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The Intergenerational Effects of Early Childbearing

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Abstract

Since World War II, the average age at which women experience their first birth has drifted up, but since 1986 there has been a resurgence of births to teenagers. Just as early fertility appears to adversely affect the life chances of the teen mother, it may also have negative effects on her children. We hypothesize that when the children of teen mothers are young adults, they will tend to have lower education, and will be more likely to be economically inactive, to have children when they are teens, and to have children out of wedlock when they are teens. In this paper, we present several models designed to reveal the impact that being born to a teenage mother has on children's chances for success as young adults. Our findings indicate that the children of mothers who first gave birth as teens are adversely affected as young adults.

The Intergenerational Effects of Early Childbearing

INTRODUCTION

Over the post–World War II period, the average age at which women experience their first birth drifted up, in part caused by the increase in the age of first marriage. Consistent with these trends, the number and rate (per 1,000 women) of births to teenage women also decreased. For example, in 1955 the teen birth rate stood at over 90; by 1975 it had fallen to 56, and in the early 1980s it hovered in the low 50s.

However, from 1986 to 1992, the number of teen births in the United States increased from 472,000 births to 517,635, an increase of nearly 50,000 births. After reaching a low of 51 in 1986, birth rates to U.S. teens have increased steadily, standing at 60.7 in 1992. This post–1986 increase is recorded for both young teens (ages 15–17), and older teenagers; for the younger group, the increase from 1986 to 1992 was from 31 to 37.8; for the older group, from 81 to 94.5. Whereas the bulk of teen births—about two-thirds—are to white women, this percentage had been falling until recently. By 1992, although African American women aged 15–19 composed 15.7 percent of this female age cohort, they accounted for 30 percent of the teen births. Indeed, teen births account for nearly one-quarter of all births to African American women.

Substantial shifts have occurred in the pattern of teen births between married and unmarried women. In 1970, 70 percent of the teen births were to married women; by 1992, 71 percent of teen births were out of wedlock. For African Americans, the unmarried teen birth rate stands at about 106 and has been rising since 1970; the rate for unmarried white teens is about 33, increasing about two and a half times since 1970.

The teenage birth rate in the United States is high in comparison with that of other developed, industrialized countries. Canada, for example, has a teenage birth rate less than one-half of that of the

United States, as does the United Kingdom. The teen birth rate in the northern European countries stands at about one-third of that in the United States.

Few social issues have attracted as much attention in the popular press as the high level and rapid increase in the number of births to teenagers—especially those who are not married. The reason for this is not hard to discern. Children born to teen mothers often do not have an even start in life. They are more likely to grow up in a poor and mother-only family, to live in a poor or underclass neighborhood, and to experience high risks to both their health status and potential school achievement. For people in society who value equal opportunity as a social goal, the high rate of births to teens is viewed with great apprehension.

Teen mothers, too, often appear to be harmed by the experience. The probability that these mothers will be receiving welfare benefits within a short period after giving birth is high. Moreover, a smaller percentage of teen mothers finish high school than do their peers who do not give birth as a teen. Teen mothers clearly prejudice economic and, in many cases, marriage opportunities that they might otherwise have had, and they experience a sudden end to their own childhood.

The high level and recent growth in the number of teen births also has implications for public policy. Twenty-seven percent of teenage mothers receive welfare within a year of giving birth. Among recipients of Aid to Families with Dependent Children (AFDC) benefits who are less than 30 years old, three-quarters first gave birth as a teenager, in most cases out of wedlock. About $25 billion is paid annually through AFDC, food stamps, and Medicaid to women who are or were teenage mothers. Each family that began with a birth to a teenager is expected to cost the public an average of about $17,000 in some form of support over the next 20 years (see Center for Population Options 1990).

Although the implications of the unmarried teen birth rate noted above seem consistent with both casual observation and common sense, the birth of a child to a teenager is not necessarily responsible for the observed patterns of poverty, failure to complete high school, and welfare recipiency. The girls who give birth as teens may have these poor outcomes even if they had not had the birth; they might have family backgrounds or personal characteristics that foster low attainments. The experience of a birth to a teenager may be but another manifestation of this poor outlook for future success.

