EDUCATION AND FERTILITY: IMPLICATIONS FOR THE ROLES WOMEN OCCUPY

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The interplay between education and fertility has a significant influence on the roles women occupy, when in their life cycle they occupy these roles, and the length of time spent in these roles. The overall inverse relationship between education and fertility is well known; but little is known about the theoretical and empirical basis of this relationship. This paper explores the theoretical linkages between education and fertility and then examines the relationships between the two at three stages in the life cycle. It is found that the reciprocal relationship between education and age at first birth is dominated by the effect from education to age at first birth with only a trivial effect in the other direction. Once the process of childbearing has begun, education has essentially no direct effect on fertility; but it has a large indirect effect through age at first birth.

No factor has a greater impact on the roles women occupy than maternity. Whether a woman becomes a mother, the age at which she does so, and the timing and number of her subsequent births set the conditions under which other roles are assumed. Some may deplore this situation and it may be changing, but the dominance of motherhood continues to be a fact for the vast majority of women. While there is clearly variance in this role dominance, the assumption of nonfamilial roles varies markedly with the fact, timing, and extent of maternity.

Education is another prime factor conditioning female roles. Education is expected to impart values, aspirations, and skills which encourage and facilitate nonfamilial roles. It is possible that better-educated women may assume less traditional role patterns than less-educated women with identical fertility histories. However, it is also likely that education affects women's roles through differing patterns of fertility. This paper discusses some of the possible linkages between education and fertility and reports analyses bearing on: (1) the relationship between education and age at first birth, (2) the effects of education on the timing of subsequent births, particularly on the experience of short birth intervals, and (3) educational differences in wanted family sizes.

EDUCATION–FERTILITY LINKAGES

Given the importance of the interplay between education and fertility for the roles women occupy in industrialized
societies, there has been surprisingly little attention paid to the causal linkages between the two. In part, this may be because the possible causal connection between fertility and education is exceedingly complex. Some have assumed that education affects fertility (e.g., Westoff and Ryder, 1977; Rindfuss and Sweet, 1977; Cho et al., 1970; Whelpton et al., 1966), and some have argued that fertility also affects education (Waite and Moore, 1978).

Most of the theory and research concerned with education and fertility conceptualizes both in terms of their end products: completed education and children ever born. In fact, children come one at a time (usually), and education is completed a year at a time, sometimes a course at a time. Children can come close together, or at intervals of 10, 15 or even 20 years. Formal schooling can be completed without interruption; or it can be completed after short or long interruptions (Davis and Bumpass, 1976). Models of education and fertility should reflect the fact that education and fertility are processes which take time to complete and which can intercept each other in complex ways.

The overall relationship between education and fertility has its roots at some unspecified point in adolescence, or perhaps even earlier. At this point aspirations for educational attainment as a goal in itself and for adult roles that have implications for educational attainment first emerge. The desire for education as a measure of status and ability in academic work may encourage women to select occupational goals that require a high level of educational attainment. Conversely, particular occupational or role aspirations may set standards of education that must be achieved. The obverse is true for those with either low educational or occupational goals. Also, occupational and educational aspirations are affected by a number of prior factors, such as mother's education, father's education, family income, intellectual ability, prior educational experiences, race, and number of siblings (for example, see Hout and Morgan, 1975).

Occupational and educational aspirations are also reciprocally related to evolving fertility preferences. These fertility preferences include both number and timing preferences, that is, whether a first birth is wanted ever and, if so, when. The number and timing preferences may be related if, for example, a desire for many children leads to a desire to begin childbearing as soon as possible (Bumpass and Westoff, 1970). Moreover, the preference for postponing a first birth may lead to interests in other areas which may then lead to a decision not to have any children. There is evidence that repeated postponement of the first birth is a typical pattern among those who are voluntarily childless (Veevers, 1973). Such preferences for timing are necessarily vague, but nonetheless important. Some young women may wish to have a baby as soon as possible, perhaps to establish an adult identity separate from their parents, or to fulfill strong nurturing needs. Such aspirations among young women are likely to have a negative effect on evolving role and educational aspirations. Similarly, a young woman who is sure she does not want to have a child any time soon, if at all, may expand her role and educational aspirations accordingly. Influences in the opposite direction operate as the threat of early fertility to educational attainment are recognized and fertility desires are adjusted accordingly.

Both of these preference sets (occupational and educational aspirations as well as fertility preferences) influence actual age and education at first birth through a set of intervening variables that include the standard intermediate variables affecting exposure to intercourse, conception risk and gestation and parturition (Davis and Blake, 1956; Bongaarts, 1978). Adolescents with higher educational and occupational goals may choose social patterns that are less likely to lead to early

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2 The work of Holsinger and Kasarda (1976) for developing countries is an exception.

3 In actual practice, we know of no case where all the intermediate variables are adequately measured. Models are evaluated as if there were direct effects, with researchers unable to specify the precise nature of the social and economic effects on fertility as they operate through the intermediate variables.
marriage, that is, "not wanting to go steady or get serious with boys," because they want to go to college. They may be less willing to engage in intercourse because of the threat of possible pregnancy to their educational or career plans. Sexually active adolescents with high educational aspirations may be more likely to try to control the risk of pregnancy through careful contraceptive use.

