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ECONOMIC DETERMINANTS OF FERTILITY

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Results from Cross-Sectional Aggregate Data

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I. Introduction and Summary

The purpose of this research may be found in the following challenge expressed by Professor Ronald Freedman at a conference on family planning:

> On balance we probably know more about the fertility and family planning of the American population than about that of any other country in the world. While this accumulation of information is impressive, the gaps in knowledge are large.... Our large-scale field surveys have been much more successful in measuring and describing the variations in fertility and family planning than in finding the causes of these variations (10, p. 211).

In this paper an economic model is used to explain variation in rates of fertility among American wives. The model is applied to aggregate data for SMSA's of 250,000 population and over for 1960 and 1940,[1] and we test whether fertility rates change in response to changes in prices, income, and other explanatory variables.

We find that fertility rates across SMSA's are significantly affected by economic variables; in particular, by the income of males and by the market wages available to wives in an SMSA. The signs of the coefficients of the variables agree with the theoretical expectations, and the results are reasonably consistent among the various age and color groups.

In Part II we present the conceptual model, which is derived from previous economic research. The definitions of the variables used and the discussion of some of the data problems are given in Part III. Detailed results of our empirical work are given in Part IV. Part V summarizes our results and compares them with the general research on this topic.

There are a number of shortcomings in the analysis and data that compel more than the usual amount of caution. First, the theory underlying the model deals with "lifetime" variables for micro-units, yet the empirical

application is for cross-section aggregates. Second, we wish to make an inference about how fertility behavior would change from one equilibrium at a point in time to another equilibrium at a later point in time. The use of cross-sectional data for this purpose is subject to well-known hazards, mainly, the assumptions that the cross-sectional observations themselves represent equilibria and that selective migration has not "contaminated" the cross-sectional observations (in ways discussed below). Of course, there is the obvious assumption that variables in the cross-section model will behave similarly over time. Third, the model consists of a single equation, with fertility as the one endogenous variable, even though a plausible case can be made for various forms of simultaneity. Finally, in a number of instances the empirical proxies chosen to represent theoretical variables were unsatisfactory.

II. An Economic Model for Analyzing Fertility Decisions

The principal theoretical work on which our analysis is based is Gary Becker's "Economic Analysis of Fertility" (1), although essentially the same ideas were presented by a demographer, Norman Ryder, around the same time (19, pp. 426-27). The theory of utility maximization which underlies price theory was used as a framework for postulating certain effects on family size of variables that measure "costs" and "benefits" of children.

In a developed economy like the United States, which is largely non-agricultural and where laws restrict child labor, the benefits of children are largely "psychic" rather than monetary. In this respect (i.e., providing psychic income) children may be considered similar to durable consumer goods. Since children would not be thought of as inferior goods--not,

at least, over the range of numbers of children that apply to the majority of families--the effect of increases in income on the demand for children is expected to be positive. But as with other consumer durables--for example, automobiles or houses--buying more could mean buying a more expensive commodity (and in this sense a higher-quality commodity). Becker concludes that the effect of income on the number of children would be positive but probably small. On the basis of a small amount of empirical evidence, Becker did find such a small and positive effect. The data, however, covered only a narrow and selective range of observations.

There has been considerable controversy about the appropriateness of Becker's separation of income effects from price effects, and thus about whether the income effect must be positive. One argument is that social pressures "impose" higher costs for children on parents with higher income status, so that larger expenditures do not increase the utility of children (3, 6, 17, 20). Increased utility is believed to be derived only from levels of expenditures that are higher than the mean level of one's peer group; thus the price of a given level of utility from children would go up with the family's normal income, since normal income implies a corresponding peer-group status. Such forces, if they operate as described here, probably should also apply to some extent to other consumer durables like cars and houses. We conjecture that rises in expenditures for children that result from rises in permanent income will yield less increase in utility if the relative income position of the family (or parents) is unchanged. Presumably, income gains within peer groups have more effect than similar gains among peer groups. At the other extreme, income gains that affect the nations as a whole will

produce even smaller positive effects on fertility.[2] We find it difficult to believe, however, that the utility gains would be zero, despite the evidence cited in note 2.

A second argument which raises the possibility of a negative sign of the income effect is based on the association of income with labor earnings, recognizing that a higher income usually means a higher price of the time of the adult members of the family unit. Three cases are interesting. First, when family income includes the earnings of the wife, it is clear that higher income derived from higher wages paid to the wife will produce a price effect that will have a negative effect on the number of children "purchased." This point will be discussed more fully below. Second, if we assume that the husband also contributes his time to the homework activities associated with raising children, then a negative effect from increases in family income (from his increased labor earnings) is also produced. In this paper, however, we make the simplifying assumption that the husband does not contribute to homework involving children in his own household. Finally, Robert Willis (23) has demonstrated that, under certain restrictive (but not implausible) conditions, the sheer time intensity of the care of children can lead to a positive reduction in the "purchase" of children as income of the husband rises, even when children remain a "normal good" and where the husband's time is not used in the production of "home goods."

The cost side of the analysis is more straightforward. The number of children is expected to be negatively related to the cost of children--that is, to the prices of such complementary goods as the food, clothing, shelter, medical care, and education for children.

