Institute for Research on Poverty
Discussion Paper no. 1027-93

Effects of Pregnancy, Childbirth, and Motherhood on High School Dropout

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December 1993

A previous version of this paper was presented at the annual meeting of the Population Association of America, April 1, 1993, Cincinnati, Ohio.

Abstract

This paper uses data from the National Longitudinal Survey of Youth to explore the effect of fertility on high school dropout, and differences in that effect by age at first birth. Fertility is conceptualized as a series of states: pregnancy, childbirth, postpartum, and motherhood. Pregnant students and mothers are much more likely to drop out than students who are not pregnant or mothers. Models including a wide variety of controls for social background, ability, schooling factors, and adolescent behaviors show that the net effects of pregnancy and motherhood on dropout are substantively and statistically significant. The effects of fertility on dropout are strongest for the youngest students.

Effects of Pregnancy, Childbirth, and Motherhood on High School Dropout

This paper examines two aspects of the interaction of education and childbearing in the lives of women: the impact of adolescent childbearing on the high school dropout chances of mothers, and how that impact differs by age at first birth. A brief review of some previous work is given, along with reasons for doubting its adequacy. A discussion of how to measure childbearing and schooling outcomes is followed by the presentation of new models. The results of these new models are presented, with conclusions and a discussion of their importance.

FERTILITY AND EDUCATION

Fertility and education have received a great deal of attention over many years, with debates over sophisticated models and methods often in the foreground (Hofferth 1984; Hofferth and Moore 1979; Marini 1984; Rindfuss, Bumpass, and St. John 1980; Rindfuss, St. John, and Bumpass 1984). There has long been a consensus that women who give birth early end up with less schooling. However, the causal order of fertility and education has been debated. Various models allowing for reciprocal effects of age at first birth and educational attainment have agreed that additional schooling increases age at first birth: women in school postpone childbearing. But there has been disagreement about the net effects of a first birth on schooling. Some contend that early childbearing truncates education, while others insist that it has no net effect.

It is difficult to translate complex reciprocal-causation models into the social world that they should reflect. In the real world, most high school women do not have an "age at first birth" or a final "years of schooling completed." Relatively recent advances in event history methods and the collection of appropriate data allow models to come closer to the more familiar realities of schooling and fertility.

Upchurch and McCarthy (1990) examined first births and secondary education using event history methods. They focused their attention on the timing of first births, high school dropout, and graduation. This strategy promised to avoid logical pitfalls connected with the ordering of events, as well as the statistical and theoretical mires involved in finding instrumental variables to identify nonrecursive models. Their event history methods allowed for relatively simple models with less restrictive assumptions. They modeled the various transitions, the *processes* of education and fertility, rather than just the end results. Upchurch and McCarthy also suggested that the effects of fertility would vary with age: very young women would experience different consequences of fertility than older youths, an intriguing possibility not adequately dealt with before.

Upchurch and McCarthy's conceptualization of the processes of education and childbearing was an important breakthrough and has been widely cited. However, several of their empirical results and interpretations have been questioned (Anderson 1993; see also Upchurch, McCarthy, and Ferguson 1993). This paper further questions their results while building upon their conceptual base.

After examining schooling and childbearing histories in some detail, Upchurch and McCarthy reached several surprising conclusions. Among them, "pregnant young women do not drop out in anticipation of impending motherhood" (p. 231).[1] Second, young women who become mothers while still in high school do not have lower chances of graduating than their childless peers. Third, net of other influences, "having a child while enrolled in school does not significantly increase the risk of dropping out of school" (p. 231). Elsewhere, it has been shown that their analyses do not support the second and third conclusions (Anderson 1993). This paper challenges the first conclusion by pointing out other logical inadequacies in Upchurch and McCarthy's study.

Though Upchurch and McCarthy alluded to three separate analyses related to the effects of pregnancy on dropout, they failed to present any direct test. In the first instance, a footnote referred to a test of the combined effect of pregnancy and motherhood on dropout that, according to Upchurch and McCarthy, showed no effect. However, the model in question was a variant of a model presented and misinterpreted in the text which, if used properly, actually shows a greater dropout rate for mothers at most ages (see Anderson, 1993). In the second instance, they claimed that "the majority of dropouts who have babies do so more than nine months after dropping out, suggesting that they did not drop out because of an impending birth" (p. 230). Upchurch and McCarthy are correct in stating that most female high school students who drop out do not leave school because of pregnancy, but this does not mean that pregnancy is harmless to the educational prospects of young women. In the third instance, they included a variable for the timing of a birth in a model predicting graduation among dropouts. This is not relevant to the question of pregnancy effects on dropout.