Adolescent women who desire early motherhood (and presumably early marriage) are likely to follow social patterns that lead to early intensive emotional involvement; and, when sexually active, this group may have relatively low motivation to avoid pregnancy. Such patterns may lead indirectly to lower educational achievement because of an early age at first birth.

Early marriage may have a direct effect on reducing educational attainment, for example, when a girl leaves school in order to be married. These social patterns also have an indirect effect on education through factors affecting pregnancy and early age at first birth.

It should be noted that in the reciprocal relationship between education and age at first birth, the effects of education on age at first birth can only be the result of the intermediate variables discussed above (also, see Davis and Blake, 1956; Bongaarts, 1978) whereas the effect of age at first birth on education may also include a direct effect.

Both age and education at first birth can affect subsequent role and educational aspirations, and subsequent preferences for the timing and number of children. These subsequent aspirations and preferences are also reciprocally related. After the birth of their first child some women may find that they wish to reduce their fertility goals, increase their occupational goals, and return to school. Others who had planned on continuing their education may decide to have more children, or to quickly become pregnant again, either because of great satisfaction in the mother role, or because of a sense that it is an all-consuming role that precludes other options, or because they are not sure of what else to do.

Education, age at first birth, the possibly revised occupational and educational aspirations, as well as timing and number preferences all affect various aspects of the intermediate variables in a process similar to that elaborated above with respect to the period before the first birth. The period prior to the first birth includes an unmarried and sexually inactive period as well as a married interval for most women. For most (but not all) women, the period following the first birth begins within marriage. Some women will not yet be married and others will have married and separated or divorced by the time of the first birth. At the second birth, a woman may be never married, currently married, widowed, divorced or separated (Rindfuss and Bumpass, 1977). Marital instability is an important social factor in the social patterns category in each segment to the extent that it affects other intermediate variables such as frequency of intercourse, periods of abstinence, and use of contraceptives.

Fecundity is largely exogenous to the processes we are examining, though it has a clear effect on the timing of the first birth and may mediate the effect of age at first birth on subsequent fertility.

While these potential intersections in the relationship between education and fertility warrant more intensive study, that is not our purpose in this paper. The point we are attempting to make in the preceding discussion is that the observed relationship between completed education and completed family size is the cumulative outcome of a complex process that involves attitudes and decisions about both education and fertility that may change as time passes or as the woman moves from one stage to the next, and that it is necessary to examine empirically the various stages in the process.

Data

The data used are from the 1970 National Fertility Study (NFS), a multipurpose study based on a national probability

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Note, however, that Voss (1977) finds a negative effect of age at first marriage on educational attainment. Marini (1978) argues, and we agree, that this finding of Voss is the result of the lack of an adequate instrument for age at first marriage.
sample of 6,752 ever married women under 45 years of age residing in the continental United States (Westoff and Ryder, 1977). Complete birth and pregnancy histories were obtained, thus permitting analysis of age at first birth and of birth intervals. Unfortunately, a complete educational history was not obtained. Only education at interview and education at marriage were obtained. This means that we have to use education at marriage as a proxy for education at first birth. For most women this is a reasonable proxy, since the correlation between age at first birth and age at first marriage is 0.74. In order to check the reasonableness of using education at marriage, we reran all the analyses using education at interview, and results were unaffected. However, it should be recognized that for younger mothers the first birth is likely to precede the first marriage. Finally, it should be noted that there were no questions asked about educational or occupational aspirations during the adolescent and young adult years.

Although not reported in detail here, wherever possible we have also examined data from the 1973 National Survey of Family Growth (FGS) (NCHS, 1978) (a national probability sample of 9,797 women under age 45 who had ever been married or who were never married mothers in 1973), and essentially comparable results were found in both data sets.

Education and Age at First Birth

In the absence of accurate data on the intermediate variables, the relationship between the fertility and educational processes can be conceptualized as a simple causal process. The aspirations, plans, and decisions (and “apparent” nondecisions) leading to an early first birth may result in lowered educational aspirations and achievement. Women who desire and obtain a high level of education may adjust their fertility preferences accordingly. Both the educational and the first birth process are affected by a set of exogenous factors reflecting background characteristics and characteristics of early adolescence. A model of these relationships is shown in Figure 1. The rationale for this set of exogenous variables, and their effects on education and age at first birth, is considered elsewhere (Rindfuss and St. John, 1979); in the present paper we concentrate only on the relationship between education and age at first birth. Table 1 indicates the measurement of these exogenous variables, and the Appendix reports the zero-order correlations among all the variables in Figure 1.