This position has been suggested by a number of researchers (Luker 1991; Nathanson 1991). Moreover, a recent study comparing sisters (hence, controlling for family background) who become mothers at different ages found only negligible differences between teen and nonteen mothers in a wide variety of outcomes (see Geronimous and Korenman 1992). For several reasons, however, the results from this study do not appear robust, and a recent critique (and reanalysis of its model) concludes that "the socio-economic effects of teen motherhood do not disappear, nor, indeed, are they small" (Hoffman, Foster, and Furstenberg 1993).

Just as early fertility appears to adversely affect the life chances of the teen mother, it may also have a negative effect on her children. In this study, we hypothesize that having children while an adolescent interferes with the mother's investments in her own human capital, such as schooling and work experience; giving birth as a teen, in effect, alters the mother's life path in the dimensions of education, marital status, labor supply, and economic well-being. Because of the teen mother's lower human capital and economic well-being and the higher probability that she will be a single parent, we expect her children to grow up with lower family income and less adult supervision. Because of these disadvantages, we hypothesize that, as young adults, the children of teen mothers will tend to have lower education (and income), will be more likely to be economically inactive, will be more likely to have children when they are teens, and will be more likely to have children out of wedlock when they are teens.

Hence, in this paper, we study the question: Do the children of teen mothers experience adverse effects from the teen birth—and the accompanying shift in the life path of their mothers? Can these effects be measured some two decades after the mothers' early fertility?

In the following sections, we present several models designed to reveal the impact that having a teenage mother has on children's chances for success as young adults. In the study, the four measures of children's success are: (1) whether or not a child graduates from high school, (2) whether or not a daughter gives birth as a teen, (3) whether or not a daughter gives birth as an unmarried teen, and (4) whether or not at age 24 a child is economically inactive. In "Simulation Results," we present simulations of the expected increase in high school graduation, decrease in teen births, decrease in nonmarital teen births, and decrease in economic inactivity if the mothers postponed initial childbearing from early to late teen years and on to the early 20s. Finally, we present our estimates of the benefits that would accrue to society (and taxpayers) from the increased education of children of teenage mothers were their mothers to have delayed childbearing until age 20–21 years.

MODELS

To answer the questions about adverse effects, we consider three models that describe the effect on children of having an "early-fertility" mother (one who first gave birth when she was very young [15 or less], quite young [16–17], or an older teen [18–19]).

The first model presumes that initially, prior to giving birth, teen mothers are not very different from other girls. Then, when they become mothers at an early age, motherhood interferes with their human capital formation (in terms of schooling and work experience), marriageability, and general living situation. Their life path then diverges from the trajectory it would have taken if they had delayed childbearing until later in life, especially until their postadolescent years. If this is the case, we would not expect to observe significant *prebirth* differences between girls who are early-fertility mothers and those who are not. Nevertheless, the *postbirth* life paths of the early-fertility mothers are likely to differ from those of later-fertility mothers, and these life path differences are at least in part attributable to early fertility. These differences may then also affect the early mothers' children's lives, and these intergenerational effects would be due to early fertility. Hence, to measure the total effect that having an early-fertility mother has on a particular outcome for children, we estimate a simple equation relating a measure of the outcome for the child to dummy variables (those taking on a value of either zero or one) indicating whether the child was born to an early (very early)–fertility mother.

Model 2 reflects the view that, even in prebirth years, differences exist between early- and later-fertility mothers that are likely to influence the development and attainments of their children. To the extent that such *prebirth* differences are reasonably represented by descriptive characteristics of these mothers, the *total* effect that being born to a teen, or early-fertility, mother has on children's outcomes can be measured by an equation relating some child's outcome measure to a dummy variable indicating whether the child was born to an early-fertility mother but also including variables to control for prebirth differences in the mother's choices and background. The coefficient on the early-fertility mother dummy variables would then reflect this effect, apart from the other prebirth differences between teen and later-fertility women.

A third model suggests not only that the early- and later-fertility mothers might differ in some important *prebirth* ways but that the environments in which the children grow up and reach adolescence also differ in some ways potentially related to the policy regimes in effect. Hence, in addition to controlling for differences in the observed prebirth characteristics between teen and late-fertility mothers, we control for selected differences in the policy regimes confronting their children. Here the coefficients on the early-fertility dummy variables should not change (will be robust) if these policy regimes are truly exogenous (i.e., predetermined outside of the model). However, if children of adolescent mothers are at a disadvantage, the coefficients on these variables may give some insight into whether poor outcomes can be mitigated by public policy.[1]