Becker's treatment of the demand for children in a price-theoretic framework also calls attention to "technology" and "tastes"--the two remaining categories of variables which complete the model. In this paper it is assumed that the amount and distribution of knowledge about birth control is given by the state of technology.[3] Both over time and in a cross-section, income is positively correlated with knowledge about and access to birth control techniques. Thus the expected positive sign of income's effect on the number of children might only show up in a context where the factor of birth-control knowledge was held constant.

"Tastes" is a broad category which includes attitudinal variables and which refers to the preferences of the decisionmakers. Religion, for example, is expected to represent an important set of attitudes or tastes regarding fertility. In general, taste factors undoubtedly account for much of the variation observed in choices about family size. Moreover, the possibility that tastes are correlated with such variables as income and prices dictates that we find ways of controlling for their influence or find contexts for analysis in which variations in tastes are minimized. Both steps are taken in the empirical work reported below.

An important theoretical and empirical addition to the Becker model was made by Jacob Mincer (15), who called specific attention to what is undoubtedly the single most important price or cost variable associated with bearing and raising children--the opportunity cost of the mother's time.[4] The market wage available to the wife, the empirical proxy for measuring this opportunity cost, is expected to be negatively related to fertility. Ideally, we would like also to measure the nonpecuniary aspects of employment--how interesting and easy the job is, its cleanliness and pleasantness, and so on. As Mincer points out, the wife's earnings

capacity and her husband's income are likely to be positively correlated, and since their expected effects on fertility pull in opposite directions, the use of one without the other results in measured effects that are biased toward zero.[5]

The observed effect of wage earnings of the wife includes both a positive income effect and a negative price effect. We can subtract our estimate of the income effect, obtained from the measured net effect of the husband's income, from the observed wage coefficient to separate the "pure substitution" effect. The wage coefficient will be negative only if the negative substitution effect is larger in absolute value than the positive income effect. Using the coefficient of husband's income to measure the income effect is permissible if, as we assume, there is no cross-substitution effect of the husband's wage rate with fertility choices.

The female wage rate is expected to be positively correlated with knowledge of and sophistication in the use of birth control techniques. Thus the negative effect on fertility of the wage rate would be biased and larger in absolute value if the birth-control factor were not held constant. (We should be careful, however, not to "hold constant" expenditures and knowledge about contraception that are endogenous and a result of a high wage rate--the argument being that an opportunity for a good-paying job will lead women to adopt more effective contraceptive techniques.)

In addition to the research by economists, there has been considerable research by sociologists which directly or indirectly supports the application of economic variables to the problem. Most direct has been the research of Ronald Freedman and his associates at the University of Michigan (9, 11, 12, 18). Variables such as the labor-force participation

of wives, earnings of the wife, and (with less success) husband's income have been used to explain fertility differentials. Other studies could be mentioned, and some will be referred to later in this paper. At the same time, much of the demographic research carried out by sociologists does not attribute an important role to economic variables in the determination of fertility. The hypotheses examined in this paper are therefore subject to some degree of controversy.

To summarize the preceding discussion, the key economic variables affecting fertility fall into the category of prices and income. The family unit is expected to have more children when its income rises and to have fewer children when, as an example of a price effect, the wage rate facing the wife rises. The decision-making unit is assumed to consist of both husband and wife, and our research does not examine which one is the more influential in making the decision.

The application of this model to cross-sectional aggregative data calls for additional comment. At a moment in time, prices for goods and services are likely to be relatively constant for all households. If, however, the households are dispersed among separate markets, then wage rates and housing prices will vary among these markets. An SMSA, which is the unit of observation used in the research, may be considered such a separate labor and housing market.[6] The proxy variables used to represent these prices, as well as those representing income and the sources of variation in birth-control knowledge and tastes, are discussed in the next section.

III. The Variables in the Regression Analysis

The Fertility Rate. The dependent variable is the number of children ever born, per 1000 women ever married, for each of four age-color groups of wives. The fertility rate for each group and other relevant statistics are shown in Table 1 (for 1960) and Table 2 (for 1940). There were 66 SMSA's in 1960 with 250,000 population or more which had separate data for white and nonwhite populations. For most of the regressions that were fit for the white population we used an additional 34 SMSA's which met the population criterion, but where the fertility rate applied to the total population. In the other 66 SMSA's the white fertility rates were computed by subtracting the nonwhite figures from the amounts for the total population. Only 37 SMA's in 1940 had a population of 250,000 or more and had a relatively complete set of independent variables.

The Income Variable. The variable used to measure the effect that income has on the fertility rate is the median income for 1959 of males for each age-color group in the SMSA, and for 1940 regressions it is the median income in 1939 for all males in the SMA. The income of males of a certain age and color is a proxy for the income of husbands of that group.[7] Transitory components of income are minimal in an income measure that is averaged over a large number of persons, so the median should represent the "normal" (or "permanent" or "long-run") income of the group of males in question. The normal income is considered to be the relevant concept, since decisions about fertility have ramifications over at least 18 years of the parents' lives.

To the extent that median incomes do deviate from the normal levels, most transitory components may be accounted for by the unemployment rate in the SMSA, since employment variation is the principal source of

transitory deviations. The male unemployment rate is included in the model for this purpose.[8] But because unemployment is only a temporary status for an individual, it is by itself probably not an important determinant of fertility.