Though conceptually interesting and useful, the Upchurch and McCarthy research failed to adequately address the effects of fertility on high school dropout. This paper therefore presents an entirely new analysis of the same issue. Following their agenda,[2] attention is focused on the effects of fertility on high school dropout, taking care to estimate age-specific effects of fertility. This work does not address schooling after a first dropout episode, though that is an essential part of the educational careers of many young mothers.

A NEW VIEW OF FERTILITY

This paper propounds and incorporates a broader view of fertility. Fertility is conceived as a series of transitions rather than a dichotomous variable. While previous works have considered educational effects of pregnancy (see for example Crowley, Pollard, and Rumberger 1983) or motherhood (Upchurch and McCarthy 1990), this paper considers the distinct educational consequences of pregnancy, entering motherhood, and being a mother.

This work then has two primary goals:

1. Estimate the effects of fertility on high school dropout where fertility includes pregnancy, the transition to motherhood, and motherhood.

2. Explore the temporal differences in the effects of fertility, the ways that fertility affects dropout differently at different ages.

In both cases, the gross association of fertility and dropout and the effects of fertility net of other factors are of interest. This agenda therefore requires a baseline model that adequately reflects the time dependence of dropout and incorporates other determinants of dropout as controls.

MEASURING FERTILITY AND EDUCATION

The National Longitudinal Survey of Youth (NLSY) provides the best nationally representative data for studying the educational and childbearing careers of a recent cohort. This paper uses NLSY data from the 1979 to 1988 interviews. Analysis is based on schooling histories constructed from annual enrollment reports and fertility histories for all female respondents who provided sufficient information. Controls include a wide variety of variables representing race/ethnicity, cohort, socioeconomic background, geographic location, ability, school experience, and adolescent deviance. See Table 1 for a complete listing of variables with definitions and descriptive statistics. Age is an important determinant of dropout and fertility and is the time dimension of all models presented.

Time-varying covariates represent various stages of transition into motherhood. I first considered why different stages of fertility would have different consequences for women in high school. Early in pregnancy, a woman becomes aware of her condition and considers her options, privately if she wishes. As the pregnancy progresses, the fact of pregnancy becomes obvious to those around and could become a social liability, thereby leading to dropout. Physical discomfort may be high early in pregnancy with "morning sickness" and again later, when physical size inhibits motion

(text continues on p. 9)

TABLE 1

Definitions of Variables and Descriptive Statistics, Based on 5394 Cases from NLSY Waves 1979–1988

Variable		Minimum Value	Maximum Value	Weighted Mean	Standard Deviation
Time-varying covariates					
Pregnant	Six months of pregnancy	0	1		
Childbirth	Month preceding and month of first birth	0	1		
Postpartum	Two calendar months following first birth	0	1		
Motherhood	Motherhood more than two months after birth	0	1		
Time-invariant covariates					
Hispanic as defined by NLSY		0	1	.059	.237
Black as defined by NLSY		0	1	.143	.350
White as defined by NLSY		0	1	.798	.402
Born in 1957		0	1	.127	.333
Born in 1958		0	1	.126	.331
Born in 1959		0	1	.125	.331
Born in 1960		0	1	.126	.331
Born in 1961		0	1	.126	.332
Born in 1962		0	1	.122	.327
Born in 1963		0	1	.126	.331
Born in 1964		0	1	.123	.329
Lived with both biological parents		0	1	.741	.438
Did not live with both biological parents		0	1	.258	.438
Missing parents		0	1	.001	.030

(table continues)

TABLE 1 (continued)