DATA

The data used for our estimation are based on a sample of 1,705 persons who were 0–6 years old in 1968 and were then surveyed for each of 21 years (through 1988). The data come from the Panel Study of Income Dynamics (PSID) and include background information such as age of the mother when she had her first child. Some retrospective information on when the mother was growing up is available in the PSID; we added data on state welfare generosity and state spending on family planning services, based on where the child lived while growing up.[2]

Individuals who did not respond for two consecutive years were excluded from the sample. Observations with missing data were generally assigned values based on an interpolation of their data for the prior and subsequent year. In a few cases, additional dummy variables indicating missing data were also created. Our sample does not include anyone who was incarcerated or died between 1968 and 1988. Table 1 presents the means and standard deviations for the variables that we use.

ESTIMATES OF THE INTERGENERATIONAL EFFECTS OF EARLY CHILDBEARING

We present estimates of the effects of mother's early childbearing on four outcomes of her children: (1) the probability that the child will graduate from high school, (2) the probability that the female children will have a birth while a teenager, (3) the probability that the female children will have an out-of-wedlock birth while a teenager, and (4) the probability that the child will be economically inactive at age 24. *Economic inactivity* is defined as follows: Youths at age 24 are inactive if they fall into *none* of the following categories: (1) a mother of an infant or of two or more children, one of

TABLE 1

Means and Standard Deviations of Variables Used in Estimation

A. Full-Sample Statistics (N = 1705)

Variable	Mean	Standard Deviation
Mother became a mother at age ≤15	0.06	0.23
Mother became a mother at age 16–17	0.15	0.36
Mother became a mother at age 18–19	0.25	0.43
Mother became a mother at age 20–21	0.22	0.42
Mother lived with both her parents	0.70	0.46
Maternal grandfather had a high school education or more	0.20	0.40
Maternal grandmother had a high school education or more	0.29	0.46
Mom's sentence completion score	8.56	1.20
Missing mom's sentence completion score	0.70	0.46
Mother is African American	0.43	0.49
Mother is Catholic	0.19	0.39
Number of times mother attends religious services each month	1.95	1.29
Mother grew up poor	0.46	0.50
Average public family planning expenditures per capita in states child lived at ages 13–19	1.06	0.36
Firstborn child	0.23	0.42
Female child	0.51	0.50
Child graduated from high school	0.84	0.36
Average adult unemployment rate in neighborhood at child's ages 6–15	7.08	4.08
Real average maximum state welfare benefits at child's age 15–18	$353.95	$78.45

TABLE 1, continued

B. Female-Sample Statistics (N = 873)

Variable	Mean	Standard Deviation
Mother became a mother at age $\leq$15	0.06	0.23
Mother became a mother at age 16–17	0.16	0.36
Mother became a mother at age 18–19	0.23	0.42
Mother became a mother at age 20–21	0.23	0.42
Mother lived with both her parents	0.70	0.46
Maternal grandfather had a high school education or more	0.19	0.40
Maternal grandmother had a high school education or more	0.29	0.45
Mom's sentence completion score	8.52	1.20
Missing mom's sentence completion score	0.71	0.46
Mother is African American	0.45	0.50
Mother is Catholic	0.18	0.39
Number of times mother attends religious services each month	1.97	1.27
Mother grew up poor	0.48	0.50
Average public family planning expenditures per capita in states child lived at ages 13–19	1.07	0.36
Firstborn child	0.21	0.41
Female child	1.00	0.00
Child graduated from high school	0.86	0.35
Average adult unemployment rate in neighborhood at child's ages 6–15	7.14	4.10
Real average maximum state welfare benefits at child's ages 15–18	$354.07	$77.15
Child had a birth at age <20	0.24	0.43
Child had a birth at age <19	0.19	0.39
Child had a birth at age <18	0.13	0.33
Child had out-of-wedlock birth at age <20	0.18	0.38
Child had out-of-wedlock birth at age <19	0.14	0.35
Child had out-of-wedlock birth at age <18	0.10	0.30