The second important economic variable is the market wage available to the wife who works. The female wage rate largely reflects the industrial structure of the SMSA--high wages are available in a city like Washington where the demand for clerical and professional work is high, and low wages are available in mining communities where the demand for female labor is low. We assume that, on average, the wage available to the wife in the given SMSA is an estimate of the wage that confronts her over her entire married life. On this basis we expect the average fertility rate for a large sample of wives in the given SMSA to show a negative relation to the average wage for that group of wives.[9]

Unfortunately, the wage rate is not known. In 1960 the median income is reported for each age-color group of females, and there is additional information on the average number of weeks worked by females who worked. Dividing the income variable by the weeks worked and multiplying by 52 should give a reasonably good estimate of full-time annual earnings--a wage-rate concept. In 1940 we have only the median income and average months worked in the SMA of all females as variables to construct a full-time earnings proxy.

Labor-force participation rates are available for the separate age groups of wives, but the wage rate is the appropriate theoretical concept for our model. The reason is that time worked (weeks or hours worked, or, as a proxy for these measures, the labor-force participation rate) is not a suitable independent variable in a model explaining fertility rates,

since the fertility rate might just as reasonably be considered the determinant of the labor-force participation of wives as the other way around. Causality runs both ways or, what is more likely, both changes in fertility and in labor-force participation are caused by other factors. By this reasoning, the interpretation of a negative relation between fertility and the median earnings (equal to the wage rate x hours worked) of a given age-color group is ambiguous. To what extent is the source of the inverse relation the wage rate, which is a causal factor, and to what extent is it the weeks or hours worked, which is a noncausal factor?

Before ending the discussion of the wage variable, it may be worthwhile to examine whether low fertility itself leads to a high wage among wives. With disaggregated data (for individual wives) this relation might be expected if preferences for work and for few or no children led to more training and education. With aggregative data the variation in preferences is, of course, greatly minimized, but it would be foolish to assume that they are nonexistent. Selective migration could produce situations in which wives with tastes for work and for investing in human capital (which yields high market earnings) are grouped in SMSA's and thus produce a spurious negative relation between high wages and low fertility. (Spurious in the sense that tastes represent the causal variable.) The bias from this source is troublesome, but two checks (over and above aggregation) against the bias are available. First, educational attainment can be explicitly accounted for in the model. Second, the supply effect of a preference for low fertility and for work will militate against the negative relation between wages and ferility. Consider a hypothetical

situation in which the industrial structure generating the demand for labor is the same for all city-markets. If some of the cities have a high concentration of wives who prefer to have few children and to work, then these cities will indeed show a negative relation between family size and labor-force participation. Either the fertility rate or the preferences may be said to cause work variation. However, the increase in the labor supply of wives in these cities will lower wages (if the demand curve is not perfectly elastic), so the relation between wages and fertility will be positive instead of negative. Existing studies suggest that the wage rates of females in cities reflect the interaction of differing demand conditions (stemming from the varying industrial structures of the cities) and a stable labor supply curve of females (4, 5, 16).

Birth-Control Knowledge. For several reasons the variations in birth-control knowledge in our data should not be large. First, the use of aggregates sharply diminishes the wide variation that surely exists among individual households. Second, the regressions are restricted to certain age-color groups. Finally, since marked improvements in birth-control techniques and their spread across all strata in the population have been occurring secularly, fixing the date will reduce variations in birth-control knowledge relative to the variations in a time series. Several variables measuring educational and occupational attainments among males and females in the SMSA offer some control over the variation that remains. From a large number of variables available, for regression analysis, we experimented with several and report on the following: each of which applies to the given age-color group:

1. percent of females with less than five years of schooling completed
2. percent of males with less than five years of schooling completed
3. percent of females in clerical and professional occupations
4. percent of males in professional and managerial occupations[10]

The occupational variables will represent in part the concepts of "socio-economic status" and "life styles." To some extent, therefore, the occupation variables will represent differences in the limited degree of variation in tastes across SMSA's.

Both education and occupation are, of course, highly correlated with each other and with income and wages, and this causes problems of interpretation when using all these variables together. In principle, we should like to say that the theoretical reasons for the net or partial effects of education and occupation are different from the reasons for the effects of husband's income or wife's earnings; to say, for example, that education represents birth-control knowledge and occupation, defined as the percent in white-collar occupations, represents a set of attitudes or life styles that are associated with desiring a relatively small family size.[11]

In practice, of course, all these basic and theoretically justified effects are mixed into each of the variables. In particular, a wage effect is represented by education and occupation to the extent that these latter variables represent the nonpecuniary aspects of employment conditions for wives in the SMSA's or compensate for any measurement errors in the wage variable. The educational and occupational variables for males similarly

represent the incomes of husbands. For this reason, the measured net effects of income and earnings may be understated when the other variables are included, since their presence dilutes the effects of imperfectly measured income and wage variables.[12]

Tastes. Tastes differences across SMSA aggregations of common age-color groups is likely to be minimal--particularly since educational and occupational differences are accounted for. Measures of ethnic and religious differences were sought but not satisfactorily obtained. In an attempt to determine the percent Catholic of the SMSA's in 1960, we collected data on the percent of the population which had Ireland, France, Poland, Czechoslovakia, Italy, Mexico, or Puerto Rico as the "country of the origin of the foreign stock." These percentages were tried separately and as a sum. Information was not available for the separate age groups. Other variables used were the percent of the population reported in the Catholic diocese statistical yearbooks and the percent of the school-age population in private schools (a close proxy for the parochial school population). In 1940 a more direct measure of the percent Catholic in the SMA's was available.