That the relationship between education and age at first birth should be viewed as potentially reciprocal is often overlooked: one direction of causation is usually emphasized to the exclusion of the other. For example, Jaffe (1977:22) asserts: “Pregnancy is the most common cause of school dropout among adolescent girls in the U.S.” Others, however, contend that education determines age at first birth; and, further, that women who get pregnant while still in school do so to have an “acceptable” reason for dropping out of school (Cutright, 1973). Since there is considerable overlap in the time when women leave school and the time when they have their first child (median age at first birth is currently about 22, and, of recent cohorts, 25% have their first birth by the end of the 19th year), it is important to investigate the extent to which the educational attainment process and age at first birth process are reciprocally related.

The part of the model shown in Figure 1 of direct interest here is the relationship between education and age at first birth. We allow for a reciprocal relationship between these two variables, with each affected by other variables in the model as well. Age at first birth is computed from the date of respondent’s birth and date of birth of respondent’s first child. Education, as noted, is education at marriage, not education at first birth. In order to estimate the reciprocal relationships between education and age at first birth, instrumental variables are needed for each of the two endogenous variables—that is, variables are needed which directly affect one of the endogenous variables but not the other, which are not causally determined by the endogenous variables, and which are not correlated with the unspecified source of the endogenous vari-
Corresponding equations:

\[
\begin{align*}
\hat{ED} &= b_0 + b_1 \text{DADSOCC} + b_2 \text{RACE} + b_3 \text{NOSIB} + b_4 \text{FARMBACK} + b_5 \text{REGNBACK} \\
&\quad + b_6 \text{ADOLFAM} + b_7 \text{RELIGION} + b_8 \text{YOUNGCIG} + b_9 \text{AGEFST} + u \\
\text{AGEFST} &= c_0 + c_1 \text{RACE} + c_2 \text{NOSIB} + c_3 \text{FARMBACK} + c_4 \text{REGNBACK} + c_5 \text{ADOLFAM} \\
&\quad + c_6 \text{RELIGION} + c_7 \text{YOUNGCIG} + c_8 \text{FECUND} + c_9 \text{ED} + v
\end{align*}
\]

Figure 1. A Model of the Relationship between Educational Attainment and the Beginning of Motherhood
<table>
<thead>
<tr>
<th>Variable Label</th>
<th>Variable Name</th>
<th>Units of Measurement</th>
<th>Description</th>
<th>Mean</th>
<th>Standard Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>DADDSOCC</td>
<td>Respondent’s father’s occupation</td>
<td>Duncan’s SEI scores</td>
<td>Missing data were given the mean value</td>
<td>30.209</td>
<td>21.370</td>
</tr>
<tr>
<td>RACE</td>
<td>Race of respondent</td>
<td>Dummy variable</td>
<td>Blacks are coded 1, all others coded 0</td>
<td>0.099</td>
<td>0.299</td>
</tr>
<tr>
<td>NOSIB</td>
<td>Respondent’s number of siblings</td>
<td>Actual number is coded</td>
<td></td>
<td>3.889</td>
<td>0.305</td>
</tr>
<tr>
<td>FARMBACK</td>
<td>Respondent’s farm background</td>
<td>Dummy variable</td>
<td></td>
<td>0.330</td>
<td>0.470</td>
</tr>
<tr>
<td>REGNBACK</td>
<td>Region where respondent grew up</td>
<td>Dummy variable</td>
<td></td>
<td>0.357</td>
<td>0.479</td>
</tr>
<tr>
<td>ADOLFAM</td>
<td>Household composition when respondent was 14</td>
<td>Dummy variable</td>
<td></td>
<td>0.183</td>
<td>0.387</td>
</tr>
<tr>
<td>RELIGION</td>
<td>Respondent’s religious preferences when growing up</td>
<td>Dummy variable</td>
<td></td>
<td>0.231</td>
<td>0.421</td>
</tr>
<tr>
<td>YOUNGCIG</td>
<td>Whether respondent smoked at a young age</td>
<td>Dummy variable</td>
<td></td>
<td>0.136</td>
<td>0.342</td>
</tr>
<tr>
<td>FECUND</td>
<td>Whether respondent had a miscarriage before the first birth</td>
<td>Dummy variable</td>
<td></td>
<td>0.099</td>
<td>0.298</td>
</tr>
<tr>
<td>ED</td>
<td>Respondent’s education</td>
<td>Years of schooling completed</td>
<td>This is education at first marriage</td>
<td>11.595</td>
<td>2.360</td>
</tr>
<tr>
<td>AGEFST</td>
<td>Respondent’s age at first birth</td>
<td>Years</td>
<td></td>
<td>22.012</td>
<td>4.079</td>
</tr>
</tbody>
</table>

Note: Throughout, the usual practice of deleting missing data cases is followed.
able for which it is not an instrument (Duncan, 1975; Heise, 1975). As can be seen from Figure 1, fecundity is used as the instrument for age at first birth and respondent’s father’s occupation as the instrument for education. Fecundity is measured by whether or not the respondent had a miscarriage prior to her first birth. A miscarriage before the first birth postpones the first birth in a direct and obvious way: it takes time to conceive again and carry that conception to successful parturition. It also gives the woman a second chance if she wants to contracept. The additional time involved as the result of a miscarriage before the first birth can be substantial since approximately one-fourth of the women who have one miscarriage before their first birth have two or more miscarriages before their first birth.

