support is necessary for marriage and family formation. Thus the explanation of marriage behavior involves a question of the earnings potential of young men relative to desired living levels, a conception similar to that advanced to explain fertility changes in nineteenth-century Britain and the recent swing both in marriage and fertility behavior in the United States (Banks 1954; Easterlin 1973).

Noneconomic factors are also relevant to explaining marital status. The type of kinship organization in a society may be important. Davis and Blake (1956: 215) suggest, for example, that a joint household system is more conducive to early marriage than an independent nuclear family organization, because "marriage is in no way made contingent on the possession of separate property by the newly married pair." There are also important differences among societies in social customs relating to remarriage of those whose spouses have died.

Mortality conditions play a part in shaping the distribution by marital status. The practice of early marriage is sometimes attributed to concern over high and variable mortality. "Early marriage . . . represents the maximum possible hedge against the threat of failure in population replacement" (Davis and Blake 1956: 215). Coale (1967: 207) has pointed out that in India the decline in mortality has reduced the incidence of widowhood. The consequent shift in the marital status distribution of women would tend to raise fertility, other things being equal.26

An analysis of marriage behavior must also take account of interdependence between marriage and other components of fertility. The previous discussion noted a possible connection between nonmarital fertility and marriage. Matras, Coale, and others have suggested a link between marital fertility and marriage behavior. The argument is that as knowledge and acceptance of various practices of fertility regulation became common in twentieth-century Europe, this diminished the pressure for deferring marriage and contributed to a tendency toward earlier marriage (Coale 1967: 207; Hawthorne 1970: 25; Matras 1965: 349–362). It is possible that in Ireland religious constraints on family limitation within marriage contributed to the development of an unusually late marriage pattern even by Western European standards. Factors such as these need to be integrated in a framework that will lay a basis for systematic interpretation of observed marriage behavior.

**Extension of marital fertility analysis.** The present analysis was developed on the basis of assumptions especially chosen with a view to focussing attention on the interrelations among desired family size, the potential output of children, and the costs of fertility regulation. Extende

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26 See also Sauvy (1969: 359) for an indication of the possible importance to fertility of the lessened dissolution of marriages due to the death of one partner.
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7. Instead of the “representative” household, one may deal explicitly with the population of households, taking account of the variation in circumstances among them. Not only would this facilitate analysis of fertility differentials at a point in time, but it lends itself to recognition of the concurrent existence of a demand for ways of increasing fertility as well as of limiting it, and to formal analysis of a child- adoption market.

8. The previous observation starts to go beyond marital fertility as such. In conclusion, one further research possibility of this sort may be noted. In many models of economic growth, population and human fertility are treated as independent of the process of economic development. According to the view sketched above, voluntary fertility regulation tends to be induced by the pressures of modernization. Once this adaptive mechanism is recognized, models of the effects of population on economic growth which treat fertility as exogenous are called into question. According to the present analysis, a more realistic representation would treat fertility as an endogenous variable in the model, and recognize that economic growth has feedback effects on population change.

VI
SUMMARY

This chapter presents an analytical framework that integrates the approaches to fertility analysis of economists and sociologists, thus fostering mutual understanding and a more common conception of the subject, and of the needs for research and the potential contributions of both disciplines. While the chapter is primarily conceptual in nature, the empirical counterparts of the various concepts are discussed, and the use of the framework is illustrated by applying it to the interpretation of premodern fertility behavior and the transition to modern fertility levels. One implication of the discussion is that the dominant factors in fertility explanation and the underlying mechanisms may be different in premodern and modern circumstances.

The framework developed here is an expansion of the usual economic framework for fertility analysis to take fuller account of subjects particularly stressed in sociology, especially the production side of fertility when assessing the frequency of contraceptive methods, it is certain that infanticide is no longer an important method of fertility control.” On the other hand, Carl Taylor (1968: 2–7) speaking of today’s less developed countries, expresses the view that “[i]n many rural groups differential care favoring boys produces a significantly higher mortality of girl babies, a highly effective population control method.”
behavior, and attitudes toward and access to fertility regulation. More formal treatment of the production of children, including the possibility of shifts in output independently of demand conditions, is one of the principal innovations of the framework. The analysis relates to marital fertility, the principal dependent variable being the cumulative number of children surviving to adulthood (C), and, for simplicity, is expressed in terms of the "representative" household.

The determinants of fertility are seen as working through one or more of the following: (1) desired family size (C_0), the number of surviving children parents would want if fertility regulation were costless; (2) the potential supply of children (C_n), the number of surviving children parents would have in an unregulated fertility regime; and (3) the costs of fertility regulation, including both subjective (psychic) costs and objective costs, the time and money required to learn about and use specific techniques. The immediate determinants of desired family size are income, Y; the price of children relative to goods, p_c/p_g; and tastes (the utility function for children and goods), the factors chiefly discussed in economic analyses of fertility. It is through tastes or subjective preferences that some of the attitudinal considerations and measures stressed by sociologists operate such as norms regarding family size and the "quality" of children (that is, standards of child care and rearing). Economists, for the most part, pay less attention to tastes, and emphasize in their theoretical and empirical work income and price determinants of the demand for children.

