DIMENSIONS OF HOUSEHOLD FERTILITY: AN ECONOMIC ANALYSIS

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The study of population has had a long tradition in economics dating at least from the time of Thomas Malthus. Yet until quite recently very little attempt was made to apply the current tools of economic analysis to the area of human fertility. Gary Becker's paper[1] delivered in 1958 marked the beginning of a serious attempt to render fertility behavior comprehensible in the context of an economic framework where households exercise volition over their family size. Currently a number of economists are engaged in research in this area, perhaps partly in response to the current national interest in population growth and its relation to our environment;[2] but partly, too, because the analysis of fertility is an excellent application of recent advances in the theory of household decision making.[3]

The purpose of the present paper is to summarize some of the information available from the NBER-Census Bureau's Consumer Anticipation Survey (CAS)[4] on economic factors related to dimensions of household fertility behavior. The paper first sketches the broad outlines of the analytical framework currently being applied to household decision making with respect to fertility. It then discusses some of the implications of this theory and relates them to empirical findings from the CAS data. The fertility dimensions considered are (1) the number of children in the household; (2) the age interval in which the wife engages in childbearing; (3) the spacing interval between children; and (4) the expected educational attainment of the children. The empirical results are indicated in cross-tabulations by age, education, income and number of children (where appropriate) and in multiple regressions with three to five explanatory economic variables.

The dimension of fertility behavior most extensively analyzed by economists is the household's completed fertility. Very little work has been done, by contrast, on the spacing of children. So this paper in part tests relatively well established hypotheses, while with respect to some other aspects of fertility it is essentially descriptive. It approaches the household's fertility behavior from the perspective of a single-equation model instead of in the context of a model which emphasizes interdependencies related to fertility decisions.[5]

The Analytical Framework

The broad outlines of an economic analysis of fertility may be summarized as follows.[6] The household is the decision making unit which attempts to maximize an objective function subject to constraints on its available resources and on its capacity to convert these resources into the arguments of its objective function. The household is analogous to a small multi-product firm. It is endowed with time, a rate of conversion of time into money (a wage rate), and perhaps non-human wealth which yields property income.[7] It converts these resources into "commodities" through production functions. These commodities are the arguments in its utility function.

Assume one of these commodities to be "childservices," defined as a quality adjusted flow of services from children. The household produces childservices by spending time and money maintaining the child and effecting the child's quality. A given level of childservices can be produced from various combinations of number and quality of children. Economic theory suggests that the factors which might affect the household's demand for childservices include income and relative prices.

Since the production of childservices uses the household's own time as well as purchased goods and services, the opportunity cost of time becomes an important determinant of relative prices and hence of demand. It is usually assumed that the production of childservices is relative intensive in the wife's time. So the relative price of childservices is positively related to the opportunity cost of the wife's time. It is also generally assumed that the production of childservices uses relatively little of the husband's time, so the relative price of childservices is negatively related to his opportunity cost of time. In the cross-section, market prices of goods and services are assumed to be the same for all households. So differences in relative prices of commodities across households are determined by relative time intensities and differences in the opportunity cost of time.

Since the opportunity cost of time is integrally related to earnings, the effects of income on demand for childservices depend critically upon the source of the income.[8] Failure to contend with subtle changes in relative prices which accompany changes in income probably accounts for the widely different estimates of the effect of income on the demand for children in the literature. A final economic variable which may affect both relative prices and real income is the level of "technology" utilized in household production. Increases in the couple's level of education may raise the household's commodity output per unit of input and thereby raise its real wealth; if education affects productivity differently across commodities, relative prices will also be affected.[9]

Since it is not assumed that childservices are proportional to the household's stock of children across households, the implications with respect to childservices do not directly apply to the household's derived demand for children. Indeed substitution between number of children and quality of children is one of the most interesting, albeit difficult, aspects of this framework. To obtain implications related to the number of children, assume that their production is relatively intensive in the wife's time. Then increases in her opportunity cost of time raise the relative price of children as well as the relative price of childservices. So through substitution in production and substitution in consumption, the theory implies a negative relationship between her time value and the household's demand

for children.

If we assume the husband's time is used relatively more extensively in the production of child quality, increases in his time value, holding income fixed, induce substitution toward quantity of children and away from higher quality children, while through substitution in consumption the demand for childservices rises. So the model predicts a positive effect of his time value on quantity of children and the effect on quality of children depends upon the strength of the effects of substitution in production (away from quality) and in consumption (toward more childservices and therefore toward higher quality). Increases in income which are not related to the value of time may still affect the relative price of quantity to quality if expenditures on quality are complementary with expenditures on "luxuries."[10] So without additional restrictive assumptions the predictions about the direction of effect of income on the derived demand for children are ambiguous.

The effect of the couple's education level on the relative price of quantity to quality operates through its effects on relative proficiencies of producing quantity of children and quality of children. With respect to quantity the dominant effect is presumed to be through contraceptive efficiency. Expenditures of time and money on contraception are made to prevent the acquisition of additional children. The higher the costs of contraception (for any given level of exposure to the risk of pregnancy) the lower the cost of acquiring an additional child. Said differently, the more it costs to avoid having a child the greater the economic incentive to have the child. Therefore if increases in education lower the expenditure on contraception necessary to achieve any given level of risk of pregnancy, increases in education will, in effect, raise the shadow price of having children.[11] This will induce a shift in the production of childservices toward fewer, higher quality children.