Variable	Minimum Value	Maximum Value	Weighted Mean	Standard Deviation
Parents born in USA	0	1	.896	.306
Foreign-born parents	0	1	.087	.281
Missing foreign birth of parents	0	1	.018	.132
Born in the USA	0	1	.958	.201
Born outside the USA	0	1	.042	.201
Missing foreign birth	0	0	.000	.000
Used foreign language in home	0	1	.133	.340
Did not use foreign language in home	0	1	.866	.340
Missing foreign language used in home	0	1	.000	.018
Mother attended some college	0	1	.202	.402
Mother graduated high school	0	1	.433	.496
Mother did not finish high school	0	1	.320	.466
Missing mother's education	0	1	.045	.208
Father attended some college	0	1	.255	.436
Father graduated high school	0	1	.335	.472
Father did not finish high school	0	1	.307	.461
Missing father's education	0	1	.104	.305
Parent had military occupation	0	1	.014	.119
Parent occupation in bottom third of SEI scale	0	1	.173	.379
Parent occupation in middle third of SEI scale	0	1	.257	.437
Parent occupation in top third of SEI scale	0	1	.307	.461
Parent a farmer	0	1	.031	.174
Missing socioeconomic status of parents	0	1	.248	.432

(table continues)

TABLE 1 (continued)

Variable	Minimum Value	Maximum Value	Weighted Mean	Standard Deviation
Adult female in home at 14 worked outside home	0	1	.530	.499
Missing adult female worked outside home	0	1	.017	.129
Had 2 or fewer sibling	0	1	.409	.492
Had 3 or more siblings	0	1	.590	.492
Missing sibling	0	1	.001	.033
At least two: magazine, newspaper, library card	0	1	.514	.500
Fewer than two: magazine, newspaper, library card	0	1	.483	.500
Missing reading	0	1	.003	.053
Northeast residence at 14	0	1	.206	.405
North central residence at 14	0	1	.294	.455
Southern residence at 14	0	1	.328	.469
Western residence at 14	0	1	.150	.357
Missing region of residence at 14	0	1	.022	.148
SMSA, not central city	0	1	.317	.465
SMSA, central city status undetermined	0	1	.219	.414
SMSA, central city	0	1	.167	.373
Not in SMSA	0	1	.290	.454
Missing SMSA	0	1	.008	.087
AFQT ability test score in top third	0	1	.409	.492
AFQT ability test score in middle third	0	1	.346	.476
AFQT ability test score in bottom third	0	1	.206	.405
Missing AFQT ability test score	0	1	.039	.193

(table continues)

TABLE 1 (continued)

Variable	Minimum Value	Maximum Value	Weighted Mean	Standard Deviation
In ESL or bilingual education program in HS	0	1	.025	.157
Not in ESL or bilingual education program in HS	0	1	.467	.499
ESL or bilingual education program unavailable in HS	0	1	.166	.372
Missing ESL-bilingual education	0	1	.342	.475
Attended a public high school	0	1	.925	.264
Attended a private high school	0	1	.073	.260
Missing public/private school	0	1	.002	.046
Took remedial course in high school	0	1	.076	.264
Did not take remedial course in high school	0	1	.544	.498
Remedial courses unavailable in high school	0	1	.041	.199
Missing remedial coursework	0	1	.339	.474
Took college-preparatory curriculum in high school	0	1	.309	.462
Missing high school curriculum	0	1	.052	.221
First smoked or drank before age 15	0	1	.928	.258
Missing problems	0	1	.018	.134
Sampling Weight				
1979 case weight, adjusted to average 1 in full sample	.01789	3.682	1.522	.671
Dependent Variable				
DROPOUT See text for definition	0	1	.203	.402

and daily activities become difficult. Immediately after delivery, school attendance may be physically impossible for many women. After physical recovery from a birth, the daily demands of caring for a child could easily prevent school attendance. A strong social support network that provides economic and emotional support as well as child care is necessary for schooling to continue. I initially coded fertility into three-month intervals roughly corresponding to early, middle, and late pregnancy, the childbirth and immediate postpartum period, and motherhood after that, by quarter. This scheme proved conceptually satisfying, but was inordinately complex and made the data too thin for reliable analysis. As a compromise, I have selected four fertility-stage categories based on the dropout rates observed at various stages of fertility:[3] first, the six calendar months of pregnancy from seven months to two months before the birth; second, the month before and the month of delivery; third, the two months following a birth; fourth, motherhood ever after. I will refer to these stages as pregnancy, birth, postpartum, and motherhood.[4]

Dropout is defined as nonattendance in secondary school for at least one calendar month while school was in session, without graduating or earning a General Educational Development (GED) certificate. Women are counted as enrolled for every month of age until graduation or dropout. This definition of dropout is determined in part by the data available and a desire for consistency with previous work. It may depart from social definitions of dropout in several ways. First, women may be unable to attend school for some period of time due to illness, childbirth, or other reasons, but not formally withdraw or intend to quit. What women perceive as sick leave, maternity leave, or another justified reason for absence would be counted as dropout, though the social consequences might be quite different. At the other extreme, a woman could formally withdraw from school, dropping out in both bureaucratic and social senses, but return very soon and not be counted as a dropout here. A companion paper will analyze return to school after dropout, considering the reasons given for leaving school and the timing of return.