A miscarriage before the first birth should have no effect on education, except indirectly through age at first birth. This would occur only if the woman dropped out or was expelled from school prior to the miscarriage because of the pregnancy. If this were the case, then the miscarriage would be correlated with the disturbances in the education equation and would be unsuitable as an instrument. However, this is unlikely because the vast majority of miscarriages occur in the early months of pregnancy, before it is obvious to observers that the woman is pregnant, and often before the woman knows that she is pregnant (see National Center for Health Statistics, 1966). If the woman is unmarried, she is unlikely to notify the school that she is pregnant until it becomes absolutely necessary. It is probably in part for this reason that unmarried women often do not seek prenatal care until very late in pregnancy (National Academy of Sciences, 1973). Furthermore, education should not have any effect on whether or not there is a miscarriage before the first birth. The only exception to this statement would involve a woman obtaining an induced abortion in order to complete her education. However, induced abortions are so grossly underreported in United States fertility surveys that reported miscarriages are essentially spontaneous miscarriages.

That respondent’s father’s occupation affects respondent’s educational attainment is well known (Alexander and Eckland, 1974; Blau and Duncan, 1967; Kerckhoff and Campbell, 1977; Sewell and Hauser, 1977) and does not require further elaboration here. We also argue that father’s occupation does not have a direct relationship with age at first birth. Rather, we would argue that the relationship is indirect through education. It can be expected that families of an orientation in which the father has a high status job would be more likely to encourage daughters to postpone the first birth than families of an orientation in which the father has a low status job. However, the most likely explicit and implicit justification for this encouragement would be to allow daughters time to complete their education, and thus the effect on age at first birth would be indirect. However, there may also be an intergenerational transmission of norms regarding age at first birth. (Leonetti [1978] provides a good example of this in the case of Japanese-Americans.) To the extent that socioeconomic status directly affects the intergenerational transmission of norms regarding age at first birth—that is, in addition to the indirect transmission through educational aspirations—then respondent’s father’s occupation would not be a suitable instrument for education. Recent work by Thornton (forthcoming) suggests that there is no direct transmission of fertility norms from parental status. Instead, this influence was transmitted through the education of the offspring.

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5 There is some evidence that a history of miscarriage greatly increases the chance that subsequent conceptions will be terminated by a miscarriage (Funderburk et al., 1976; Shapiro et al., 1971). Given the unreliability with which fetal losses are reported in pregnancy histories (Bumpass and Westoff, 1970) and given the fact that very early miscarriages are often unnoticed by the woman, we experimented with alternative and more complex measures of fecundity which incorporated information from the woman’s history subsequent to the first birth. However, the simple measure of whether or not the woman had a miscarriage prior to the first birth proved to be the strongest predictor of age at first birth, and this is the measure that has been used in the final models.
In order to examine our assumption that parental socioeconomic status does not have a direct effect on the transmission of norms regarding age at first birth, we examined the determinants of ideal age at first birth. The 1970 NFS included the following question:

"Q. 3: What do you think is the ideal age for a woman to have her first child?"

Although this question suffers from all the problems of "ideal" questions (Blake, 1966; Bumpass and Westoff, 1970; Rindfuss, 1974; Ryder and Westoff, 1969) as well as some problems specific to this question (Rindfuss and Bumpass, 1978), it does provide the best measure available for norms regarding age at first birth. Using a sample of recently married women in order to minimize the possibility that the responses to the question would be affected by the cumulative maternal experience of the woman, we find that, after other appropriate factors are controlled, father's occupation has no significant direct effect on the ideal age to have a first birth. This further supports Thornton's results and supports the theoretical argument that parental socioeconomic status influences age at first birth only indirectly through its effect on the offspring's educational aspirations, and thus supports the use of father's occupation as an instrument for education in our model.

However, somewhat less consistent support was found in an examination of the 1971 National Survey of Young Women data. Since father's occupation was not available, the relationship between father's education and ideal age at first birth was considered for this sample of teenagers 15–19 years of age. While most of the association is accounted for by educational aspirations, ideal age at first birth is 0.4 years lower among the children of high school graduates than among those of fathers who attended college, net of other factors. While this modest net effect of father's education cautions our theoretical position, we would expect the net effect of father's occupation on ideal age at first birth to be considerably weaker.