Likewise, if increases in education have a disproportionate, positive effect on the couple's capacity to produce quality in children, this too will raise the relative price of quantity to quality. This latter effect is difficult to substantiate directly without more definitive work on the characteristics of "quality" in children. If we assume "quality" to be positively monotonically related to the child's ultimate level of schooling, the hypothesis could then be more explicit: the higher the couple's education level the greater the marginal product of the couple's time spent with the child on the child's ultimate schooling level.

The previous paragraphs set out a conceptual framework in which the effects of changes in economic factors on the household's demand for childservices and derived demand for children and their quality have been analyzed. In some cases unambiguous predictions about the direction of effects have been made; in other instances opposing influences are identified. The focus has been upon the demand for number of children or quality of children while the empirical results also look at the timing and spacing of children. The framework discussed here will be of use in interpreting these latter results as well.

Household Fertility Patterns from the CAS Data

The household's fertility behavior was not a primary concern of the Consumer Anticipation Survey. Yet in the context of a model which views children as a consumer durable, the present analysis seems to fit comfortably with this survey which does emphasize the ownership and acquisition of durable goods. Since the survey obtained information on only the children under the age of twenty-two, the empirical analysis is restricted to households in which the wife is under the age of 40. It is further limited to husband-wife families in which the husband was not self-employed and was working at a full-time job for 50-52 weeks in 1967. The sample of 1711 households (from the approximately 4600 observations in the first wave of the survey conducted in May 1968) is a relatively high income, well educated group of suburban families. The means (and standard deviations) of key variables from the sample are indicated in the accompanying table.

Summary Statistics, Sample of 1711 Households
Consumer Anticipation Survey

variable	mean	(standard deviation)
Age of husband	34.9	(5.65)
Age of wife	31.8	(4.71)
Education of husband	15.4	(2.34)
Education of wife	13.9	(2.06)
Wage rate of husband	$5.73	($2.14)
Income of husband*	$16,455.	($6207.)
Number of children	2.44	(1.34)

*The "income of husband" variable used throughout this paper is age adjusted. The husband's observed full-time current income (not earnings) is used to project to age 40 his full-time income

(a) The Quality of Children

The CAS data contain information on the number of children in the household (under the age of 22) rather than the more frequently used variable, the number of children ever born to the woman. In a vast majority of cases the two variables will be the same although discrepancies may exist as a result of infant or child mortality, children from previous marriages, adoptions and children over the age of twenty-two.[12]

Table 1 indicates the average number of children in the household at specified age intervals for couples who indicated their fertility was completed.[13] Panel A reflects a negative relationship between the wife's education level and the number of children. Unless the youngest cohort in this table experiences an appreciably reduced completed fertility the table suggests that several of those who indicate their fertility completed will in fact have additional children in the future. Panels B and C suggest that the effect of the wife's education remains negative when either the husband's income or his education level is held constant. Since the opportunity cost of her time is positively related to the wife's education level, this negative relationship is consistent with the model's prediction. The partial effect of income in Panel B appears to be positive while the husband's education level (Panel C) has no clear systematic effect

when the wife's education is held constant.

Multiple regressions within age groups are shown in Table 2. Again the wife's education has a negative partial effect on the number of children although it is statistically significant only at the higher age interval. The husband's wage rate has a positive effect on the number of children as predicted. The income variable also has a positive coefficient although its t-value is about 1.75 for both age groups. When both the husband's wage rate and age-adjusted income are included, the coefficients are positive for each in both age groups but neither exhibits statistical significance.[14] For the women aged 35-39 the regression which includes the income variable implies an income elasticity at the point of means of .086 which is not unlike other estimates in the literature. But when the husband's wage is held constant the implied elasticity falls to .058 and the income coefficient's t-value is 0.68. So in studies where a positive and statistically significant income elasticity is observed, if the husband's opportunity cost of time is not held constant, the observed income elasticity may simply reflect this substitution effect.

The effect of the husband's education level on the number of children in these regression is consistently negative although not statistically significant. The two education variables reflect the partial effects of increases in each separately. An alternative interpretation rests on the result from human capital theory that absolute differences in education levels are proportionate to relative differences in full-time earnings.[15] The coefficient on the wife's education level reflects an increase in the difference between her education level and her husband's, so it reflects the effect of an increase in her relative earning-power (or the opportunity cost of time). Summing the coefficients on the wife's education and husband's education reflects an increase in their education level holding her relative time value fixed.[16] Since his wage rate is also held constant in the regression the sum of the two coefficients is interpreted as the effect of education through nonmarket productivity. It is negative and statistically significant in the four regressions in Table 2.[17]

The third regression in Table 2 indicates that an increase in the wife's relative time value lowers the couples fertility (one more year of schooling lowers fertility by six-hundredths of a child on the average). An increase in the couple's level of education holding their market time value constant lowers fertility (one more year of schooling lowers fertility by seven-hundredths of a child). Increases in the husband's wage rate raise fertility (a dollar increase in his hourly wage rate raises fertility by four-hundredths of a child). So these results closely conform to the implications from the theoretical model. The magnitude of the effects though is small -- the residual variation is only slightly reduced and the slope coefficients are quite low. Economic theory predicts the direction of effects of factors which influence relative prices and real wealth but does not imply that these effects will dominate at the individual household level. Yet small effects if systematic and predictable may be relatively important to an understanding of aggregate behavior across cities, regions, or nations or over periods of time, since in the aggregate many of the individual idiosyncrasies which pervade micro data sets will cancel out.