This coding scheme implies that all women are enrolled in school and are at risk of dropout at every month of age from age 14 to dropout or graduation. In my analysis, however, months of age are experienced in different calendar months by different women. The first month of age 14 for women born on July 1, for instance, is July; similarly, the first month of age 14 for those born on January 1 is January. So, for approximately one-quarter of my sample, a given month of age falls in June, July, or August--months during the summer break, when there is no risk of dropout. The calculated dropout rate for each month of age is therefore lower than the rate for each month of actual attendance. This poses no problem if this fact is considered when interpreting the results. For example, the annual dropout risk for any woman is given by the relevant age-specific rates cumulated over twelve months. The same annual rate would be obtained by cumulating the dropout rate calculated on attendance months over nine months.

The seasonal nature of schooling also affects estimates of the fertility-stage effects. Any dropout decisions made during the summer are counted as dropout at the time of last school-leaving, the end of the previous year, which could be in a different fertility period. In addition, women are not counted as dropouts when they experience fertility transitions in the summer that would have resulted in dropout if school were in session, but who manage to resume schooling in the fall. A summer birth may not lead to dropout because school was out, not because a birth in general does not lead to dropout.

Blacks, Hispanics, and economically disadvantaged whites are overrepresented in the NLSY data. I use the 1979 sampling weights which attempt to make the sample representative of all U.S. youths of the appropriate ages.

Rather than deleting cases with missing data or inserting mean values, I have included "missing" as one category of most variables. For some variables, such as father’s education, not reporting a value may be a socially meaningful response.

MODELS

I estimate a series of event history models in which the outcome is the high school dropout rate at various ages. Each model that includes the fertility-stage variables computes the effect of fertility by comparing the dropout rates of women in the various fertility stages with the dropout rates of other women.

Age is the time dimension of all models presented here. Women enrolled in school at age 14 are considered to be at risk of a birth and dropout for each month of age until experiencing one of the transitions, or censoring through graduation or the end of the data record.

First, I use a Cox model in which the underlying dropout rate varies with age, but is not estimated. Instead, the model estimates proportional effects of other variables on the baseline rate. Formally,

$$r_{jk}(t) = \exp(\alpha' X)\ q_{jk}(t),$$

where $r_{jk}(t)$ stands for the instantaneous transition rate from origin state *j* to destination state *k* at time t, $q_{jk}(t)$ is an unspecified function of time, X is a vector of variables which may vary within individuals across time, and α is a vector containing the parameters estimated in the model. This model is appropriate if the variables of interest influence women's dropout behavior uniformly across all ages. Though there is good reason to believe that educational effects of fertility differ across ages, the Cox model is informative as a baseline to show the average effects. It has the further virtue of imposing few parametric assumptions, increasing confidence that the estimated effects are not simply artifacts of unwarranted assumptions.

Next, I estimate Gompertz models in which the baseline dropout rate is a function of model parameters; in these models, other variables may have proportional or nonproportional effects, which may be specific to time periods. Thus,

$$r_{jkp}(t) = \exp(\alpha' X + \beta' X t + \lambda_p' Z_p + \gamma_p' Z_p t),$$

where the above notation applies, with the addition that *p* refers to time periods. The α and β terms pertain to effects that are uniform across time, and the λ and γ terms refer to effects specific to period *p*.

Further refinements include specifying the baseline dropout rate as a series of smaller curves, allowing for greater variation. Finally, I have constrained the endpoints of adjacent segments of the dropout rate curves to be equal, producing a smooth curve. Within the Gompertz models, I have allowed for proportional and nonproportional effects of fertility stages, but have allowed for only proportional effects of control variables.

I estimate all models with the program RATE.

RESULTS

An overview of all models is presented, followed by a detailed analysis of selected results. Table 2 describes each model and presents fit statistics for all models and for selected contrasts. Figures 1 and 1a visually display the essential elements of the various models presented, using pregnancy as an example.

