AN EMPIRICAL ANALYSIS OF INTERSTATE DIFFERENTIALS IN THE RATE OF FERTILITY DECLINE, 1970 - 1971

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Ι

Birth rates have declined to record low levels in the United States. Between 1970 and 1971, the last year for which final statistics on births are available, the total number of live births in the United States declined five percent, and the U.S. birth rate declined seven percent between 1970 and 1971 (22, p. 1). Preliminary data for 1972 and 1973 indicate that the total number of births declined 8.5 percent between 1971 and 1972 and fell an additional 3.7 percent between 1972 was indicated to have been 9.4 percent lower than 1971, and the 1973 birth rate to have been 4.3 percent below the average rate for 1972 (20).

The so-called "birth-death" phenomenon that has occurred since 1970 has been nationwide in scope. Provisional data for 1973 (by place of occurrence) show that the birth rate declined in all states but Georgia (20). But while this general pattern of fertility decline has been nationwide, the relative magnitudes of these declines and the levels of fertility themselves among the states have been subject to considerable variation -- for example, annual declines between 1970 and 1971 ranged from over ten percent in crude birth rates in states such as Connecticut, New York, Washington, and California to a slight increase in South Carolina.

Given this pattern of variation, this paper presents preliminary results from empirical analysis of the factors associated with interstate variations in the percentage decline in the numbers of births and in the birth rate between 1970 and 1971.

II

Previous studies have examined the determinants of differential fertility in the United States utilizing cross-section data (3,7,8,9,10, 24), but have concentrated on explanation of variation in the levels of fertility. Analyses have also examined the factors associated with U.S. fertility trends, but these have generally investigated the trends in national fertility measures rather than differential regional trends. (1,6)

We will formulate the following linear stochastic model to test the association of a combination of socioeconomic and demographic characteristics of states with (a) the percentage decline in births and (b) the percentage decline in birth rates during the 1970-1971 period:

F = F(Y,U,B,R,L,M,Ed,A,P,I,Ec)

where

- F refers alternatively to (a) the percentage decline in the number of live births and (b) the percentage decline in the crude birth rate between 1970 and 1971.
- Y refers to the median income of families in 1969. The relationship between income and fertility has been studied extensively.¹ Typically, analysis has been in terms of association between family size and income or wealth levels. In our context, we will investigate the relationship between differences in the magnitude of the fertility decline and the relative income levels of families among states.
- U refers to the 1970 unemployment rate. This additional economic variable is included as a measure of the influence of short run fluctuations in economic conditions upon fertility decisions -- particularly upon the timing of births.²
- B refers to the proportion of the total 1970 Census population of the state that was Negro. Previous analyses have identified race as a significant determinant of differential fertility (2,15). Additionally, black attitudes toward fertility control and population growth have been the subject of considerable recent discussion (23), so that this variable has been included to study the significance of race as a factor in recent declines in fertility.
- R refers to the proportion classified as rural residents of the total 1970 Census population. Previous studies of urban-rural differentials show substantially higher fertility for rural areas, even when education, income and other socioeconomic factors are taken into account (2,5,8,15).
- L refers to the female labor force participation rate. Theoretical analyses have identified the opportunity cost of the mother's time as a very important factor in the family's fertility decisions (4,24); and a significant negative relationship between female labor force participation and fertility levels has generally also been empirically identified (6,7,9,24).
- M refers to the proportion of women over 14 in 1970 who were married. Since the fertility of married women is much higher than that of unmarried women, we would expect the proportion married of the female population of child-bearing age to be a significant factor determining differences in fertility rates among states.