TABLE 1, continued

C. Sample Age ≥ 24 in 1988 Statistics (N = 765)

Variable	Mean	Standard Deviation
Mother became a mother at age ≤ 15	0.06	0.24
Mother became a mother at age 16–17	0.14	0.35
Mother became a mother at age 18–19	0.24	0.43
Mother became a mother at age 20–21	0.23	0.42
Mother lived with both her parents	0.71	0.45
Maternal grandfather had a high school education or more	0.19	0.39
Maternal grandmother had a high school education or more	0.28	0.45
Mom's sentence completion score	8.54	1.22
Missing mom's sentence completion score	0.67	0.47
Mother is African American	0.43	0.49
Mother is Catholic	0.19	0.40
Number of times mother attends religious services each month	1.94	1.23
Mother grew up poor	0.47	0.50
Average public family planning expenditures per capita in states child lived at ages 13–19	1.14	0.39
Firstborn child	0.21	0.40
Female child	0.54	0.50
Child graduated from high school	0.86	0.35
Average adult unemployment rate in neighborhood at child's ages 6–15	6.64	3.72
Real average maximum state welfare benefits at child's ages 15–18	$371.59	$83.11
Child economically inactive at age 24	0.24	0.43

whom is less than six years old; (2) working 1,000 or more hours per year; (3) a full-time student; (4) a part-time student and working at least 500 hours per year; or (5) a part-time student and a mother with one child less than six years old. Because each of the outcomes is a limited dependent variable taking on the values of zero and one, we fit the models using maximum likelihood probit estimation.

As indicated above, we provide estimates from three specifications, each reflecting a particular view of the *prebirth* characteristics of mothers and the policy environment in which the children grew up. Rather than setting an arbitrary definition of early fertility, we use a set of dummy variables to capture alternative definitions. Thus, in each specification, four dummy variables describing ages of childbearing of 21 years or less are included in the specification. These categories include:

- Childbearing at age ≤ 15
- Childbearing at ages 16 and 17
- Childbearing at ages 18 and 19
- Childbearing at ages 20 and 21

The omitted category is childbearing at age 22 or older. Delineation of these early childbearing categories allows us to explore impacts of early fertility and to simulate the effects that varying magnitudes of delay in fertility will have on children's outcomes.

The first specification presumes that early- and late-fertility mothers are similar in their family background and the policy environments that influence their childbearing decisions. Hence, in addition to the variables describing the mother's early childbearing experience, only dummy variables for the gender of the child and whether or not the child is firstborn are included.

The second specification tests the hypothesis that early- and later-fertility mothers have different observed preadolescent characteristics that might influence their children's attainments and be correlated with (or causal to) their choice of when to first give birth. Because we wish to estimate the total, direct, and indirect effects of adolescent motherhood on the children's eventual outcomes, we omit any variables for the period while the child was growing up that might have been affected by the mother's life path. In addition to the early childbearing dummy variables and the variables describing gender and whether or not the child is firstborn, this specification includes:

- A dummy variable indicating whether the mother lived with both her parents when she was growing up
- A dummy variable indicating whether the mother's father ("grandfather") had a high school education or more
- A dummy variable indicating whether the mother's mother ("grandmother") had a high school education or more
- The mother's score on a sentence completion test (and a dummy variable indicating whether the mother's score is missing)
- A dummy variable indicating whether the mother is an African American
- A dummy variable indicating whether the mother is a Catholic
- The number of times the mother attended religious services each month (based on earliest response available between 1968 and 1972)
- A dummy variable indicating whether the mother grew up in a poor family

The third specification also tests the hypothesis that early- and later-fertility mothers have different observed preadolescent characteristics but, to the second specification, adds variables that reflect the policy environment influencing children's choices in their adolescent years. In addition to the variables included in the second specification, this model includes:

- Average adult unemployment rate in the neighborhood in which the child lived during ages 6–15
- Average real maximum state welfare benefits in the state where the daughter lived during ages 15–18[*]
- Average real public per capita family planning expenditures in the state where the daughter lived during ages 13–19[*]

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[*]Variable included only in specifications for the teen childbearing and teen out-of-wedlock childbearing outcomes.

Tables 2–5 present our results on the intergenerational effects of early childbearing. Table 2 shows our estimates of the effects of early motherhood on the probability that her child will graduate from high school. Table 3 gives results for the probability that her daughter will be a teen mother. Table 4 shows our results for the probability that her daughter will be an unmarried teen mother. And Table 5 offers results for the probability that her child will be economically inactive at age 24. Three columns of estimates are presented, one for each specification: all education specifications are estimated over the full sample of 1,705 mother-child pairs;[3] all those for teen adolescent motherhood are estimated over the daughters in the sample of 873 mother-daughter pairs; all those for economic inactivity are estimated over the subsample of 765 mother-child pairs for which the child has reached age 24 by 1988.