Cox models estimate uniform effects of fertility stages, absolutely (Model A) and with controls (Model B). A five-period splined Gompertz model reflects the age-dependence in the dropout rate (Model C). The vector of controls is added (Model D). Models E through J use different assumptions about the time-dependence of the effects of the various fertility stages. Like the Cox models, Model E estimates uniform effects of the fertility stages, relative to the Gompertz baseline. Model F allows a simple interaction with time for each fertility stage, letting the effects of each fertility stage increase or decrease uniformly with age. The remaining models allow for age-specific effects of fertility stages. Model G estimates simple age-specific effects of each fertility stage; each fertility stage has a constant effect at each age. Model H, the most complex, includes an

TABLE 2

Descriptions and Fit Statistics of Models

Model	Description	Log-Likelihood	χ^2 Relative to Null Model	Degrees of Freedom
A	Cox	-10024.5	595.2	4
B	Cox with controls	-9560.8	1522.4	60
C	Five-period Gompertz baseline	-7655.3	780.5	5
D	C + Controls	-7139.1	1812.9	61
E	D + Fertility-stage levels	-6901.8	2287.6	65
F	E + Fertility-stage slopes	-6872.5	2346.1	69
G	E + Age-specific levels	-6868.1	2355.0	81
H	G + Age-specific slopes	-6860.6	2370.0	101
J	Splined effects	-6865.7	2359.8	85

Contrast	Likelihood Ratio χ^2	Degrees of Freedom	P-Value
B vs A	927.3	56	.000
D vs C	1032.4	56	.000
E vs D	474.7	4	.000
F vs E	58.4	4	.000
G vs E	67.4	12	.000
H vs G	15.0	20	.776
J vs F	13.7	16	.621

Figure 1

Figure 1a

interaction with time for each effect at each age, freeing the slopes within each age. Finally, Model J constrains the effects to form smooth curves, similar to the baseline model. Among the Gompertz models, F and G provide a relatively good fit to the data and are preferred above the others.

Model A is a Cox model which shows the gross effects of fertility on dropout rates, where fertility is coded into pregnancy, childbirth, postpartum, and motherhood periods. These proportional effects can be viewed as effects averaged over relevant ages. Table 3 gives the parameter estimates for this model. The antilog of parameter estimates can be interpreted as a "relative risk." In this case, the log of the dropout rate for pregnant women is 2.44 higher than the log of the dropout rate for women not pregnant or in any of the other fertility stages. This translates into a relative risk of 11.4, meaning that pregnant women of every age are 11.4 times as likely to drop out of school as other women of the same age. The apparent effect of childbirth is almost identical at 11.6. Of those who persist in school beyond childbirth, those in the postpartum stage drop out at over five times the rate of others, and mothers beyond the postpartum stage drop out at over three times the rate of non-pregnant non-mothers. Each of these effects is highly significant.

The remaining rows on the left side of Table 3 give the zero-order effects of other variables on the dropout rate. The effect of each set of variables was estimated in a separate model. Many of these additional variables proved to be strong predictors of dropout. Consistent with previous work, higher rates of dropout are associated with being black or Hispanic, not living with both parents, coming from a home where a foreign language was used, having parents with less education or low occupational status, having many siblings, having fewer reading materials in the home, living in the North Central or Southern United States or particularly the West, living in a central city, having lower measured ability, attending a public school, and taking remedial rather than college preparatory courses. Several of the missing data variables were also significant. For some, a substantive interpretation is in order. Women who fail to report their mother’s or their father’s level of education

(text continues on p. 21)

TABLE 3

Cox Model Zero-Order Effects of Each Set of Covariates on High School Dropout, and Effects in Full Model