Before presenting the results, it is necessary to discuss some of the variables which are not included in Figure 1 and the possible biases their exclusion might introduce. The first is marriage. Although we recognized the role of age at marriage in the earlier discussion in this paper (especially since it is incorporated in sexual experience), it is age at first birth that is emphasized both there and in our analysis here. Clearly, age at first marriage and age at first birth are closely related, normatively and empirically. However, we feel that the first birth has greater consequences for the life style and roles of the woman (Rindfuss, 1979), and that the effects of the first birth are more permanent than those of first marriage. Marini (1978) has recently argued that age at marriage is more important than age at first birth in the transition to adulthood because age at marriage "usually sets a lower limit on the age at which first birth occurs." We disagree for the following reasons: In the first place, motherhood frequently precedes first marriage. (And this is more likely to be the case the younger the age at first birth.) Second, some people may initiate the serious consideration of marriage on the basis of when they want to begin parenthood, as reflected in the phrase "time to settle down and start a family." The high incidence of premarital intercourse argues against the notion that age at first marriage sets a lower bound on exposure to the risk of conception. Third, "becoming a parent" is the modal response of married parents to the question of what marks the transition to adulthood (Hoffman, 1978). Fourth, parenthood is more permanent than marriage, particularly for women. Since children tend to stay with the mother following a marital disruption. Preston (1975) has estimated that almost half of the current marriages will end in divorce; thus, women often move in and out of the wife role. Finally, and perhaps most importantly, motherhood roles more severely constrain other life options of a woman than do marital roles, especially during the early childbearing years. For these reasons, our emphasis is on age at first birth. Given the high correlation between age at first birth and age at first marriage, and given that both are affected by similar exogenous variables, we have
not included both in the analysis. Furthermore, given the assumptions of the model, the exclusion of age at first marriage will not bias our estimates of the relative importance of the processes leading to educational attainment and to the first birth.

In order to allow women sufficient time to get married (and, thus, be eligible to be in the sample) and to have a first birth, the analysis of the education-age at first birth relationship will be limited to women aged 35–44. Most of those who will ever marry before the end of the reproductive period are married by age 35. For example, the proportion of women ever married increases from 0.873 at ages 25–29 to 0.926 at ages 30–34 to 0.941 at ages 35–39. But the proportion of women ever married increases only slightly to 0.946 at ages 40–44 (U.S. Bureau of the Census, 1972). The same holds true for first births. Most of those who will ever give birth do so by age 35. For example, 79.2% of the birth cohort of 1930–1934 had a live birth by ages 25–29, 87.7% did so by ages 30–34, and 90.2% had a live birth by ages 35–39. This percentage increased only slightly to 90.8% by ages 40–44. Less than 3% of the women in this birth cohort who had a live birth had it after age 35 (Heuser, 1976).

Childless women are excluded from this analysis at age at first birth. Only a small proportion (less than 10%) of the married women in these cohorts remained childless (Heuser, 1976). To the extent that postponement leads to voluntary childlessness (Veevers, 1973), this exclusion could lead to a weaker estimated effect of age at first birth than actually exists. However, childlessness in these cohorts was primarily a product of fecundity impairments.

The model shown in Figure 1 includes background characteristics, aspects of early adolescence, and the reciprocal relationship between education and age at first birth. Period factors are not included, and this needs to be kept in mind when interpreting our results. The respondents in this analysis were aged 35–44 in 1970. Taking 15 as the youngest age at first birth and 35 as the oldest means that these women were having their first births from 1941 to 1970. During this long period, there were a number of events affecting the timing of fertility, including World War II, the Korean War, and the Vietnam War. Those women who postponed their first birth were, of course, exposed to more of these period factors, which could affect the timing of their first birth. Since so little is known about the nature of period factors that affect the timing of fertility (Rindfuss et al., 1978), they cannot be explicitly included in the analysis. Furthermore, the younger women in our sample experienced the period factors at different ages than the older women in the sample. To see if this would affect our results, we ran the model separately for women aged 35–39 and 40–44. The results were virtually identical for the two groups.

The work of Easterlin (1962; 1966 and 1973) and others suggests that the financial status of the respondent’s family of orientation while the respondent was an adolescent will affect the age at which she has her first child. Unfortunately, we do not have a direct measure of the respondent’s parents’ financial status while the respondent was an adolescent. However, a number of background variables in the model, such as race, number of siblings, farm background, regional background, and family composition when respondent was 14, indirectly control for the respondent’s family’s financial situation.

Further, the model shown in Figure 1 also does not include the labor force experiences of women. As noted earlier, labor force experiences and aspirations are likely to affect, and be affected by, childbearing and childbearing preferences. In fact, there is a long literature on this relationship (see Waite and Stolzenberg, 1976; and Smith-Lovin and Tickamyer, 1978, for recent summaries of this literature). Unfortunately, adequate labor force participation information is not available.

Estimation of the effects shown in Figure 1 was accomplished by using two-stage least squares regression analysis (Goldberger, 1964; Johnston, 1972). The estimates were made using ordinary least squares in two steps, making the appropriate corrections as outlined by Hout (1977). The results are shown in Table 2.
This table shows only the results for the endogenous variables; results for the complete model are reported and discussed elsewhere (Rindfuss and St. John, 1979).

The effect of education on age at first birth is significant—both statistically and substantively. Each additional year of schooling results in the delay of the first birth by approximately three-quarters of a year. However, the effect of age at first birth on education is not statistically significant; and even if it were, the effect would be trivial substantively.