A dummy variable for region, defined as one if the SMSA is in the South, zero otherise, was an attempt to capture several effects, including tastes. A lower quality of education in the South, more "ruralism" (on the assumption that more residents of Southern SMSA's have rural backgrounds), some differences in styles of life (especially for nonwhites), and a slightly lower cost of living all combine to make the expected partial effect of the regional variable on the fertility rate positive.

Other Cost Variables (with 1960 Data Only). Most prices of commodities, including those that are complementary to bringing up children like

food and clothing, are relatively fixed in cross-sections. Our most ambitious attempt to measure an important price (other than wages) that does not vary was the collection of the following measures of the cost of housing: (1) the median rent of four-room apartments, (2) the median rent of homes, (3) the median value of a six-room house, (4) the median value of housing. Unfortunately, none of these variables measures the price of a quality-constant unit of housing. The first and third measures come closest in this respect.

Two variables that may be correlated with population density and the associated higher costs (for given quality) of both housing and education are the percent of the population that is nonwhite and the percent of the population that lives in the central city.[13] Education appears to be an extremely important commodity among those that are complementary to children, so it would be desirable to control for any variations in the price of education, or in the quality of education if its price and quantity are constant for all groups.

IV. Results of Regression Analyses

The variables discussed in the previous section were used in a series of multiple regressions in which the fertility rate of the age-color group was the dependent variable. Tables 3 for 1960 and 4 for 1940 summarize the principal results.

Income and Wage Variables. The coefficients of both income and female wage variables are consistent with the hypotheses specified by the model. The effect of the female wage variable, in particular, is negative and statistically significant for each group tested for 1960 and 1940.

The coefficient of the income variable is generally close to zero, but where it is significantly different from zero it is positive, as it is for white and nonwhite wives aged 25-29 and 30-34 in 1960 and for white wives aged 45-49 in 1940. For all other groups of white wives the effect is positive and close to significant, and for the two older groups of nonwhite wives the income effect is negative, although insignificant. The large income effect for older wives in 1940 is puzzling since we expected the income effect to be stronger among younger wives, as it is with 1960 data.

A weaker (positive) effect of income on the fertility rate among the older age groups is expected for several reasons. First, birth-control knowledge was less uniformly spread among all income classes years ago than it is today, and income is more likely to be acting as a proxy for such knowledge, especially among the older nonwhite groups. Second, among the oldest groups there may be a weaker relation between measured income at the time of the Census and the income concept that applies to the entire married life of the couples, which would mean that the desired income variable--normal or permanent income--contains more "errors of measurement" among older groups. Such errors bias the effect toward zero.

Another rationalization is that since the fertility rates of the older groups are closer to lifetime or completed birth rates, the income effect on this rate may in fact be close to zero. By this interpretation the positive effect among the younger ages reflects decisions mainly about the timing of the births--a higher income leads to considerably more births of children at earlier ages, but only moderately more over one's lifetime.

Finally, the significant positive effect of income on the fertility rate at the younger ages may be attributable to a positive correlation between income and years married.[14] This would link income to fertility by way of the positive relation between fertility and years married. (The effect of years married should not be very important among middle and older age groups.) Note, however, that to the extent that higher income brings about marriages at earlier ages, the relation between earlier marriages and fertility fundamentally represents a causal relation between income and fertility.

Let us consider the quantitative magnitudes of the income and wage effects on fertility. On the basis of the 1960 data and the mean of the income coefficients of white families, a $100 increase in median income of husbands is associated with an increase of 11.1 births per 1000 women ever married. On a per family basis, therefore, it would require an increase of about $9000 in income to bring about an increase of one more child. The larger income coefficients (= 16 and 12) for younger wives indicate that an increase of about $6000-$8000 is required to increase the number of children by one per family. Income increases of this size are probably more than the amount required to induce a family to purchase one additional car, but less than it would take to bring about the purchase of an additional house.

Among all nonwhite wives a $100 increase in median income leads to an increase of only about 7 births per 1000 women ever married. However, among the two youngest age groups of nonwhite wives an increase of $100 in median family income leads to an increase of 21-25 births per 1000 women ever married. This is a larger arithmetic effect than for white wives in the youngest age groups, but the relative effects are

about the same--the elasticities at the means are .26 and .29 for nonwhites and .39 and .20 for whites. Similarly, the arithmetic income coefficients are much larger for the white wives in 1940, but the elasticities are more in line, ranging from .36 to .62.

The sizes of the coefficients of the market earnings of wives are generally about twice as large as the income coefficients in absolute terms. Again, however, using elasticities considerably narrows the contrast. The wage elasticity is between -.29 and -.34 for white wives in 1960, -.20 and -.33 for nonwhite wives, and between -.59 and -1.03 for white wives in 1940. The pure substitution effect is larger by about 50 percent.[15]

Education and Occupation: Control for Birth-Control Knowledge and Tastes. Education has a significant negative impact on fertility rates. This is revealed by the positive coefficient of the variable defined as the percent of the male (or female) population aged 25 or older with less than five years of schooling completed. The occupational variables were usually not significant. This should not surprise us if we believe that the influence of occupational status on fertility stems from the underlying effects of income, earnings, and education or birth-control knowledge, since specific variables to measure these latter effects have been included in the regression.