(b) The Timing of Children

The timing and spacing of children are dimensions of fertility which have not received much attention by economists. The theory discussed above focuses on the household's demand for a stock of children and does not directly yield implications regarding the optimal age interval for the production of children or the optimal spacing of a given stock of children. These factors are of more than passing interest however since for a given number of children, changes in the average age at which childbearing takes place can have an appreciable effect on the long run rate of population growth through its effect on the length of a generation.

This paper does not develop a theory of the timing of childbearing although the household production function model would seem a logical framework for such a theory. Instead the same economic variables used in the previous section are again considered in looking at evidence related to the age at which childbearing began and the probability of additional children at specified age intervals.

Tables 3 and 4 deal with the age of the oldest child in the household. For age specific groups, an increase in the age of the oldest child reflects an equal decrease in the age at which childbearing began.[18] So the very consistent negative relationship between the wife's education level and the mean age of the oldest child suggests that more educated women begin their childbearing at a later age. Table 3 also indicates that they do so when the husband's income level or the number of children in the family is held constant as well. The strong negative effect of the wife's education on the age of her oldest child (with the wife's age given) is again seen in the regressions in Table 4 which hold constant several other variables as indicated. (The slope coefficient suggests that an extra year of schooling for the wife postpones the first child by about one-half a year). The regression also indicates that the higher the education level of the husband the later childbearing begins and the effect of increases in the husband's wage rate is to lower the wife's age at the first birth.

Despite the strong statistical relationship indicated in these two tables it is not suggested that the increase in education induced the woman to choose to begin her childbearing later. Instead, both acquiring formal education and raising children are presumably relatively time intensive activities. So while engaged in education, the woman's time value is relatively high which effectively precludes her simultaneously choosing to engage in childbearing. Thus the results probably reflect the sequential nature of the optimal strategy for acquiring education and children. Whether the possession of human capital has any independent effect on the age at which childbearing commences is not clear.[19]

In addition to looking at the age at which childbearing begins, the CAS data also permit us to look at the termination of the childbearing

period. The variable is the household's own estimate of its chances of acquiring additional children within the next three years. The presumption is that differences in the household's expectations about its future fertility convey some information about its ultimate fertility behavior.[20] More certainly, the responses convey information about the couple's intentions, ex ante.

Tables 5 and 6 suggest that (holding her age constant) below age 35, increases in the wife's education raise the probability of additional births in the next few years, ceteris paribus. The effect is no longer present at the age interval 35-39 years, where the slope coefficient in the regression is in fact negative. These results along with the information in Tables 3 and 4 are consistent with the more educated woman beginning her childbearing at a later age; being more likely to have another child within any given short interval of time (i.e. three years) from the end of her schooling to, say, age 35; and ending her childbearing no later than her less educated counterpart. That is, the more educated woman may begin childbearing later, space her children closer together and end her childbearing at least no later than less educated women. The following section discusses the spacing of children more directly.

(c) The Spacing of Children

Child rearing is presumed to be relatively time intensive in the wife's time. So the higher the opportunity cost of her time the greater the incentive to compress the time interval in which childbearing takes place, in order to economize on the use of the wife's time. Not only does the wife forego other uses of her time during the period she spends with her children, she may also be disinvesting in her own marketable human capital. If so the more educated woman has an added economic incentive to concentrate her childbearing in a relatively short period of time.

Improvements in contraceptive efficiency may also shorten the time interval of childbearing. With only moderately effective contraception the couple may postpone births to achieve a smaller total family size.[21] But as contraceptive efficiency improves, the incentive to postpone for this purpose is reduced. So if the couple's contraceptive efficiency is positively related to its level of education, as hypothesized above, then aside from effects through the value of time and depreciation of human capital, the more educated may be expected to space their children closer together.

Tables 7 and 8 suggest that more educated women do in fact space their children closer together. For women aged 35-39 with three children, those with four or more years of college space their children about one-half a year closer together on the average than women with no college; for the women with four children the average difference is about two years. The regressions in Table 8 are run across households with the same number of children and the effect of the wife's education is negative though somewhat erratic. Other things held constant the effect of the husband's education is also seen to be negative as predicted although the coefficients do not exhibit much stability in this table.

Table 9 indicates the absolute and relative variation in the spacing of children within the household. The absolute variation is the standard deviation of the time intervals between successive children in the household. The relative variation in this standard deviation divided by the average spacing of the household's children. For the three columns in Table 9 in which all three cells have at least thirty observations, the figures imply that as the wife's education rises the variation in the spacing of children declines.[22] That is, more educated women tend to space their children more evenly. This may be related to contraceptive efficiency if outlying observations reflect contraceptive failures.