The first column of each table gives estimates for our first model, where we assume that no important differences exist in the mothers' prebirth backgrounds that would affect their children's outcomes. The second column of each group includes controls for the mother's prebirth characteristics that we do observe and believe could also directly affect the child's outcome. The third column adds policy variables to the second specification.

Consider Table 2. Our estimates for the first, simple model are in the first column. The coefficients on all of the childbearing dummy variables representing motherhood at age ≤ 19 are negative and statistically significant at the 1 percent level.[4] The table also shows the calculated slope (the approximate effect based on an evaluation using sample means and derived from the coefficients), indicating the effect on the dependent variable if the dummy variable were set to one rather than zero, all other things being equal.[5]

As the additional, prebirth characteristics of the mother and the policy environment when the child was growing up are added in columns 2 and 3, the magnitude of the negative-signed probit coefficients on the early-fertility variables shrinks, as does the significance level. However, in all

TABLE 2
Effects of Early Childbearing on Probability that Child Graduated from High School (N = 1,705)

	Coefficient (Std. Error) [Slope]	Coefficient (Std. Error) [Slope]	Coefficient (Std. Error) [Slope]
Mother became a mother at age ≤15	-0.526 (0.154)*** [-0.123]	-0.392 (0.166)** [-0.085]	-0.391 (0.166)** [-0.084]
Mother became a mother at age 16–17	-0.384 (0.113)*** [-0.090]	-0.244 (0.121)** [-0.053]	-0.225 (0.122)* [-0.048]
Mother became a mother at age 18–19	-0.273 (0.101)*** [-0.064]	-0.206 (0.107)* [-0.044]	-0.219 (0.107)** [-0.047]
Mother became a mother at age 20–21	-0.060 (0.109) [-0.014]	0.002 (0.116) [0.000]	-0.006 (0.116) [-0.001]
Female child	0.133 (0.075)* [0.031]	0.135 (0.077)* [0.029]	0.135 (0.078)* [0.029]
Firstborn child	0.364 (0.099)*** [0.085]	0.294 (0.103)*** [0.063]	0.296 (0.104)*** [0.063]
Mother lived with both her parents		0.277 (0.083)*** [0.060]	0.260 (0.083)*** [0.055]
Maternal grandfather had a high school education or more		0.144 (0.123) [0.031]	0.104 (0.123) [0.022]
Maternal grandmother had a high school education or more		0.411 (0.108)*** [0.089]	0.401 (0.108)*** [0.086]
Mom’s sentence completion score		0.104 (0.029)*** [0.022]	0.105 (0.029)*** [0.022]

(table continues)

TABLE 2, continued

	Coefficient (Std. Error) [Slope]	Coefficient (Std. Error) [Slope]	Coefficient (Std. Error) [Slope]
Missing mom's sentence completion score		0.462 (0.086)*** [0.099]	0.431 (0.087)*** [0.092]
Mother is African American		0.337 (0.094)*** [0.073]	0.437 (0.099)*** [0.093]
Mother is Catholic		0.302 (0.116)*** [0.065]	0.287 (0.117)*** [0.061]
Number of times mother attends religious services each month		0.033 (0.030) [0.007]	0.033 (0.030) [0.007]
Mother grew up poor		-0.109 (0.082) [-0.024]	-0.140 (0.083)* [-0.030]
Average adult unemployment rate in neighborhood at child's ages 6–15			-0.034 (0.010)*** [-0.007]
Constant	1.057 (0.083)***	-0.687 (0.300)**	-0.425 (0.310)
Log likelihood	-720.65	-670.35	-664.56
Chi-square	41.952	142.56	154.13
Percentage of zeros correctly predicted	0.0	3.7	4.1
Percentage of ones correctly predicted	100	99.4	99.4

* = .10; ** = .05; *** = .01.