Region. The significant negative coefficient in 1960 of the dummy variable for region tells us that the southern SMSA's have 130-300 fewer births per 1000 women ever married, holding other factors constant. This was unexpected since the cost of living is somewhat less in the South, the residents presumably have somewhat more rural backgrounds, and knowledge

of birth control was believed to be less widespread, particularly among nonwhites. An examination of residuals reveals that the reason the South has comparatively low fertility rates is that the West has high rates. The high fertility rates in western SMSA's may be caused by greater living space and better education, but selective migration and tastes may also be important factors.

In 1940 region was not significant, but this may be attributable to the paucity of observations--only 10 out of 37 SMSA's were classified as southern.

Percent Catholic. As noted previously, the variable measuring the foreign stock from seven predominantly Catholic countries may not correlate closely with the actual proportion of Catholics in each age group in the SMSA's. Although this could explain a zero effect of the variable we used, the significant negative coefficients is a result for which we have no satisfactory answer.

The 1940 data give a more accurate measure for the percent Catholic of the SMSA. A survey of religious bodies was conducted in 1936 to determine religious affiliation in the major cities. With 1940 data the percent Catholic has a positive coefficient, but the coefficient is negligible and not significant.

V. Conclusion

The immediate objective of this paper is to explain the differentials in fertility rates among several age-color groups of women in the largest SMSA's as of 1940 and 1960. In 1960 the fertility of white wives, aged 30-34 for example, ranged between 2000 and 3200 children ever born per

1000 women ever married; among nonwhite wives aged 30-34, between 2257 and 3725. In 1940 the range for white wives aged 30-34 was 935-1836. These differences are considerable and compare with changes that span decades.[16] The relative variation in our sample of SMSA's is, of course, small compared to that among families within an area, where wide variation in physiological differences and in countless personal traits would produce a wide dispersion in fertility rates. It is not known how these types of differences varied for the population as a whole over time, and it may be only a hope that the analysis of a cross-section of SMSA's provide a relevant testing ground for an economic model of fertility that seeks to explain fertility behavior over time.

The use of an economic model is based on several considerations. First, decisions about the number of births is partly a matter of conscious choice, and the area for choice widens (and that of chance narrows) as contraceptive knowledge and devices become more widespread. We expect that the choices are somewhat influenced by the costs of bearing and raising children and by the family's capacity to pay these costs. The framework for employing these economic factors in the determination of fertility was borrowed from Becker (but see also Ryder [19]) and was discussed in Part II.

The most striking result from both 1940 and 1960 empirical analyses is that fertility is negatively related to the potential earnings available to wives in the labor market. Using the lower estimates from 1960, the magnitude of the effect is roughly as follows: Fertility declines by about 250 births per 1000 women for each $1000 increase in the wives' annual earnings potential. Since increases in the earnings in real terms of year

around, full-time female workers has been almost $2000 during the past 25 years, the potential impact that earnings may have had on fertility is considerable.

The effects of income on fertility is positive, but they were not consistently significant in the statistical sense. The strength of income among the younger age groups suggests that its major effect is on the timing rather than the total number of children. Averaged over all age groups the income elasticity is about the same absolute size in 1960 (and smaller in 1940) than the wage elasticity. The fact that the two variables are positively correlated but exert opposite effects on fertility reminds us that a multivariate analysis is called for when testing the economic model.

The theory underlying the economic model helps explain the reasons for the observed relations between fertility and other variables.[17] Sometimes this means that complexities and ambiguities in interpretation are made explicit. When, for example, we see the negative relation between fertility and education, are we to attribute this to an underlying relation between education and (1) birth-control knowledge, (2) various attitudinal (or tastes) factors, (3) occupational status (and, again, perhaps attitudinal variables), or (4) attractive employment opportunities? Similar questions can be asked about other variables used in our analyses.

How consistent are the results reported in this paper compared with other studies? We have not covered all previous studies, but our impression is that they are generally consistent. High rates of fertility are characteristic of women with low education, low occupational status, rural backgrounds, and who are Catholic--and all may be partly attributable to

the generally lower level of market earnings available to women with these traits. At the very least, the correlation between the available wage rate and these traits should be kept in mind when observing and reporting their gross relations to fertility. Recall that the importance of knowledge of and access to birth control techniques is consistent with the view that a high wage rate available to the wife motivates attaining both, because it is costly not to.

Two persuasive patterns of fertility changes that have occurred over time are also consistent with the economic framework: (1) the sharp declines associated with the move from farms, where children are cheap, to cities, where they are costly, and (2) the inverse relation between fertility rates (and marriage rates) and the business cycle--a relation which, however, affects mainly the timing of births (14).

A criticism of the economic model as it has been used in this paper is that it focuses on changes in fertility rates over only a narrow range of variation. The implication of this criticism is that the really interesting question is why the range has its particular level and width. Two replies may be offered.

The humble reply is the suggestion that predictions over a relatively narrow range may themselves be useful. There may be a use, for example, for accurate predictions of the annual per capita consumption of meat in the United States (which varied between 130 and 175 pounds from 1930 to 1964 [21, p. 86]), even though the economist does not explain why U.S. consumers are not vegetarians.

A bolder answer is one that attempts to explain the large changes over time in birth rates and in the consensus about desired family size.

The reference to the explanation of farm-nonfarm differences in fertility illustrates this attempt. Nevertheless, the observed large fluctuations in the time series of birth rates--particularly the postwar boom followed by the sharp decline in recent years--all in the face of rather steadily rising values of income, wages, educational attainment, and other variables, is cause for skepticism about the adequacy of the simple model presented in this paper. But its modest success in the application in this paper offers the hope that it promises a useful direction for further work.