(d) The Quality of Children

The theory emphasized the possibility of substituting between quantity of children and quality of children in meeting the household's demand for childservices. It was indicated that the relative price of number of children to quality of children is, under the assumptions of the model, positively related to the wife's opportunity cost of time, to the education level of the husband (through technological effects which lower the cost of contraception and lower the cost of quality production) and to the household's income level (if luxuries are complementary with direct expenditures on quality of children). The relative price is negatively related to the husband's opportunity cost of time (if quality production is more time intensive in his time). So holding the household's demand for childservices fixed the theory implies a shift toward quality as the wife's opportunity cost, the couple's education level, and income rise and as the husband's opportunity cost of time falls.

The difficulty in testing these predicted effects is in holding the demand for childservices constant. Without this, one observes that the net effect of substitution in production between quality and quantity and substitution in consumption toward or away from childservices as discussed above in an earlier section. In the case of the husband's time value, for example, the former implies a negative effect on quality of children while substitution in consumption implies a positive effect. Only in the case of income, with the income elasticity of childservices positive, do these two effects move in the same direction yielding an unambiguous prediction of a positive effect on quality of children. What can be determined from the empirical results, then, is whether the substitution in production or consumption appears to dominate.

Table 10 suggests that the effect of the wife's education on the quality of children -- measured by the level of education the couple expects its oldest child to attain[23]-- is positive. The effect persists when the household's income or the number of children is held constant. Income itself appears to have a positive effect on the child's education, ceteris paribus. If one looks at only those cells in Panel B with at least thirty observations, there appears to be an erratic but negative relationship between the number and education level of children.

In the regressions in Table 11, in most cases the direction of effects of the four vari-

ables, although not statistically significant, are consistent with the predicted effects through substitution in production between quantity and quality of children. The wife's relative education level, the couple's education and the husband's income appear to raise the child's education level. The effect of the husband's wage is less clear. On the whole these regressions seem to suggest that the substitution between quantity and quality is of greater magnitude than the substitution between commodities toward or away from childservices.

FOOTNOTES

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[1]Gary S. Becker, "An Economic Analysis of Fertility," in Demographic and Economic Change in Developed Countries, NBER, Princeton University Press, 1960.

[2]See for example the papers delivered at the 1970 American Economic Association meetings in the session "Population and Environment in the United States," American Economic Review, LXI (May 1971), pp. 392-421.

[3]In particular see Gary S. Becker, "A Theory of the Allocation of Time," Economic Journal, 75 (September 1965).

[4]This survey is a panel survey of some 4600 households living in suburban Boston, Minneapolis and San Jose. Its basic objective was an analysis of consumer anticipations regarding durable goods purchases and components of savings. In the first visit of the survey, conducted in May 1968, considerable information was obtained about the household's children under the age of 22 and about expectations regarding the education of the children and the couple's future fertility. Only the information from this first visit is utilized in this paper.

[5]For an example of a simultaneous equations model which treats fertility decisions along with marriage, migration and women's labor force participation decisions, see Marc Nerlove and T. Paul Schultz, Love and Life Between the Censuses: A Model of Family Decision Making in Puerto Rico, 1950-1960, RM-6322-AID, The Rand Corporation, Santa Monica, Calif., September 1970.

[6]There are a number of ongoing research projects, especially PhD. dissertations, which use a similar framework. For a thorough discussion of one such model see, Robert J. Willis, A New Approach to the Economic Theory of Fertility Behavior, mimeo, 1969.

[7]Of course, the amount of human and nonhuman wealth the household has is a function of its previous consumption-investment decisions. These are taken as already determined for the discussion here.

[8]On this point, see Robert J. Willis and Warren Sanderson, "Is Economics Relevant to Fertility Behavior?" presented at the AEA meetings, December 1970.

[9]See my The Effect of Education on Efficiency in Consumption, NBER, 1971 (forthcoming).

[10]If childquality, K, is a function of expenditures of time and money on the child's quality, k, and of the environment to which the child is exposed, e,

$$K = f(k,e)$$

then if $f_{ke} > 0$ and if e is positively related to the couple's level of income, the higher their income the greater their incentive to produce childservices with relatively fewer, higher quality children.

Verbally the argument is this: by definition wealthier households spend proportionately more on "luxuries" and empirically these include travel, durable goods and housing. These expenditures for the adults' own use may complement the couple's direct expenditure on the child's quality. If so, they will lower the relative price of quality to quantity of children and hence that relative price will be negatively related to the couple's income.

[11]Considerable evidence exists that more educated couples use contraceptive techniques more extensively, adopt them at an earlier birth interval and tend to select more effective methods. See P.K. Whelpton, A.A. Campbell and J.E. Patterson, Fertility and Family Planning in the United States, Princeton University Press, 1966 for evidence based on a national survey conducted in 1960. Similar surveys conducted in 1955 and 1965 offer additional supporting evidence.

[12]Neither variable precisely reflects the couples derived demand for children since the one excludes children already grown up while the other ignores children not born of the mother. It is also not clear how child deaths or children from previous marriages should be considered in a study of demand. The date of birth of each child ever born is clearly preferable for the study of the timing and spacing of children. This information is not available in the CAS data so the ages of the children in the household have been used.