The results shown in Table 2 are based on the assumption of linear effects. It might be argued that the effect of age at first birth on education is not linear. The inclination to have a birth at a very young age may have more serious effects on educational plans than the preference to have a child at a later age. The potential conflict between school and motherhood is greatest at the younger ages at first birth. This suggests that a nonlinear age at first birth effect on education should be specified. Such a specification should force a difference of a year at the younger ages at first birth to be larger than a difference of a year at the older ages at first birth. We used three different transformations of age at first birth (AGEFST) to explore this possibility: (1) LN (AGEFST), (2) 1/AGEFST, and (3) 1/ (AGEFST)^2. The model shown in Figure 1 was reestimated for each of these three transformations. In each case the results are the same as the linear model: age at first birth does not have a significant effect on educational attainment.

Furthermore, there is some evidence to suggest that the family building process may be different for whites and blacks. For example, blacks have higher illegitimacy rates than whites (NCHS, 1977), and blacks appear to rely more heavily on relatives to take temporary, but primary, care of children born to young mothers than whites (Rindfuss, 1977). In order to check for a potential interaction with race, we reran the analysis separately for whites and blacks. The important point for the present analysis is that, for both blacks and whites, education has a strong and significant effect on age at first birth, but age at first birth has an insignificant effect on education. Thus, our results are unaffected by any racial interaction.

In the relationship between education and age at first birth, the principal direction of causality is from education to age at first birth. Those who have recently examined the relationship between education and age at first marriage have found corroborating results (Marini, 1978; Alexander and Eckland, 1978), namely, that education has a much stronger effect on age at first marriage than age at first marriage has on education. Given the sheer amount of time the mother role requires in contrast to the wife role, the timing of the first birth has greater consequences for the roles women occupy. Yet, it is interesting to note that (ignoring the differences between the samples used here and those used by Marini [1978] and Alexander and Eckland [1978]), age at first marriage appears to have a somewhat greater effect on education than age at first birth. Even though age at first birth has a greater effect on the roles occupied by women, age at first marriage could have a stronger effect on educational attainment because first marriage schedules are younger and more compact than first birth schedules. Thus, more marriages take place during the years in which women are in school.

* N = 1,766.  Significant at 0.05.

6 Other nonwhites were not included.
The finding that age at first birth has only a very small effect on educational attainment may seem paradoxical, given the social policy concern with the pregnant girls who have to drop out of school and face reduced social opportunities as a consequence. Such a fate is unquestionably experienced by some women, particularly those among the 3% to 6% of the American cohort that have had a first birth before age 17. But the fact is that the vast majority of women do not get pregnant while they are enrolled in school. Even among those who do become mothers at ages at which society expects one to be in school, the direction of causality might run from education to fertility. Zelnik and Kantner (1978) and Ross (1978) suggest that a significant minority of premarital pregnancies were intentional. To further explore this issue, we compared the age at leaving school\(^7\) with age at first birth for women who become mothers at age 17 or younger. If leaving school and the first birth occur in the same year, it is ambiguous which process dominates. But for those who left school more than a year before their first birth, one can assume that the educational process is affecting the fertility process. Surprisingly, more than 40% of the women who had a first birth at age 17 or less dropped out of school at least a year prior to becoming a mother—which suggests that even at the very young ages at motherhood, the fertility process is being affected by the educational process.\(^8\) Further, there is longitudinal evidence showing a negative relation between educational aspirations and age at first birth (Marshall and Cosby, 1977; Card and Wise, 1978, Table 3), which suggests that many of those who have a first birth while they are of school age do so after deciding not to continue in school—and, perhaps, do so to justify dropping out of school. Finally, Haggstrom and Morrison (1979) find that among teenagers who do not drop out of high school, the effects of adolescent parenthood on subsequent educational aspirations are extremely small when other appropriate factors are controlled. All of this does not mean that fertility never truncates education, but only that it does so rarely. In the vast majority of the cases, education and educational aspirations determine age at first birth.

It is important that scientific discourse clarify the difference between a social policy concern that requires amelioration and the characterization of the overall process in which that concern is embedded.

*Education and the Lengths of Birth Intervals*

As discussed in the first section of this paper, we would expect to find a variety of reasons why women with more education would want to avoid very short birth intervals and we would expect them to be more effective at implementing their preferences. In this section we examine the relationship between education and the probability of having a short interbirth interval. Unlike the previous section, here, we assume that the direction of causality runs from education to the length of birth intervals.\(^9\)

The birth history information contained in the 1970 NFS allows us to compute the length of each birth interval. Given the well-known difficulties involved in the analysis of birth intervals (see Bumpass et al., 1977, for a fuller discussion), we ini-

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\(^7\) Age at leaving school was computed by assuming a normal starting age, and assuming that education is obtained one year at a time.

\(^8\) To further explore this issue, and to explore whether a gating mechanism existed, we reran the two-stage least squares analysis for women who became mothers at a young age. Although caution is necessary in interpreting such an analysis because the variance of the endogenous variables has been reduced, age at first birth does not have a significant effect on education.