- Ed refers to the median number of school years completed by women 25 years and over in 1970. A measure of female educational attainment has been included in our analysis because previous research has identified a strong inverse relationship between education and fertility (2,8,10,15). Additionally, a positive relationship between educational attainment and the rate of fertility decline might be hypothesized on the basis of a positive relationship between education and the awareness of new economic and social trends and/or changes in contraceptive technology that would effect fertility.
- A refers to the median age of the female population in 1970. <u>Ceteris paribus</u>, the age composition of the female population in the child-bearing ages has important effects upon aggregate fertility because age specific fertility rates vary tremendously among different age groups. Further, the rate of fertility declines has been much higher for older women than those in the prime childbearing ages. Inclusion of the median age of the female population as an explanatory variable provides an indirect measure of differences in the age composition of the female population.³
- P refers to the percentage increase in the population aged 18-44 between 1970 and 1971. Even if age specific fertility rates remained constant, the number of births and the birth rate would be expected to change if the size of the child-bearing population varied during the time period; this age specific population growth measure has been included to investigate the significance of this factor.
- Ι refers to the percentage change in the infant mortality rate between 1969 and 1970. The infant mortality rate is generally considered a sensitive measure of the general level of health and medical care (2); it has been included in the analysis as a measure of the importance of such health factors upon the rate of fertility decline.⁴ Alternatively, the inclusion of this variable might be considered a test of a theory of fertility decline that has received considerable study -- the direct impact of the decline in infant mortality upon the number of births per woman (7,13), in the context of the recent U.S. experience.
- Ec refers to the number of members of the conservationist society, the Friends of the Earth, per 1000 population. This variable might be interpreted as a proxy of the degree of the environmental concern among the states' residents.

Further definitional details and data sources are presented in the appendix for all variables.

It should be noted that <u>a priori</u> hypotheses concerning the direction of the relationship

between most of the independent variables and the measures of fertility decline were not stated. Previous analyses have analysed the relationship between income, education, age structure, female labor force participation, race, urban-rural residence and fertility levels; but little prior evidence exists regarding the association between the socioeconomic variables and the rates of fertility decline.

Theory may imply a positive relationship between fertility levels and a particular independent variable, and the theory may also be supported by empirical results indicating the existence of such a positive association. If a linear model is assumed, it is also possible to extend the theory to imply a positive relationship between changes in fertility and variations in the particular independent variable. Unfortunately, neither variant of such a theory concerning the relation between fertility - independent variable provides much insight into the expected relationship between the rate of change in the dependent variable and the level of the independent variable. Therefore, the test of significance employed in the analysis was a twotailed t test -- that is, no assumption was made about the direction of the specified relationship between the rate of fertility decline and most of the independent variables prior to analysis.

III

Ordinary least squares regression analysis was utilized to estimate the alternate versions of the model described in the previous section. Table 1 presents separate regression results with the percentage decline in births and the percentage decline in birth rates alternatively employed as the dependent variable in the multivariate model. A constant term was computed for each regression but not reported. The table reports beta coefficients for each variable, rather than standard regression coefficients to allow direct comparison of the relative impact of each factor upon the rate of fertility decline.⁵ The estimated t value for each coefficient is also reported in parentheses below the respective coefficient, and those coefficients which are indicated to be statistically significant at the ten percent, five percent, and one percent levels of significance are designated by the superscripts "a," "b," and "c" respectively.

Of the eleven explanatory variables included in the analysis, the regression results show seven to be statistically significant at the ten percent level of confidence or above (when twotailed test is applied) in the aggregate birth equation, while six are indicated to be statistically significant in the birth rate equation.

Interpreting the beta coefficients as measures of the relative impact of each significant explanatory variable upon the rate of fertility decline, the results show the median income measure to have been the most important variable in explaining the decline. Differences in urbanrural residence of the states' populations were indicated to be the second most important factor for both fertility measures, and the racial composition was shown to be the third most important factor. The proportion of the female population married and the measure of decline in the infant mortality were also found to be significant variables for both measure of the rate of fertility decline. Declines in aggregate births were also significantly correlated (positively) with female median age and with the variable measuring growth of the population in the child-bearing ages (inversely); these factors were found to have the same signs in the birth rate equation, but were not indicated to be statistically significant. The measure of environmental concern was shown to be positively related to both measures of the rate of fertility decline, but significantly correlated only in the case of the birth rate equation. Differences in educational attainment, female labor force participation, and unemployment rates were not indicated to be significant in either equation.