A later interview in the CAS did ask the respondent "How many children have you ever had." A check has been made for the women age 35-39 to see how closely the response to this question conforms to the information on the children in the household from the survey a year earlier. Adjusting for new births, on which information also exists, of the 425 households for which the comparison was possible about 5 per cent indicated having had a greater number of children than the number currently in their household. In half of these cases the oldest child listed was below the age of 12 and for these it would seem more likely that the discrepancy resulted from a child death than a child over the age of 22. It was also found that in about 1 per cent of the cases the number of children in the household exceeded the number ever born. This could result from adoptions, children born of a previous marriage by the husband or, of course, tabulation

error. Some of these issues could be resolved if information were available on the age at marriage or the existence of previous marriages but neither was available in the CAS data.

[13]Couples were asked "Do you think you are likely to have one or more (additional) children at some time in the future?" Only those who answered "No" are designated as having completed fertility. While the usual practice is to consider women of a given age as having completed their fertility, the responses to this question reveal that about 14 per cent of the women 35-39 did not consider their family size completed.

[14]The simple correlation between the two variables is .825 and .847 in the two age subsets so the problem of multicollinearity may explain the relatively high standard errors. A more adequate test of the implication that the husband's price of time and the household's income have separate, distinct effects on fertility could be made using non-earnings income although even then the value of nonmarket time is affected by the amount of market purchases with which the time is employed.

[15]One of the fundamental equations in human capital theory states

$$\ln Y_s \doteq \ln Y_o + rS$$

where Y is income, r is the rate of return to years of schooling, S is the number of years of schooling and the subscript designates the number of years of schooling. (See Gary S. Becker, Economic Theory, A.A. Knopf, 1971, p. 180.) So for the wife (w) and her husband (h), assuming $Y_{ow} = Y_{oh}$ and both have the same rate of return:

$$\ln \left(\frac{Y_{sw}}{Y_{sh}} \right) = r(S_w - S_h).$$

[16]If the two terms in the regression should represent the wife's relative time value and the husband's education level:

$$b_1(S_w - S_h) + c_1 (S_h)$$

and the regression run includes instead:

$$b_2(S_w) + C_2(S_h)$$

then the relevant coefficients are estimated as $b_1 = b_2$ and $c_1 = c_2 + b_2$.

[17]The values for the four regressions in Table 2 are: -.075 (.034) and -.078 (.035) for the regressions on women age 30-34 and -.072 (.028) and -.074 (.028) for the women age 35-39. The standard errors can be calculated from the variances and the covariance of the regression coefficients. In all four cases the slope coefficient is statistically significant at conventional levels of confidence.

[18]Two deficiencies exist in the data used here. First, the information does not relate to the woman's first live birth but rather the oldest child in the household. Second, the wife's age is indicated only by five year intervals. Since a principal interest here is in the education levels of the wife and husband it is important to consider whether the upward trend in education is sufficient to tend to place the more educated individuals in an age interval at the lower ages in the interval. It does not appear to be the case. For white women in the United States in March 1970 the median level of schooling was 12.5 for those in the 25-29 age interval as well as for those in the 30-34 age interval; the figure was 12.4 for those in the 35-44 age interval. (See Current Population Reports, P-20, November 30, 1970.)

[19]Another aspect of this issue is the age at marriage. Although this information was not available in the CAS data, the 1960 Growth of American Families (GAF) survey contained evidence on the wife's age at marriage and the time span between marriage and the first birth. For the 1931-1935 cohort, the average of the wife at the time of marriage rose from 18.5 for the grade school group to 19.7 for the group with four years of high school to 21.6 for those with four or more years of college. [It is interesting to note that Census data (CPR, Series P-20, No. 198, March 25, 1970) suggests a weaker relationship between husband's age at marriage and his education than the relationship seen here between wife's age at marriage and her education. This difference is consistent with an early marriage adversly affecting the wife's relative educational attainment. Another explanation for the observed difference is that the GAF data refer to means while the Census data use medians and the distribution of age of marriage is probably more negatively skewed at lower levels of education.]

The average number of months between marriage and first birth in the GAF data rose with the wife's education from 21 months for the grade school group to 28 months for the group with any college training (the comparable figures for couples using contraception during that birth interval were 24 months to 33 months). Similarly the percentages of couples with a first birth prior to their first wedding anniversary fell with education from 41% of the grade school group to 24% of the college group (see Whelpton, P.K., A.A. Campbell and J.E. Patterson, Fertility and Family Planning, 1966, pp. 320-329).

[20]From subsequent waves of this panel survey one can determine how accurately the household predicted its fertility in the next few years. This analysis has not been completed at this time.

[21]Keyfitz points out that the level of contraceptive efficiency required to assure no accidental pregnancies over a long period of time is surprisingly high. For a couple employing a contraceptive technique with 99 per cent effectiveness over a twenty-year period from say age 20 to 40, the chances of a pregnancy are about 40 per cent (for a ten-year period the probability falls to about 21 per cent). At a 99.9 per cent level of effectiveness the probability of a pregnancy in twenty years is about 5 per cent. (These figures are based on an assumed constant per month probability of conception of .2 for women exposed to the risk of conception.) See Nathan Keyfitz, "How Birth Control Affects Births," Social Biology, June 1971. Not all the above calculations are taken from Keyfitz's paper.

[22]In regressions not shown here on the standard deviation (which follow the format of the regressions in Table 8) the wife's education variable was always negative althouth significant only for the 30-34 age women with three children.

TABLE 1

NUMBER OF CHILDREN

Table includes only households not likely to have (additional) children at any time in the future.