	Zero-Order Effects			Effects in Full Model		
Variable	Coefficient	Standard Error	Relative Risk	Coefficient	Standard Error	Relative Risk
Pregnant	2.44***	(.09)	11.4	2.16***	(.09)	8.6
Childbirth	2.45***	(.17)	11.6	2.25***	(.18)	9.5
Postpartum	1.70***	(.20)	5.4	1.56***	(.21)	4.8
Motherhood	1.23***	(.14)	3.4	1.19***	(.15)	3.3
Hispanic as defined by NLSY	.44***	(.10)	1.6	-.57***	(.13)	.6
Black as defined by NLSY	.17*	(.07)	1.2	-.98***	(.09)	.4
White as defined by NLSY						
Born in 1957	-.27*	(.11)	.8	-.11	(.12)	.9
Born in 1958	-.12	(.11)	.9	.24*	(.12)	1.3
Born in 1959	-.07	(.11)	.9	.12	(.12)	1.1
Born in 1960	-.03	(.11)	1.0	.26*	(.12)	1.3
Born in 1961	-.07	(.11)	.9	.24*	(.12)	1.3
Born in 1962	.02	(.11)	1.0	.27*	(.12)	1.3
Born in 1963	-.01	(.11)	1.0	.14	(.11)	1.2
Born in 1964						
Lived with both biological parents						
Did not live with both biological parents	.74***	(.06)	2.1	.39***	(.07)	1.5
Parents born in USA						
Foreign-born parents	.11	(.09)	1.1	.06	(.14)	1.1
Born in the USA						
Born outside the USA	.17	(.12)	1.2	.05	(.17)	1.1

(table continues)

TABLE 3 (continued)

Variable	Zero-Order Effects Coefficient	Zero-Order Effects Standard Error	Zero-Order Effects Relative Risk	Effects in Full Model Coefficient	Effects in Full Model Standard Error	Effects in Full Model Relative Risk
Used foreign language in home	.22**	(.07)	1.3	.01	(.12)	1.0
Did not use foreign language in home						
Mother attended some college	-.50***	(.11)	.6	.05	(.12)	1.1
Mother graduated high school						
Mother did not finish high school	.92***	(.06)	2.5	.49***	(.07)	1.6
Father attended some college	-.83***	(.11)	.4	-.37**	(.12)	.7
Father graduated high school						
Father did not finish high school	.54***	(.07)	1.7	.17*	(.07)	1.2
Parent had military occupation	.11	(.23)	1.1	.18	(.25)	1.2
Parent occupation in bottom third of SEI scale	.39***	(.08)	1.5	.21*	(.08)	1.2
Parent occupation in middle third of SEI scale						
Parent occupation in top third of SEI scale	-.59***	(.09)	.6	.06	(.09)	1.1
Parent a farmer	-.35*	(.17)	.7	-.30	(.17)	.7
Adult female in home at 14 worked outside home	.03	(.06)	1.0	.06	(.06)	1.1
Had 2 or fewer sibling						
Had 3 or more siblings	.49***	(.06)	1.6	.19**	(.06)	1.2
At least two: magazine, newspaper, library card						
Fewer than two: magazine, newspaper, library card	.79***	(.06)	2.2	.14*	(.07)	1.1
Northeast residence at 14						
North central residence at 14	.18*	(.09)	1.2	.00	(.09)	1.0
Southern residence at 14	.42***	(.09)	1.5	.14	(.09)	1.1
Western residence at 14	.66***	(.10)	1.9	.52***	(.10)	1.7

(table continues)

TABLE 3 (continued)

Variable	Zero-Order Effects Coefficient	Zero-Order Effects Standard Error	Zero-Order Effects Relative Risk	Effects in Full Model Coefficient	Effects in Full Model Standard Error	Effects in Full Model Relative Risk
SMSA, not central city						
SMSA, central city status undetermined	.08	(.08)	1.1	-.02	(.08)	1.0
SMSA, central city	.33***	(.08)	1.4	.23**	(.09)	1.3
Not in SMSA	.11	(.07)	1.1	-.12	(.08)	.9
AFQT ability test score in top third	-1.12***	(.08)	.3	-.66***	(.09)	.5
AFQT ability test score in middle third						
AFQT ability test score in bottom third	.53***	(.06)	1.7	.23**	(.07)	1.3
In ESL or bilingual education program in HS	-.41	(.23)	.7	-.28	(.24)	.8
Not in ESL or bilingual education program in HS						
ESL or bilingual education program unavailable in HS	.11	(.08)	1.1	.15	(.09)	1.2
Attended a public high school						
Attended a private high school	-.79***	(.15)	.5	-.36*	(.16)	.7
Took remedial course in high school	.90***	(.09)	2.5	.33***	(.09)	1.4
Did not take remedial course in high school						
Remedial courses unavailable in high school	.17	(.15)	1.2	-.05	(.16)	.9
Took college-preparatory curriculum in high school	-1.18***	(.09)	.3	-.59***	(.09)	.6
First smoked or drank before age 15	-.08	(.11)	.9	.22	(.12)	1.2