TABLE 1

MEANS AND STANDARD DEVIATIONS (IN PARENTHESES) OF SELECTED CHARACTERISTICS OF EIGHT AGE-COLOR GROUPS OF WIVES, SMSA'S IN 1960

Group, by color and age	(1) Fertility rate	(2) Median male income $	(3) Average female full-year earnings $	(4) Percent male in profes-sional occupa-tions	(5) Percent female in pro-fessional and cleri-cal occu-pations	(6) Percent males <5 years educa-tion	(7) Percent females <5 years educa-tion	(8) Percent labor force participation rate of wives, husband present
White (100 SMSA's)								
25-29[a]	2128				43.7		1.4	25.9
	(183)	5201	2964	16.7	(6.6)	2.0	(1.4)	(3.7)
30-34[a]	2507	(478)	(385)	(4.0)	53.9	(1.5)	1.7	28.0
	(211)				(7.2)		(1.9)	(6.7)
35-44	2477	5936	3018	13.4	47.5	2.7	2.0	35.8
	(219)	(559)	(370)	(3.4)	(7.7)	(2.0)	(2.1)	(4.1)
45-49[b]	2206	5631	3080	10.2	44.5	4.3	3.5	39.7
	(242)	(573)	(395)	(2.6)	(6.5)	(3.2)	(3.0)	(5.6)
Nonwhite (66 SMSA's)								
25-29[a]	2664				24.1		3.1	40.0
	(291)	3326	2105	6.1	(11.1)	7.4	(1.7)	(8.1)
30-34[a]	2924	(621)	(587)	(4.5)	20.0	(4.5)	4.7	45.1
	(334)				(8.2)		(2.5)	(7.9)
35-44	2680	3652	2040	4.4	15.4	13.8	8.4	51.2
	(349)	(727)	(572)	(2.5)	(6.8)	(7.5)	(4.6)	(7.9)
45-49[b]	2345	4437	1740	3.0	10.3	24.2	16.0	50.0
	(326)	(712)	(485)	(1.3)	(4.1)	(10.3)	(7.3)	(8.6)

Column headings (all variables are age-specific according to the row designation, unless otherwise noted):

(1) Fertility rate = number of children ever born per 1000 women ever married
(2) Median income of males
(3) Average full-year income of females = median income of females divided by average number of weeks worked, multiplied by 51
(6) Percent of males (females) who have four years of
(7) schooling or less

[a]Male data are for males 25-34.

[b]Data for males and females regarding income, education, and occupation are for the age groups 45-54.

Source: State volumes, series C and D of the 1960 Census.

TABLE 2

MEANS AND STANDARD DEVIATIONS (IN PARENTHESES) OF SELECTED CHARACTERISTICS OF FOUR AGE GROUPS OF WHITE WIVES, 37 CITIES IN 1940

Age group	(1) Fertility rate	(2) Median male income $	(3) Average female full-year earnings $	(4) Percent male in professional occupations[a]	(5) Percent female in professional and clerical occupations	(6) Percent males <5 years education	(7) Percent females <5 years education	(8) Percent labor force participation rate of wives, husband present
25-29	1010					2.3[b]	1.9	
	(134)			17.2	53.2	(2.8)	(3.2)	23.0
30-34	1373			(2.4)	(7.7)	3.7[c]	2.9	(5.6)
	(181)					(3.3)	(3.4)	
35-44	1809			20.8	46.8	8.0[d]	6.3	19.2
	(248)			(3.5)	(8.0)	(4.4)	(4.4)	(5.2)
45-49	2140			23.1	39.1	13.2[e]	11.0	10.6
	(325)			(4.0)	(6.1)	(7.0)	(6.5)	(3.0)
Total labor force (all ages)		1169 (177)	946 (183)					

Column headings (all variables are age-specific according to the row designation unless otherwise noted):

(1) Fertility rate = the number of children ever born per 1000 white women ever married

(2) Median income for all males, aged 14 and over who received income in 1939

(3) Average full-year income of all females = median income for all females with income in 1939 divided by the average months worked in 1939, multiplied by 12

NB: Data on male income, female earnings, male and female occupation, and labor force refers to white and nonwhite.

[a] Includes managers.

[b] Males aged 25-34.

[c] Males aged 30-39.

[d] Males aged 35-49.

[e] Males aged 45-54.

Source: State volumes of the 1940 Census Labor Force, from G. Bancroft, The American Labor Force, Table D-5, page 225.