\(^9\) It should be noted, however, that it is possible that, for some women, short interbirth intervals prevent the return to school. Virtually nothing is known about returning to school after becoming a mother, although there has been some research on education after marriage. Approximately one in five women attend school after marriage; but the average addition to their educational attainment is relatively small: 1.0 years (Davis and Bumpass, 1976). Whether this schooling takes place before or after the start of childbearing is unknown. In order to minimize the possibility of education after the first birth being affected by the pace of fertility, we have primarily used education at marriage (rather than education at interview) for this analysis.

<table>
<thead>
<tr>
<th>Education at Marriage</th>
<th>Second Birth Interval</th>
<th>Third Birth Interval</th>
<th>Fourth Birth Interval</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
<td>Gross</td>
<td>Net</td>
</tr>
<tr>
<td>Total</td>
<td>2612</td>
<td>25</td>
<td></td>
</tr>
<tr>
<td>1–8</td>
<td>155</td>
<td>33</td>
<td>31</td>
</tr>
<tr>
<td>9–11</td>
<td>657</td>
<td>28</td>
<td>26</td>
</tr>
<tr>
<td>12</td>
<td>1218</td>
<td>24</td>
<td>23</td>
</tr>
<tr>
<td>13–15</td>
<td>388</td>
<td>22</td>
<td>24</td>
</tr>
<tr>
<td>16+</td>
<td>194</td>
<td>20</td>
<td>29</td>
</tr>
</tbody>
</table>

* Adjusted through a dummy variable regression analysis for the effects of race, religion, region, age at first birth, marital status at first birth, contraceptive use before the first birth, planning status of first birth and smoking before age 16.

sitionally constructed life tables for each birth interval. These preliminary life tables were constructed for intervals begun in the period 1959–1968. By restricting the analysis to intervals begun in this period, we avoid a young-age-at-initiation bias (see Rindfuss and Bumpass, 1979).

The preliminary life table analyses showed the expected positive relationship between education and length of intervals. However, this conclusion is based on a bivariate analysis, and there are numerous other factors affecting the length of birth intervals (e.g., Bumpass et al., 1978), and the effects of these factors should be controlled. Unfortunately, the sample size of the 1970 NFS (or the 1973 FGS) is far too small to permit the simultaneous control of all these factors by using conventional life table techniques. Consequently, we used regression analysis to examine the probability of giving birth within a relatively short time interval—specifically, the probability of giving birth within 18 months of the previous birth. Because the life table results suggested that the differences in interbirth interval length are greater between adjoining categories at the lower educational categories than at the higher educational categories, we used a variant of multiple regression analysis, Multiple Classification Analysis (Andrews et al., 1973), to see if this pattern continued when other factors were controlled. The results are summarized in Table 3.

Controlling for other factors that affect the length of interbirth intervals eliminates much of the relationship between education and the probability of having a short birth interval. Compare the gross and net columns for the second, third and fourth birth intervals. The difference which remains after controlling for other variables is primarily between those with a grade school education and all others. Given that those with only a grade school education are a small proportion of the population, and since the proportion with only a grade school education is declining, the principal result to emerge from Table 3 is that, when the effects of other factors are controlled, the respondent’s education at first marriage has essentially no effect on the probability of having a short second, third or fourth birth interval.

**EDUCATION AND FERTILITY PREFERENCES**

As discussed earlier in this paper, educational preferences and fertility preferences affect each other; and, since neither

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10 We follow the standard convention of indexing birth intervals by the order of the fertile pregnancy terminating the interval. Thus, the second birth interval is the interval terminated by the second fertile pregnancy.

11 The results in Table 3 are based on all birth intervals. Thus, both wanted or intended intervals and unwanted or unwanted intervals are included. To make sure that the relationships shown in Table 3 were not the result of differences in fertility intentions, we calculated a set of life tables for “intended” intervals, excluding the following two types of intervals: (a) closed intervals that were closed by an unwanted birth, and (b) open intervals where the respondent indicates she does not intend to have another child. These results (not shown) are virtually identical to those shown in Table 3. Also, in order to see if the finding was sensitive to the particular measure of education used, we reran the analysis using respondent’s education at interview, and then we reran it again using respondent’s husband’s education at respondent’s first marriage. These alternative analyses lead to the same conclusions.
is fixed, their interrelationship develops over time. To examine adequately this complex set of interrelationships would require longitudinal data of the kind not currently available. However, in the absence of the appropriate longitudinal data, it is still possible to examine part of the process by looking at the effect of education at marriage on fertility preferences at time of interview. Framed this way, the causal direction is essentially unambiguous.

Education at marriage can affect fertility preferences in two ways. First, education at marriage can have a direct effect on fertility preferences. Insofar as increased education makes a larger variety of roles available to women, we could expect education to have a direct and negative effect on fertility preferences. In addition, specific topics covered while in school might have a direct negative effect on fertility preferences. Second, education at marriage can have an indirect effect on fertility preferences through its effect on age at first birth. As shown earlier, higher levels of educational attainment result in older ages at first birth. An older age at first birth, in turn, leads to longer intervals between births (Bumpass et al., 1978). Thus, education leads to older ages at any given parity; and older ages at any given parity have a negative effect on the probability of wanting another child (Rindfuss and Bumpass, 1978).