(table continues)

TABLE 3 (continued)

Variable	Zero-Order Effects Coefficient	Zero-Order Effects Standard Error	Zero-Order Effects Relative Risk	Effects in Full Model Coefficient	Effects in Full Model Standard Error	Effects in Full Model Relative Risk
Missing parents	-.08	(1.07)	.9	-.28	(1.07)	.8
Missing foreign birth of parents	.88***	(.14)	2.4	.15	(.16)	1.2
Missing foreign birth						
Missing foreign language used in home	-.58	(1.50)	.6	-.62	(1.51)	.5
Missing mother's education	.87***	(.11)	2.4	.25*	(.13)	1.3
Missing father's education	.75***	(.08)	2.1	.16	(.10)	1.2
Missing socioeconomic status of parents	.32***	(.07)	1.4	-.04	(.09)	1.0
Missing adult female worked outside home	1.01***	(.15)	2.7	.72***	(.16)	2.1
Missing sibling	.48	(.83)	1.6	-.22	(.83)	.8
Missing reading	.05	(.62)	1.1	-.51	(.63)	.6
Missing region of residence at 14	.58**	(.18)	1.8	.33	(.20)	1.4
Missing SMSA	-.80	(.50)	.5	-.60	(.52)	.5
Missing AFQT ability test score	.00	(.14)	1.0	-.11	(.15)	.9
Missing ESL-bilingual education	.48***	(.06)	1.6	-.07	(.19)	.9
Missing public/private school	-.44	(.66)	.6	-.23	(.68)	.8
Missing remedial coursework	.63***	(.06)	1.9	.43*	(.19)	1.5
Missing high school curriculum	.78***	(.09)	2.2	.61***	(.09)	1.8
Missing problems	-.05	(.23)	1.0	.24	(.24)	1.3

Source: Author's computations based on data from NLSY waves 1979–1988.

*p < .05, **p < .01, ***p < .001.

are more likely to drop out of school. Not reporting educational level could indicate a lesser salience of education in the home, or the absence of that parent.

The right side of Table 3 gives the parameter estimates from Model B, which includes fertility stages and the full vector of controls. With the addition of these controls, no more than one-quarter of the apparent effects (relative risks) of the fertility-stage variables are explained away. The strong association between fertility and dropout is not primarily due to common causes. Less advantaged women are more likely to drop out and are presumably more likely to bear children, but there are unique effects of the fertility stages on dropout.

Figure 2 shows nonparametric estimates of the dropout rate by age[5] (see Wu 1989), along with the parametric model, C. Model C is a five-period splined Gompertz model; the log of the baseline dropout rate is estimated to be a straight line within each of five age segments. The lines are constrained to meet at the intersections of the age segments. Thus, the slope of the line can be different in each age segment, but the function is a continuous curve. The segments were chosen to provide a good fit to the shape of the dropout rate function (without controls). The first interval is from the month of the 14th birthday to the month of the 16th birthday. The second interval includes the next 18 months, to age 17 and one-half. The third interval is just 7 months wide, ending one month after the 18th birthday. The fourth interval extends 20 months, to a quarter of a year before the 20th birthday. The last interval is open to the right. The parametric Gompertz model (C) appears to provide a good fit to the data.

Results from Model G are displayed in Figures 3 and 4. In Figure 3 the effects of each fertility stage are shown as relative risks. The effect of each fertility stage is large early on, then declines with time. Figure 4 shows the effects of the fertility stages as deviations from the baseline dropout rate, on the log scale. Again, this shows the greatest fertility effects for the youngest women and a gradual closing of the gaps, but emphasizes that there is no great decline in the dropout rates

Figure 2 here

Figures 3 and 4 here

for those in the various fertility stages. Rather, the baseline dropout rate rises to meet the dropout rates for pregnant women and mothers. Each effect shown is significant in the first four periods, except for postpartum in the first period. No effect is significant for the oldest women, those in the fifth age group. The childbirth effect, though not significant, was very large and negative at the last age and is not shown.

Figures 5 and 6 display results from Model F. This simpler model shows large effects of fertility stages for the youngest women, and a gradual convergence of dropout rates as age increases, due primarily to increased dropout among women who are neither pregnant nor mothers. The downward slopes for pregnancy, childbirth, and motherhood were significant. The slope for postpartum was negative and similar in magnitude to the others, but failed to reach statistical significance.