A

Education of Wife	Age of Wife < 30	30-34	35-39	
≤ 12	2.45	3.06	3.13	2.98
13-15	2.21	2.83	2.85	2.75
≥ 16	2.32[d]	2.83	2.77	2.75
	2.36	2.93	2.94	2.85
				(1033 obs)

B

Education of Wife	Income of Husband ≤ 12,000	12-16,000	≥16,000	
Age of Wife:	30-34			
≤ 12	3.04	2.82	3.41	3.06
13-15	2.88[d]	2.82	2.82	2.83
≥ 16	2.17[f]	2.74	2.98	2.83
	2.92	2.80	3.06	2.93
				(366 obs)
Age of Wife:	35-39			
≤ 12	3.06	3.03	3.32	3.13
13-15	2.59	2.86	2.97	2.85
≥ 16	2.22[d]	3.06	2.78	2.77
	2.81	2.98	3.01	2.94
				(513 obs)

C

Education of Wife	Education of Husband ≤ 12	13-15	16	≥17	
Age of Wife:	30-34				
≤ 12	3.02	2.89	3.10	3.27	3.06
13-15	3.44[f]	2.86[d]	2.96	2.53	2.83
≥ 16	3.00[f]	3.20[f]	2.82	2.80	2.83
	3.09	2.90	2.96	2.84	2.93
					(366 obs)
Age of Wife:	35-39				
≤ 12	3.00	3.26	3.31	2.86[d]	3.13
13-15	2.67[d]	3.00	3.08	2.54	2.85
≥ 16	1.40[f]	2.77[e]	2.84	2.81	2.77
	2.87	3.09	3.07	2.73	2.94
					(513 obs)

Code: f indicates cell size 1-9
e indicates cell size 10-19
d indicates cell size 20-29
All others have 30 or more observations.

TABLE 3

AGE OF THE OLDEST CHILD

Table includes only households with at least one child.

(in years)

A

Education of Wife	Age of Wife ≤ 29	30-34	35-39	
≤ 12	4.79	9.55	12.99	9.51
13-15	3.77	8.43	11.76	8.17
≥ 16	2.91	6.57	10.09	6.83
	3.93	8.26	11.77	8.30
				(1591 obs)

B

Panel B includes only households not likely to have additional children at any time in the future.

Education of Wife	Income of Husband ≤12,000	12-16,000	≥16,000	
Age of Wife:	30-34			
≤ 12	10.48	9.15	10.41	9.94
13-15	9.09[d]	9.49	8.72	9.06
≥ 16	8.50[f]	7.68	7.94	7.88
	9.94	8.84	8.97	9.13
				(364 obs)
Age of Wife:	35-39			
≤ 12	13.51	13.48	13.31	13.44
13-15	11.84	11.89	12.25	12.03
≥ 16	9.93	10.22	10.79	10.43
	12.50	11.96	12.08	12.16
				(506 obs)

C

Education of Wife	Number of Children 1	2	3	4	
Age of Wife:	25-29				
≤ 12	3.06	5.36	7.50	8.35[e]	
13-15	1.60	4.86	6.35[d]	6.00[f]	
≥ 16	1.40	3.94	5.40[e]	6.33[f]	
	1.86	4.74	6.63	8.00[d]	4.29
					(372 obs)
Age of Wife:	30-34				
≤ 12	7.27[e]	8.18	9.73	10.97	
13-15	6.08[e]	7.24	9.07	9.85[d]	
≥ 16	2.50[e]	5.52	8.07	9.27[e]	
	5.06	6.84	9.03	10.27	8.01
					(503 obs)
Age of Wife:	35-39				
≤ 12	9.00[e]	11.69	13.20	14.65	
13-15	8.43[f]	10.77	11.70	13.47	
≥ 16	8.38[e]	8.68	10.82	10.91	
	8.65	10.50	12.02	13.24	11.49
					(519 obs)

TABLE 5

PROBABILITY OF ACQUIRING A CHILD WITHIN THE NEXT THREE YEARS*
(in per cent; 100 = certainty)

A

Education of Wife	Age of Wife < 25	25-29	30-34	35-39	
≤ 12	62	37	11	8	20
13-15	76	57	20	3	29
≥ 16	84[d]	66	29	7	34
	70	53	19	6	27

(1711 obs)

B

Panel B includes only households with one or more children.

Education of Wife	Income of Husband < 12,000	12-16,000	≥16,000	
Age of Wife: under 30				
≤ 12	33	44	43	40
13-15	51[d]	56	59	57
≥ 16	59[e]	55	66	63
	42	50	57	52

(458 obs)

Age of Wife: 30-34				
≤ 12	12	7	11	10
13-15	21	19	21	21
≥ 16	44[e]	22	29	28
	19	15	22	19

(550 obs)

Age of Wife: 35-39				
≤ 12	11	3	6	7
13-15	4	4	3	4
≥ 16	12	2	9	7
	10	3	6	6

(583 obs)

C

Education of Wife	Education of Husband ≤12	13-15	16	≥17	
Age of Wife: under 30					
≤ 12	44	42	47	49	45
13-15	68[e]	53	68	54	61
≥ 16	37[f]	77[f]	72	64	68
	48	50	65	58	57

(551 obs)