The supply of children in an unregulated fertility regime depends on natural fertility, N, the total number of births parents would have if no conscious effort were made to regulate fertility, and the probability of a baby surviving to adulthood, s. As studies by sociologists, anthropologists, and economic historians show, natural fertility depends on both physiological and cultural factors. The latter comprises household circumstances which unintentionally influence fertility, such as an "intercourse taboo" or physical separation of partners due to such things as civil strife or seasonal migration for employment purposes.

The supply and demand conditions relating to children jointly determine the motivation for fertility regulation. If the potential supply falls short of demand (C_n < C_0), there is no desire to limit fertility. On the contrary, an "excess demand" situation of this type would result in a demand for ways to enhance fertility and for children to adopt, though these possibilities are usually quantitatively unimportant. In this situation, actual fertility would depend on natural fertility.

On the other hand, if the potential supply exceeds demand (C_n > C_0), an "excess supply" situation, parents would be faced with the prospect of having unwanted children and would be motivated to regulate their fertility. The degree of motivation, however, must be weighed against the costs of fertility regulation, which are of two types. There are psychic costs—the displeasure associated with the idea or practice of fertility control. Data relevant to these costs are obtained in sociological inquiries into fertility control attitudes. There are also market costs—the time and money necessary to learn about and use specific techniques, covered under sociological discussions of "access." The costs of fertility control are formalized in the present analysis in terms of \( \alpha \), a summary measure of subjective concerns about fertility regulation affecting the indifference map, and \( p_c \) and \( p_g \), the fixed and variable market costs of fertility regulation, which modify the budget constraint.

When account is taken of the costs of fertility regulation along with the factors shaping motivation, an equilibrium value of number of children, C, and births, B, is determined. At the same time the extent and efficiency of fertility regulation, R, which measures the shortfall of actual compared with natural fertility, is determined, as well as X, the excess of the actual number of births over the desired number. The variables R and X are approximated in sociologists' measures of "births averted" and "excess fertility." Thus, in the present analysis, actual fertility, excess fertility, and "births averted" are found to be simultaneous outcomes of the determinants underlying C_n, C_0, and the costs of fertility control. These determinants are, to sum up, the utility function for goods and children, potential income of the household (Y), the price of children relative to goods (p_c/p_g), natural fertility (N), the survival rate to adulthood (s), and the subjective and market costs of fertility regulation (\( \alpha \), \( p_c \) and \( p_g \)). It is through these variables that all other influences operate.

In applying this framework to the interpretation of actual experience, it is suggested that fertility conditions in premodern societies more nearly approximate an excess demand situation than one of excess supply. This is because mortality and fertility are high and widely fluctuating in these societies. As a result the principal concern of the typical household is likely to be whether it will be able to have as many children as it wants, or whether it will have too many. In this situation, observed fertility will depend on natural fertility. The economic variables of income and prices subsumed in the budget constraint would affect fertility through their impact on the potential output of children, but not by way of the usual demand mechanisms. Tastes play a part insofar as they help to establish a desired family size as large or larger than potential output, but changes in tastes would not affect
fertility behavior unless desired size fell below potential output. With regard to research needs, this implies that inquiry into premodern fertility should be primarily along the lines followed by sociologists and other students of the cultural and biological determinants of natural fertility.

The transition to modern fertility levels occurs because modernization shifts the representative household from a situation approximating an excess demand for children to one of excess supply, thereby generating a motivation to limit fertility and avoid unwanted children. This shift arises from aspects of modernization which tend, on the one hand, to increase the potential output of children, \( C_p \), and, on the other, to reduce desired family size, \( C_d \). Potential output tends to increase because of such developments as improved health of mothers, better education and knowledge of personal hygiene, better nutrition, and reduced infant and child mortality. Desired family size tends to decrease because of changes in taste and costs favoring goods relatively more than children. Also, at the same time that modernization increases the motivation for fertility regulation, it reduces the costs of fertility regulation, through urbanization, education, and the associated expansion of the mass media. These developments reduce market costs of fertility control by increasing access to methods of fertility limitation and they lower psychic costs by legitimizing the practice of fertility control. Modernization also results in innovations in fertility control methods, further lowering the costs of fertility regulation.

Thus while the forces of modernization lead, on the one hand, to greater motivation to limit fertility, on the other, they make fertility regulation easier by lowering its subjective and market costs. Eventually in the evolution from premodern to modern conditions the balance between motivation for fertility regulation and its costs tips in favor of fertility control. A “threshold” of fertility regulation is crossed and family size moves downward. For many reasons, however, the pattern of decline would be likely to be different from one place to another. There are differences in the initial premodern conditions from which societies start, and in the trends in the various aspects of modernization. In today’s less developed countries there are influences which were absent from the earlier experience of the now developed nations.

In modernized societies, then, fertility is governed by the interaction of the factors shaping family size desires, the potential output of children, and the costs of fertility regulation. Modernization thus alters the essential nature of fertility regulation. Child-bearing in premodern societies, though “regulated” by a variety of social and biological mechanisms working through natural fertility, is not yet viewed by the household as involving a potential problem of unwanted children. In contrast, in modern societies, fertility poses difficult problems of individual choice regarding the limitation of family size. As long as fertility control costs are positive, there will continue to be some unwanted children in modern societies, but in the course of time, actual family size tends to converge toward desired family size. “Fertility has left the biological and social field to become a part of behavioral science” (Bourgeois-Pichat 1967: 163).