TABLE 3
Probability that Child Had a Birth at Age <19: Female Sample (N = 873)

	Coefficient (Std. Error) [Slope]	Coefficient (Std. Error) [Slope]	Coefficient (Std. Error) [Slope]
Mother became a mother at age ≤15	0.707 (0.209)*** [0.188]	0.437 (0.222)** [0.109]	0.421 (0.224)* [0.105]
Mother became a mother at age 16–17	0.594 (0.150)*** [0.158]	0.373 (0.159)** [0.094]	0.341 (0.161)** [0.085]
Mother became a mother at age 18–19	0.415 (0.139)*** [0.110]	0.291 (0.146)** [0.073]	0.270 (0.147)* [0.067]
Mother became a mother at age 20–21	0.223 (0.143) [0.059]	0.140 (0.150) [0.035]	0.140 (0.150) [0.035]
Firstborn child	-0.083 (0.126) [-0.022]	0.032 (0.131) [0.008]	0.033 (0.131) [0.008]
Mother lived with both her parents		-0.127 (0.112) [-0.032]	-0.104 (0.114) [-0.026]
Maternal grandfather had a high school education or more		-0.325 (0.165)** [-0.082]	-0.305 (0.169)* [-0.076]
Maternal grandmother had a high school education or more		-0.051 (0.133) [-0.013]	-0.036 (0.134) [-0.009]
Mom’s sentence completion score		-0.080 (0.039)** [-0.020]	-0.079 (0.039)** [-0.020]
Missing mom’s sentence completion score		-0.340 (0.114)*** [-0.085]	-0.329 (0.115)*** [-0.082]

(table continues)

TABLE 3, continued

	Coefficient (Std. Error) [Slope]	Coefficient (Std. Error) [Slope]	Coefficient (Std. Error) [Slope]
Mother is African American		0.181 (0.121) [0.045]	0.147 (0.134) [0.037]
Mother is Catholic		-0.327 (0.166)** [-0.082]	-0.279 (0.171) [-0.070]
Number of times mother attends religious services each month		-0.062 (0.041) [-0.015]	-0.064 (0.041) [-0.016]
Mother grew up poor		0.091 (0.107) [0.023]	0.106 (0.109) [0.026]
Average public family planning expenditures per capita in states child lived at ages 13–19			-0.195 (0.153) [-0.049]
Average adult unemployment rate in neighborhood at child's ages 6–15			0.023 (0.014) [0.006]
Real average maximum state welfare benefits at child's ages 15–18			-0.001 (0.001) [0.000]
Constant	-1.167 (0.101)***	-0.009 (0.400)	0.259 (0.518)
Log likelihood	-412.67	-387.24	-384.43
Chi-square	23.974	74.852	80.471
Percentage of zeros correctly predicted	100	98.6	98.6
Percentage of ones correctly predicted	0.0	4.2	6.0

* = .10; ** = .05; *** = .01.

TABLE 4
Probability that Child Had an Out-of-Wedlock Birth at Age <19: Female Sample (N = 873)

	Coefficient (Std. Error) [Slope]	Coefficient (Std. Error) [Slope]	Coefficient (Std. Error) [Slope]
Mother became a mother at age ≤15	0.716 (0.221)*** [0.155]	0.391 (0.237)* [0.075]	0.381 (0.239) [0.072]
Mother became a mother at age 16–17	0.568 (0.163)*** [0.123]	0.308 (0.176)* [0.059]	0.252 (0.180) [0.047]
Mother became a mother at age 18–19	0.437 (0.151)*** [0.095]	0.273 (0.162)* [0.052]	0.232 (0.165) [0.043]
Mother became a mother at age 20–21	0.263 (0.156)* [0.057]	0.179 (0.168) [0.034]	0.177 (0.169) [0.033]
Firstborn child	-0.284 (0.145)* [-0.062]	-0.186 (0.154) [-0.036]	-0.182 (0.154) [-0.034]
Mother lived with both her parents		-0.161 (0.122) [-0.031]	-0.120 (0.124) [-0.022]
Maternal grandfather had a high school education or more		-0.174 (0.180) [-0.033]	-0.152 (0.185) [-0.029]
Maternal grandmother had a high school education or more		0.034 (0.146) [0.006]	0.062 (0.148) [0.012]
Mom’s sentence completion score		-0.128 (0.042)*** [-0.025]	-0.129 (0.043)*** [-0.024]
Missing mom’s sentence completion score		-0.257 (0.124)** [-0.049]	-0.239 (0.127)* [-0.045]

(table continues)