One interesting aspect of these results is the relatively high proportion of the total variance in the fertility measures explained by the combination of eleven independent variables included in the regression equations. The \mathbb{R}^2 's of .75 in both equations compare very favorably with cross-section analyses of U.S. differential fertility -- for example, Heer and Boynton (7) were able to explain only 35 percent of the total variance in birth rates among a sample of U.S. counties, with a model including seven explanatory variables.

The positive impact of median income levels was identified as the most important relationship by the regression results. These results could be interpreted to support several alternative hypotheses. One possible interpretation would be that children are an inferior good, so that higher income levels are associated with low levels of fertility. Alternately, the observed positive relation between income levels and the rate of fertility decline may be indirect evidence of the relationship between the opportunity cost of wives' time and fertility, since families' income levels and the value of time would be expected to be positively related. Finally, even after standardization for educational, racial, and residential differences, there may be a positive relationship between income levels and adoption of new contraceptive technology, so that the elimination of unwanted fertility among higher income individuals has become increasingly successful compared with the experience of the low income population.

The regression results also indicated that the rate of fertility decline was significantly larger in states' with relatively large rural populations. This observed relationship supports other evidence that rural fertility has been declining more rapidly than urban fertility -- that is, the differential between rural and urban fertility levels has been narrowing over time (8,15).

Similarly, the positive relationship indicated between the proportion of the population which was Negro and the rate of fertility decline can also be interpreted as the results of the lessening of the gap between higher Negro and lower white fertility rates. Alternatively, the observed relation might also be explained in terms of the effects of underlying differences in socioeconomic variables that were not adequately measured by the present aggregate analysis. For example, Negro income levels could have risen faster than white income levels, so that those states with relatively high proportion of Negroes would have larger fertility declines.

The regression results with respect to the effects of improvements in infant mortality can also be interpreted in at least two ways. If the infant mortality measure is assumed to be a proxy for improvements in health care (perhaps including the provision of abortion and family planning programs), then the positive relation discovered could be interpreted in terms of the positive influence of these health-related factors upon the rate of fertility decline. On the other hand, it is also possible to explain this evidence in terms of a direct relationship between changes in infant mortality and changes in fertility. Previous analyses have usually examined the infant survival factor in the context of developing societies, but Heer and Boyton (7) found a significant and positive relationship between infant mortality rates and birth rates for U.S. counties. Our evidence could also be interpreted as confirming this relationship in the context of the recent U.S. experience.

In the case of the birth rate equation, the significant positive relationship between the environmentalist measure and birth rate declines support the hypothesis that one of the important factors leading to the unexpectedly rapid decline in fertility of the 1970's has been the increasing concern with the negative impact of population growth upon the quality of life. A recent national opinion poll indicated that two-thirds of the respondents regarded U.S. population growth as a serious problem; and data collected in the 1970 National Fertility Study indicated that, among married women under 30 with less than two children, those concerned with population growth intend to have only half as many additional children as those not concerned (11).

For those two demographic variables for which <u>a priori</u> hypotheses concerning the nature of their impacts upon fertility decline were obvious -- the proportion of the female population married and the growth rate of the population of child-bearing ages during the 1970-1971 period -the theoretically expected negative relationship was, in fact, observed in both regression equations.

Finally, the results did not demonstrate significant relationships, when the effects of the other factors are taken into account, between fertility declines and female educational attainment, female labor force participation, or the unemployment rate. The lack of significant relationship between the rate of fertility decline and female educational levels is somewhat surprising,

given the positive associations that have been observed between educational attainment and contraceptive use and attitudes relating to abortion and fertility control (2,12). Similarly, substantial evidence exists of a close association between fertility and labor force participation by women, so a lack of evidence reaffirming such a relationship with respect to the rate of fertility decline was also somewhat unexpected. Failure to observe a significant relation between the rate of fertility decline and the unemployment rate was not as surprising, given the controversy concerning the importance of business cycle effects upon fertility rates (16). These results may be due, however, to shortcomings in the actual variables utilized in the empirical analysis as measures of the theoretical relationships under study. The existence of multicollinearity among the independent variables may also have resulted in the estimated coefficients of these variables to be nonsignificant.