CONCLUSIONS

This dynamic view of high school and fertility reveals several important relationships.

1. Pregnant women and mothers are much more likely to drop out of high school than other women at standard high school ages.

2. Becoming a mother and being a mother dramatically increase a young woman’s dropout chances. Though less advantaged young women are more likely to conceive and bear children and to drop out of school, pregnancy, childbirth, and motherhood have dramatic independent effects on dropout rates. High dropout rates for pregnant women and mothers are not explained away by their other characteristics.

3. The effects of fertility are strongest for the youngest women and decline with age.

4. The decline in the effects of fertility on dropout does not mean that older women have lower dropout rates than younger women in the same stage of fertility. Rather, women in the various

Figures 5 and 6 here

fertility stages have high dropout rates at every age while the dropout rate increases for all other women as they age.

5. Pregnant women have higher relative dropout risks than mothers. This does not mean that motherhood is less difficult than pregnancy. Women who are at risk of dropout as mothers are a highly select group who persisted in school through pregnancy and a birth. Mothers in school are the ones who had the determination and social support necessary to stay in school in spite of the challenges of pregnancy and delivery. The pregnancy dropout rate for this group was zero. The motherhood dropout rate for women who left school while pregnant cannot be calculated here, but would almost certainly be higher.

DISCUSSION

The results presented above show the statistical significance of fertility in determining high school dropout. Following are examples of the cumulative effects of monthly dropout rates typical of various groups of women.

Table 4 gives the monthly and annual dropout rates associated with various log dropout rates. A log dropout rate near -6, typical of early high school ages (see Figure 2), produces a modest annual dropout rate of 2.9 percent. A log dropout rate of -5, typical of 17-year-old women, produces a much higher annual dropout rate of 7.8 percent.

The elevated risks of dropout associated with pregnancy, childbirth, and the postpartum period are experienced for a limited time; the elevated risks of dropout associated with motherhood on the other hand can continue for several years. To illustrate the cumulative effects of these elevated risks, I calculate annual dropout rates for three hypothetical women: a 16-year-old who has the omitted value on every variable in the analysis, a woman only different by the fact of a pregnancy discovered near the 16th birthday, and a woman already a mother at the 16th birthday. I use Model

TABLE 4

Comparisons of Selected Log Rates, Monthly Rates, and Annual Rates of High School Dropout

Log Rate	Monthly Rate	Annual Rate
-8	0.0%	0.4%
-7	0.1%	1.1%
-6	0.2%	2.9%
-5	0.7%	7.8%
-4	1.8%	19.9%
-3	5.0%	45.8%
-2	13.5%	82.5%
-1	36.8%	99.6%

Source: Author’s computations based on data from NLSY waves 1979–1988.

G as illustrated in Figure 4 to calculate the dropout rates. The first woman faces a moderately increasing dropout rate which cumulates to 2.4 percent over the year. The second woman faces the increased dropout risk associated with pregnancy for six months, and the elevated risks associated with childbirth, postpartum, and motherhood for two months each. The annual dropout rate becomes 21.8 percent. The woman who was already a mother faces an annual dropout rate of 10.8 percent. The fertility differences are not only statistically large and significant, but are practically important as well.

This research demonstrates that fertility significantly increases high school dropout. It does not address eventual educational attainment, the variable of interest in much previous research. However, Upchurch and McCarthy (1990) found that motherhood depresses graduation rates among dropouts, providing little hope that these women will recover their educational losses. More research is needed on the later educational careers of young mothers, but it appears that early fertility has a lasting negative effect on educational attainment.

Endnotes

[1]This is not the first or major conclusion of their research, but it is logically the first to be dealt with in this paper.

[2]I would prefer to replicate Upchurch and McCarthy's analysis as a baseline, then proceed with improved models. However, after considerable effort, I was unable to replicate their coding of educational histories based on the information in the article (Upchurch and McCarthy 1990) and in Upchurch's dissertation (1988).

[3]Selection of categories is based on an analysis of dropout rates by month starting at conception and extending beyond birth. This analysis is not shown here but is available upon request.

[4]This scheme is based on counting months from actual births. Pregnancies that do not result in a reported birth are ignored.

[5]Further details available upon request.

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