The measure of fertility preferences used here, FERTPREF, is the sum of the number of "wanted" children the woman had had by the time of the interview plus the additional number of children she intended to have. For each live birth, the woman was asked a series of questions to determine whether or not, before that child was conceived, she wanted to have a birth of that order at some time during her reproductive life (see Westoff and Ryder, 1977, for a more detailed description). Such a series of questions minimizes the possibility of post factum rationalization of unwanted births (Rindfuss, 1974). The additional number intended is obtained from a question asking the respondent how many additional children she intended. This fertility preference measure is coded in numbers of children and has a mean of 2.9, and a standard deviation of 1.5.\textsuperscript{12}

Because one of our interests is in the mediating effect of age at first birth, the sample being analyzed is limited to mothers, that is, women who have had at least one live birth. As in the previous two sections, in order to allow women sufficient time to get married and have a first birth, younger women are excluded from the analysis. The analysis in this section, like the age at first birth analysis, will be restricted to respondents aged 35–44 at the time of the interview. Because the full set of questions used in constructing our fertility preference measure was not asked of postmarried women (i.e., those widowed, divorced or separated at the time of the interview), the analysis will be limited to currently married women. Finally, for ease of presentation, the set of exogenous variables to be used here, in addition to education at first marriage, is exactly the same as those shown in Figure 1 and described in Table 1. We have experimented with other sets of exogenous variables and with other definitions of the sample, and the results are similar in all cases.

The results are summarized in Figure 2. In order to focus on the education-fertility preference relationship, only the direct and indirect effects of education are shown. It can be seen that the direct effect of education on fertility preferences is trivial and insignificant. Virtually all of the effects of education at marriage on fertility preferences operates through age at first birth. Furthermore, the importance of age at first birth in influencing fertility preferences at time of interview should be underscored. Although it is not shown in Figure 2, age at first birth has a stronger direct effect on fertility preferences measured at time of interview than any of the listed exogenous variables. Thus, it appears that education affects fertility preferences by sorting women into various ages at first birth.

\textsuperscript{12} It should be noted that there is little variance in fertility preferences. Three-fourths of the sample gave a preference of 2, 3 or 4. This, of course, reduces the possibility of any variable significantly affecting fertility preferences.
For approximately four-fifths of these women, education at first marriage is the same as education at interview; but one-fifth of these women have attended school since their first marriage (Davis and Bumpass, 1976). For many women, this school attendance takes place a considerable time after the first marriage. For example, for women first married between 1951 and 1955 who returned to school after marriage, 62% last attended school 10 or more years after the first marriage. This additional schooling could affect fertility preferences, or could be affected by fertility preferences. We do not have the appropriate data to sort out these possibly reciprocal influences. But we did rerun the analysis in Figure 2 using education at interview instead of education at marriage, and the results are suggestive. The finding, as before, is that most of the relationships between education and fertility preferences operate through age at first birth. However, the direct relationship between education and fertility preferences is somewhat larger when education at interview is used than when education at first marriage is used. Without being able to sort out the potential reciprocal effects, we can only speculate that education after marriage operates to provide options that would not otherwise be available, or is itself a response to (or simultaneous with) a decision to terminate childbearing earlier than planned. This issue is something that warrants further examination.

CONCLUSION

To summarize, the reciprocal relationship between education and age at first birth is dominated by the effect from education to age at birth, with only a trivial effect in the other direction.

Once the process of childbearing has begun, education has essentially no direct effect on that process. Education has little direct effect on either the length of interbirth interval or on fertility preferences. Work by Vaughn and her colleagues (1977) shows that education has no direct effect on contraceptive efficacy. However, education has a significant indirect effect on these various components of fertility because it is the major determinant of age at the beginning of childbearing; in fact, education has a substantially greater influence on age at first birth than any other variable (Rindfuss and St. John, 1979). Thus, it is the postponing of motherhood that produces the often-observed negative bivariate relationship between education and children ever born.

The powerful mediating effect of age at first birth is of interest in its own right. Older ages at first birth lead to longer interbirth intervals (Bumpass et al., 1978), more effective contraceptive use (Vaughn et al., 1977), and preferences for fewer
children (as shown in the previous section of this paper).

These results, particularly if they are supported by future research on more recent cohorts, raise a set of interesting policy issues about which we can only speculate at present. Because the postponement of something is always more amenable to policy initiatives than its prevention, policies aimed at influencing age at first birth would be more likely to succeed than policies aimed at directly influencing children ever born. Furthermore, how adolescents spend their time has been accepted (although not universally) as something governments can legitimately influence—the military draft system is the most obvious example.

We began with the observation that a major way education might affect the roles women occupy is through altering the structure of childbearing experience, given the dominance of mother roles. We conclude that such educational effects as we can identify are explicable more in terms of education's effect on age at first motherhood than in terms of other values or aspirations that might derive from advanced schooling.

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