IV

In summary, these results have emphasized some interesting aspects of the recent fertility experience. The evidence demonstrates that a high proportion of the differentials in the rate of fertility decline among the states can be explained on the basis of a combination of several socioeconomic and demographic characteristics of the states' populations. These results may also be interpreted as indirect evidence of the role of certain factors in the unexpectedly rapid decline in fertility experienced by the United States during the early 1970's. The regression analysis indicates that (1) ceteris paribus, the downward trend was most pronounced in states with relatively high median income levels; (2) a process of fertility differentials between rural and urban residents and between Negroes and Whites narrowing during the period also contributed to the fertility decline; and (3) empirical support exists for the hypothesis that growing the environmentalist sentiment had an impact upon fertility during the recent period.

FOOTNOTES

¹For summaries of previous studies refer to Easterlin (4) or Simon (14).

²The relationship between the business cycle and short-run fluctuations in birth rates has received considerable analysis (1,8,16). Easterlin has also related changes in economic conditions to longer-run trends in fertility (4).

³The median age is an imperfect measure of such age compositional effects, since it is many different age compositions could have the same median age, but it is a single, available proxy measure which does provide some indication of age structure difference.

⁴The level of infant mortality rates in 1970 was also employed as an alternate variable, but was found not to be correlated with fertility declines. ⁵A "beta coefficient" is equal to the estimated coefficient times the ratio of the standard deviation of the independent variable divided by the standard deviation of the dependent variable.

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DATA APPENDIX

The percentage declines in births and in birth rates between 1970 and 1971 were computed from data on live births and birth rates (births per 1000 population) recorded by place of residence (22). Unfortunately, final fertility data for the years after 1971 has not yet been published. Data series for 1969 median family income, average 1970 unemployment rate for persons 16 and over, and the proportion of the total 1970 Census population that was Negro were compiled from the 1973 Statistical Abstract of the United States (19).

Information by state on the proportion classified as rural-farm of the total 1970 population, the proportion of females 16 and over in the labor force, the proportion of females 14 and over married, the median number of school years completed by women 25 and over, and the median age of the female population was collected from the 1970 Census of Population (17).

The percentage changes in the population 18-44 between 1970 and 1971 for each state were computed from age specific population data (18).

The percentage declines in infant mortality rates (the number of deaths to infants less than one per 1000 live births) between 1970 and 1971 by state were computed from data on infant mortality in 1970 and 1971 (21) and on the number of live births reported in (22).

The number of members of Friends of the Earth per 1000 population in each state was computed from data on FOE membership by state in 1972 reported in a private letter from the national office of the organization and population estimates of state populations as of July 1, 1972 presented in (18). It would have been preferable to have such membership rates for the 1970-71 period but membership data for years before 1972 were not available.

REGRESSION RESULTS: PERCENTAGE DECLINES IN BIRTHS AND IN BIRTH RATES AS FUNCTIONS OF SELECTED SOCIOECONOMIC AND DEMOGRAPHIC VARIABLES, FOR THE FIFTY STATES, 1970 - 1971.

	Dependent Variable	
Independent Variables	Births (Beta Coefficient)	Percentage Decline in Births/1000 Population (Beta Coefficient)
Y	.6449 ^c (3.30)	.7367 ^C (3.79)
U	.1540 (1.21)	.1421 (1.12)
В	.3274 ^b (2.33)	.3167 ^b (2.27)
R	.4527 ^c (3.76)	.3845 ^c (3.20)
L	0041 (0.03)	0143 (0.11)
М	2744 ^C	2005 ^a
Ed	.1260	.1346
A	.2148 ^a	.1660
P	(1.98) 2883 ^c	1359
I	(2.53) .2451 ^c	(1.20) .2035
Ec	.1885	(1.98) ⁻ .2653 ^b
R ²	(1.46)	.753

TABLE I