Age of Wife: 30-34					
≤ 12	15	11	10	5	11
13-15	16[e]	18	19	23	20
≥ 16	43[f]	35[e]	31	26	29
	16	16	22	20	19

(563 obs)

Age of Wife: 35-39					
≤ 12	5	8	11	9[d]	8
13-15	2[d]	0	3	7	3
≥ 16	17[f]	4[e]	7	8	7
	5	4	7	8	6

(597 obs)

TABLE 7

TIME BETWEEN BIRTH OF OLDEST AND YOUNGEST CHILD
(in years)

Education of Wife	Number of Children 2	3	4	5	
Age of Wife: 25-29					
≤ 12	2.73	5.10			
13-15	2.77	4.54[d]			
≥ 16	2.25	4.33[e]			
	2.59	4.73			(223 obs)
Age of Wife: 30-34					
≤ 12	3.03	5.86	7.28	8.69[e]	
13-15	2.70	5.53	6.96[d]	8.50[f]	
≥ 16	2.68	4.95	6.91[e]	7.67[f]	
	2.80	5.48	7.10	8.41[d]	(484 obs)
Age of Wife: 35-39					
≤ 12	3.81	6.04	8.79	10.78[d]	
13-15	3.03	5.85	8.07	9.78[f]	
≥ 16	3.02	5.52	6.81	9.67[f]	
	3.31	5.82	8.02	10.37	(523 obs)

TABLE 9

VARIATION IN THE SPACING OF CHILDREN

Standard deviation* (in years) and coefficient of variation (%)

Table includes only households with a positive time span between the ages of the oldest and youngest child.

Education of Wife	Number of Children 3	4	5	
Age of Wife: 30-34				
≤ 12	1.08 (32.0)	0.90 (34.7)	1.06[e] (42.3)	
13-15	0.92 (29.3)	0.99[d] (36.7)	0.74[f] (30.0)	
≥ 16	0.72 (27.7)	0.95[e] (38.2)	0.75[f] (35.0)	
	0.93 (29.9)	0.94 (36.0)	0.90[d] (37.0)	(293 obs)
Age of Wife: 35-39				
≤ 12	1.05 (34.7)	1.28 (39.2)	1.55[d] (51.3)	
13-15	0.99 (28.9)	1.30 (43.3)	0.84[f] (30.0)	
≥ 16	0.71 (23.8)	0.84 (34.4)	0.92[f] (30.0)	
	0.92 (29.6	1.16 (38.9)	1.28 (42.9)	(328 obs)

TABLE 10

THE NUMBER OF YEARS OF SCHOOLING EXPECTED TO BE COMPLETED BY THE OLDEST CHILD*

(in years)

A

Panel A includes only households with one or more children.

Education of Wife	Income of Head <12,000	12-16,000	≥16,000	
Age of Wife: under 30				
≤ 12	14.8	15.2	15.2	15.1
13-15	15.4[d]	15.9	15.5	15.6
≥ 16	16.2[e]	16.3	16.2	16.2
	15.2	15.7	15.7	15.6
				(458 obs)
Age of Wife: 30-34				
≤ 12	15.5	15.5	15.8	15.6
13-15	15.5	15.7	16.1	15.9
≥ 16	16.1[e]	16.2	15.7	15.9
	15.6	15.8	15.8	15.8
				(550 obs)
Age of Wife: 35-39				
≤ 12	15.2	15.3	15.8	15.4
13-15	15.5	15.8	16.1	15.8
≥ 16	15.6	15.8	16.2	16.0
	15.3	15.6	16.0	15.7
				(583 obs)

B

Education of Wife	Number of Children 1	2	3	4	5	
Age of Wife: 25-29						
≤ 12	15.5	15.2	15.0	15.1[e]	16.0[f]	15.2
13-15	15.4	15.8	16.0[d]	16.0[f]	16.0[f]	15.7
≥ 16	16.2	16.2	16.1[e]	16.0[f]	16.0[f]	16.2
	15.8	15.7	15.6	15.2[e]	16.0[f]	15.7
						(376 obs)
Age of Wife: 30-34						
≤ 12	15.2[e]	15.7	15.6	15.6	15.5[e]	15.6
13-15	15.5[e]	15.8	16.0	16.0[d]	15.8[f]	15.9
≥ 16	15.1[e]	16.2	15.7	16.3[e]	16.2[f]	15.9
	15.3	15.9	15.7	15.8	15.7[d]	15.8
						(530 obs)
Age of Wife: 35-39						
≤ 12	15.6[e]	15.6	15.5	15.3	14.6[d]	15.4
13-15	16.3[f]	15.9	15.9	15.4	16.0[f]	15.8
≥ 16	16.2[e]	15.7	16.1	16.1	15.7[f]	15.9
	15.9	15.7	15.8	15.5	15.1	15.7
						(557 obs)

*The figures are obtained from the response to the question: what grade or year of schooling is the child expected to eventually complete?

TABLE 2

Number of Children

Regressions include only households not likely to have (additional) children at any time in the future.