TABLE 3

SUMMARY OF SELECTED REGRESSIONS FOR ALL AGE-COLOR GROUPS, 1960 (Dependent Variable is the SMSA Fertility Rate of the Age-Color Group of Women Ever Married)

Age-Color group of wives	Coefficients of Independent Variables and "t" Ratios in Parentheses									R^2
	Male income ($00's)	Female full-year earnings ($00's)	Male education (%≤4 yrs.)	Female education (%≤4 yrs.)	Occupational composition of the labor force[a]	Region (South = 1; 0, otherwise)	Percent native nonwhite[b]	Percent of "Catholic origin"[c]	Median value of house	
White 25-29	16.2*	-24.0*		67.4*		-130*	-2.1	-12.3*	-1.3	.63
100 SMSAs	(3.75)	(5.56)		(5.72)		(2.72)	(.92)	(4.42)	(1.62)	
White 30-34	12.1*	-24.2*		60.6*		-161*	-2.7	-12.6*	-.04	.57
100 SMSAs	(2.25)	(4.52)		(5.88)		(2.70)	(.96)	(3.76)	(.04)	
White 35-44	9.7	-27.2*		53.9		-203*	-3.1	-10.0	-.34	.52
100 SMSAs	(1.84)	(3.97)		(5.4)		(3.17)	(1.05)	(2.86)	(.30)	
White 45-49	6.7	-24.4*		43.6*		-253*	-3.8	-10.8*	-1.6	.57
100 SMSAs	(1.34)	(3.52)		(5.73)		(3.82)	(1.20)	(3.11)	(1.36)	
Nonwhite 25-29	20.6*	-41.2*	21.2		-5.1	-197*	2.3		-1.1[d]	.57
66 SMSAs	(2.24)	(3.36)	(2.39)		(1.00)	(1.93)	(.54)		(.78)	
Nonwhite 30-34	25.9*	-51.1*		52.1*		-147	1.8		-2.0[d]	.60
66 SMSAs	(2.47)	(4.68)		(3.31)		(1.30)	(.36)		(1.39)	
Nonwhite 35-44	-.20	-52.6*		35.4*	38.7*	-305			1.8[e]	.55
66 SMSAs	(.02)	(4.07)		(3.43)	(2.43)	(2.44)			(.38)	
Nonwhite 45-49	-15.4	-26.5*		15.3*		-285*				.44
66 SMSAs	(1.69)	(2.40)		(2.51)		(2.55)				

[a]Either (1) percent of males in professional and managerial occupations or (2) percent of females in clerical and professional occupations. Neither was significant in regressions with whites. (1) was used "successfully" with nonwhites aged 35-44; (2) was used with nonwhites aged 25-29.

[b]For regressions with the nonwhite population, the variable "percent Negro" was used instead.

[c]Percent of the population which had Ireland, France, Poland, Czechoslavakia, Italy, Mexico, or Puerto Rico as the "country of origin of the foreign stock" which includes first and second generations in America.

[d]Median value of a standard 6-room house. [e]Median rent of 4-room apartments.

TABLE 3

SUMMARY OF SELECTED REGRESSIONS FOR ALL AGE-COLOR GROUPS, 1960 (Dependent Variable is the SMSA Fertility Rate of the Age-Color Group of Women Ever Married)

Age-Color group of wives	Coefficients of Independent Variables and "t" Ratios in Parentheses									R^2
	Male income ($00's)	Female full-year earnings ($00's)	Male education (%≤4 yrs.)	Female education (%≤4 yrs.)	Occupational composition of the labor force[a]	Region (South = 1; 0, otherwise)	Percent native nonwhite[b]	Percent of "Catholic origin"[c]	Median value of house	
White 25-29	16.2*	-24.0*		67.4*		-130*	-2.1	-12.3*	-1.3	.63
100 SMSAs	(3.75)	(5.56)		(5.72)		(2.72)	(.92)	(4.42)	(1.62)	
White 30-34	12.1*	-24.2*		60.6*		-161*	-2.7	-12.6*	-.04	.57
100 SMSAs	(2.25)	(4.52)		(5.88)		(2.70)	(.96)	(3.76)	(.04)	
White 35-44	9.7	-27.2*		53.9		-203*	-3.1	-10.0	-.34	.52
100 SMSAs	(1.84)	(3.97)		(5.4)		(3.17)	(1.05)	(2.86)	(.30)	
White 45-49	6.7	-24.4*		43.6*		-253*	-3.8	-10.8*	-1.6	.57
100 SMSAs	(1.34)	(3.52)		(5.73)		(3.82)	(1.20)	(3.11)	(1.36)	
Nonwhite 25-29	20.6*	-41.2*	21.2		-5.1	-197*	2.3		-1.1[d]	.57
66 SMSAs	(2.24)	(3.36)	(2.39)		(1.00)	(1.93)	(.54)		(.78)	
Nonwhite 30-34	25.9*	-51.1*		52.1*		-147	1.8		-2.0[d]	.60
66 SMSAs	(2.47)	(4.68)		(3.31)		(1.30)	(.36)		(1.39)	
Nonwhite 35-44	-.20	-52.6*		35.4*	38.7*	-305			1.8[e]	.55
66 SMSAs	(.02)	(4.07)		(3.43)	(2.43)	(2.44)			(.38)	
Nonwhite 45-49	-15.4	-26.5*		15.3*		-285*				.44
66 SMSAs	(1.69)	(2.40)		(2.51)		(2.55)				

[a]Either (1) percent of males in professional and managerial occupations or (2) percent of females in clerical and professional occupations. Neither was significant in regressions with whites. (1) was used "successfully" with nonwhites aged 35-44; (2) was used with nonwhites aged 25-29.

[b]For regressions with the nonwhite population, the variable "percent Negro" was used instead.

[c]Percent of the population which had Ireland, France, Poland, Czechoslavakia, Italy, Mexico, or Puerto Rico as the "country of origin of the foreign stock" which includes first and second generations in America.

[d]Median value of a standard 6-room house. [e]Median rent of 4-room apartments.

TABLE 4

SUMMARY OF SELECTED REGRESSIONS FOR ALL AGE-COLOR GROUPS 1940 (Dependent Variable is the SMSA Fertility Rate of White Women Ever Married)

Age group of wives (white)	Coefficients of Independent Variables and "t" Ratios in Parentheses							R^2
	Male[a] income ($00's)	Female[b] earnings ($00's)	Female education (%≤4 yrs.)	Male occupation (% professional & managerial)	Female occupation (% clerical & professional)	Percent Catholic[c]	Male unemployment rate	
25-29	36.4	-63.1*	21.3*	-1.2		1.0	12.4*	.78
37 cities	(1.51)	(2.67)	(3.45)	(.16)		(.84)	(1.89)	
30-34	45.3	-66.8*	22.4*	-14.4*		1.0	17.8*	.76
37 cities	(1.33)	(2.07)	(2.60)	(1.91)		(.58)	(1.92)	
35-44	49.7	-135.5*	33.6*	-29.1*	20.8*	2.1		.85
37 cities	(1.31)	(3.62)	(4.18)	(3.12)	(3.46)	(1.02)		
45-49	113.4*	-232.7*	38.3*	-37.9*	35.9*	-.41		.94
37 cities	(3.46)	(6.84)	(7.18)	(4.96)	(5.35)	(.22)		

[a]Median income in 1939 of all males with income.

[b]Median income in 1939 of all females with income.

[c]Source: W. H. Grabill, C. V. Kiser, and P. K. Whelpton, The Fertility of American Women. Data derived from U.S. Bureau of the Census, Religious Bodies, 1936, Vol. I, Table 31.

NOTES

[1]Curiously, no useable fertility variable is available in the 1950 Census.

[2]For evidence of an income effect that is positive within peer groups and zero across groups, see (9). See also (7) and (8).

[3]There are many contexts, however, in which knowledge about birth control is more appropriately viewed as an endogenous variable; specifically, as an investment good, purchases of which are determined by economic and social variables.

[4]The viewpoint of the importance of time in consumption theory is developed by Becker (2) and developed more fully in connection with children by Willis (23).

[5]Thus the following procedure for selecting variables to include in the model that is described by Westoff, Potter, and Sagi is hazardous. "In the first phase of our study we retained for multivariate analysis only those variables showing significant zero-order relationships with the dependent variables" (22, p. 209).

[6]Price differentials in housing among SMSA's may be attributed to different costs of land, variations in labor costs (perhaps because of differences in union strength), and to differences in building codes and regulations, taxes, and climatic conditions.

[7]This is a reasonable assumption. The median income for male family heads for all males over 14 years of age is not available by color, but for the total population the correlation between it and the median income of all males over 14 years of age is greater than .9 in our sample of SMSA's.

[8]An implicit assumption is that the male unemployment rate for April 1960 (the date of the Census) is a good proxy for the average unemployment rate that applied to the SMSA in 1959.

[9]The relation with disaggregated data would undoubtedly be very loose. Some couples would not alter their decisions about fertility in response to the wages available to the wife. Others who are responsive may have lived in a different SMSA all their lives except at the time of the Census, so they would not be affected by the wage which we associate with them. For many reasons, therefore, we should expect a poor fit (i.e., low R^2) with disaggregated data, although the regression coefficient need not be affected by aggregation.

NOTES (contd.)

[10]Other variables experimented with were (a) median years of schooling completed, females; (b) percent of males with some college; and (c) percent of females in professional occupations. These variables contributed slightly less to the R^2 than their counterpart variables listed above. Moreover, there is some a priori justification for selecting educational variables that measure the extent of low attainment, like (1) and (2) instead of measures like (a) and (b), which deal either with central tendencies or the upper tail of the distribution. If we believe that a common level of birth-control information is known throughout the middle and upper ranges of the educational strata, then variation in percentages at the lower end may contribute the most explanation to variability in fertility.

[11]One behavioral pattern by which educational attainment and high occupational status affects fertility negatively is that of delayed marriages. The negative effect on the age specific fertility rates would be particularly strong for the younger age groups.

[12]Another potential intervening variable we might mention is that of a farm background, which is expected to be positively correlated with fertility (13). Note that education, occupation, income, and the wife's wage rate are all correlated with farm background.

[13]The density of population is a variable that might be correlated with the price and quality of housing (and with the quality of the environment for children in general), but this variable partially measures the number of children, and so it is not an appropriate explanatory variable of the number of children.

[14]The positive correlation between income and years married is, of course a partial correlation, after controlling for education of both spouses and other variables.

[15]The pure substitution effect is defined as

$$Es = Ew - Ei$$

where Ei is the income elasticity and Ew is the uncompensated wage elasticity. The derivation is based on the assumption that family income, Yf, equals the sum of husband's income and wife's income (Yh + Yw). The fertility rate equals

$$\begin{aligned} F &= a + b_1 Yf + b_2 Yw \text{ (omitting the error term)} \\ &= a + b_1 (Yh + Yw) + b_2 Yw \\ &= a + b_1 Yh + cYw \end{aligned}$$

$b_2 = c - b_1$ and in elasticity terms $Es = Ew - Ei$.

[16]For example, the number of children ever born per 1000 women aged 35-39 who were ever married increased from 2414 to 3045 from 1940 to 1964 (21, p. 50).

NOTES (contd)

[17]To be sure, the interpretations of causality are limited to the methodological framework associated with an economic analysis. Other disciplines will make quite different interpretations of even the same variables.

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