Mean and (st. deviation) of dep. var.	Education of husband	Education of wife	Wage rate of husband	Income of husband	R^2 s.e.e.
	Age of wife: 30-34 (366 observations)				
2.93	-.023	-.052	.057		.020
(1.084)	(.028)	(.032)	(.028)*		1.078
	-.026	-.053		.002	.017
	(.029)	(.032)		(.001)	1.080
	Age of wife: 35-39 (513 observations)				
2.94	-.012	-.059	.042		.017
(1.196)	(.026)	(.028)*	(.025)		1.189
	-.012	-.062		.002	.018
	(.026)	(.028)*		(.001)	1.189

* implies statistical significance at 95% level of confidence (two-tail test)

TABLE 4: Age of the Oldest Child [1]

Mean and (st. deviation) of dep. var.		Education of husband	Education of wife	Wage rate of husband	Income of husband	R^2 s.e.e.
		Age of wife: under 25 (80 observations)				
1.94	(1)	-.058	-.251	.194		.108
(1.487)		(.075)	(.120)*	(.151)		1.432
	(2)	-.017	-.279		-.000	.089
		(.074)	(.120)*		(.003)	1.447
		Age of wife: 25-29 (378 observations)				
4.35	(3)	-.103	-.523	.048		.133
(3.007)		(.076)	(.087)*	(.086)		2.811
	(4)	-.067	-.517		-.002	.134
		(.079)	(.088)*		(.003)	2.809
		Age of wife: 30-34 (550 observations)				
8.26	(5)	-.147	-.640	.180		.187
(3.353)		(.066)*	(.070)*	(.063)*		3.031
	(6)	-.141	-.639		.004	.179
		(.068)*	(.070)*		(.002)	3.046
		Age of wife: 35-39 (583 observations)				
11.77	(7)	-.195	-.449	.213		.098
(4.001)		(.079)*	(.083)*	(.074)*		3.810
	(8)	-.154	-.453		.003	.088
		(.079)	(.083)*		(.003)	3.832

1. Regressions include only observations with one or more children.

TABLE 6: Probability of Additional Children within the Next Three Years

Mean[1] and (st. deviation) of dep. var.		Education of husband	Education of wife	Wage rate of husband	Income of husband	R^2 s.e.e.
		Age of wife: under 25 (124 observations)				
7.0	(1)	.207	.410	-.372		.071
(4.00)		(.172)	(.241)	(.344)		3.91
	(2)	.145	.450		-.001	.062
		(.172)	(.241)		(.006)	3.92
		Age of wife: 25-29 (427 observations)				
5.3	(3)	.136	.543	-.110		.070
(4.50)		(.113)	(.126)*	(.128)		4.36
	(4)	.051	.535		.006	.073
		(.117)	(.126)*		(.004)	4.35
		Age of wife: 30-34 (563 observations)				
1.9	(5)	-.083	.423	-.055		.050
(3.61)		(.076)	(.080)*	(.073)		3.53
	(6)	-.079	.425		-.002	.049
		(.078)	(.080)*		(.003)	3.53
		Age of wife: 35-39 (597 observations)				
0.6	(7)	.121	-.057	-.123		.018
(2.30)		(.047)*	(.049)	(.044)*		2.28
	(8)	.122	-.052		-.005	.019
		(.047)*	(.049)		(.002)*	2.28

1. The probability is the mean times ten (7.0 implies a mean of 70%).

TABLE 8: Time (in years) Between Birth of Oldest and Youngest Child

Mean and (st. deviation) of dep. var.		Education of husband	Education of wife	Wage rate of husband	Income of husband	R^2 s.e.e.
		Age of wife: 30-34				
		Households with three children (196 obs.)				
5.5	(1)	-.006	-.195	-.027		.031
(2.270)		(.080)	(.090)*	(.082)		2.252
	(2)	.007	-.187		-.002	.033
		(.081)	(.090)*		(.003)	2.249
		Households with four children (70 obs.)				
7.1	(3)	-.040	-.099	.044		.010
(2.079)		(.134)	(.183)	(.129)		2.115
	(4)	-.020	-.084		-.002	.010
		(.139)	(.181)		(.004)	2.115
		Age of wife: 35-39				
		Households with three children (180 obs.)				
5.8	(5)	-.191	-.005	.028		.035
(2.263)		(.091)*	(.099)	(.081)		2.242
	(6)	-.172	.000		-.001	.036
		(.090)	(.100)		(.003)	2.241
		Households with four children (110 obs.)				
8.0	(7)	-.001	-.395	.046		.091
(2.825)		(.149)	(.151)*	(.126)		2.731
	(8)	.046	-.403		-.003	.094
		(.146)	(.150)*		(.004)	2.727

TABLE 11: Number of Years of Schooling Expected to be Completed by the Oldest Child [1]

Mean and (st. deviation) of dep. var.		Education of husband	Education of wife	Wage rate of husband	Income of husband	R^2 s.e.e.
		Age of wife: 30-34 (550 observations)				
15.8	(1)	.074	.035			.014
(1.728)		(.037)*	(.039)			1.718
	(2)	.068	.033	.031		.015
		(.037)	(.040)	(.036)		1.719
	(3)	.070	.034		.000	.014
		(.038)	(.040)		(.001)	1.720
		Age of wife: 35-39 (583 observations)				
15.7	(4)	.151	.033			.052
(1.790)		(.034)*	(.038)			1.746
	(5)	.132	.033	.057		.056
		(.036)*	(.038)	(.034)		1.743
	(6)	.127	.031		.003	.059
		(.036)*	(.038)		(.001)*	1.741

1. Regressions include only observations with one or more children.