TABLE 4, continued

	Coefficient (Std. Error) [Slope]	Coefficient (Std. Error) [Slope]	Coefficient (Std. Error) [Slope]
Mother is African American		0.501 (0.136)*** [0.096]	0.475 (0.153)*** [0.089]
Mother is Catholic		-0.242 (0.191) [-0.046]	-0.170 (0.197) [-0.032]
Number of times mother attends religious services each month		-0.103 (0.046)** [-0.020]	-0.109 (0.047)** [-0.020]
Mother grew up poor		0.001 (0.119) [0.000]	0.018 (0.121) [0.003]
Average public family planning expenditures per capita in states child lived at ages 13–19			-0.394 (0.174)** [-0.074]
Average adult unemployment rate in neighborhood at child's ages 6–15			0.031 (0.015)** [0.006]
Real average maximum state welfare benefits at child's ages 15–18			-0.001 (0.001) [0.000]
Constant	-1.338 (0.112)***	0.086 (0.430)	0.695 (0.575)
Log likelihood	-346.54	-313.87	-307.4
Chi-square	24.002	89.343	102.28
Percentage of zeros correctly predicted	100	99.3	98.8
Percentage of ones correctly predicted	0.0	4.8	8.8

* = .10; ** = .05; *** = .01.

TABLE 5
Probability of Child Being Economically Inactive at Age 24 (N = 765)

	Coefficient (Std. Error) [Slope]	Coefficient (Std. Error) [Slope]	Coefficient (Std. Error) [Slope]
Mother became a mother at age ≤15	0.581 (0.213)*** [0.179]	0.362 (0.226) [0.109]	0.360 (0.226) [0.109]
Mother became a mother at age 16–17	0.327 (0.158)** [0.101]	0.190 (0.166) [0.058]	0.187 (0.166) [0.056]
Mother became a mother at age 18–19	0.376 (0.134)*** [0.116]	0.276 (0.140)** [0.083]	0.275 (0.140)** [0.083]
Mother became a mother at age 20–21	0.038 (0.144) [0.012]	0.016 (0.148) [0.005]	0.016 (0.148) [0.005]
Female child	0.308 (0.102)*** [0.095]	0.302 (0.104)*** [0.092]	0.302 (0.104)*** [0.092]
Firstborn child	-0.259 (0.133)* [-0.080]	-0.209 (0.136) [-0.063]	-0.199 (0.137) [-0.060]
Mother lived with both her parents		-0.118 (0.114) [-0.036]	-0.106 (0.115) [-0.032]
Maternal grandfather had a high school education or more		0.101 (0.155) [0.031]	0.109 (0.155) [0.033]
Maternal grandmother had a high school education or more		-0.234 (0.138)* [-0.071]	-0.229 (0.138)* [-0.069]
Mom’s sentence completion score		-0.089 (0.041)** [-0.027]	-0.088 (0.041)** [-0.027]

(table continues)

TABLE 5, continued

	Coefficient (Std. Error) [Slope]	Coefficient (Std. Error) [Slope]	Coefficient (Std. Error) [Slope]
Missing mom's sentence completion score		-0.061 (0.115) [-0.019]	-0.052 (0.116) [-0.016]
Mother is African American		0.198 (0.127) [0.060]	0.165 (0.133) [0.050]
Mother is Catholic		-0.252 (0.152)* [-0.076]	-0.250 (0.152) [-0.076]
Number of times mother attends religious services each month		0.053 (0.042) [0.016]	0.052 (0.042) [0.016]
Mother grew up poor		-0.057 (0.108) [-0.017]	-0.043 (0.110) [-0.013]
Average adult unemployment rate in neighborhood at child's ages 6–15			0.013 (0.015) [0.004]
Constant	-1.015 (0.114)***	-0.160 (0.407)	-0.264 (0.426)
Log likelihood	-409.36	-397.49	-397.15
Chi-square	29.917	53.663	54.34
Percentage of zeros correctly predicted	100	98.6	98.4
Percentage of ones correctly predicted	0.0	4.8	7.0

* = .10; ** = .05; *** = .01.

cases, the coefficients on the dummies for childbearing prior to age 20 are statistically significant at the .1 level. In both of these models, the set of early childbearing variables passes the log likelihood ratio test, again rejecting the null hypothesis that age of motherhood does not matter.

Being a female child and being firstborn each increase the probability of graduating from high school, and these variables are statistically significant in all models. The firstborn variable also indicates that this is the child born to the teen mother (if the mother gave birth as a teen). The positive coefficient suggests that being born to an early-fertility mother while she was a teen has no additional negative impacts beyond those experienced by all of her children.

The control variables indicating the mother’s prebirth characteristics are generally signed as expected and are often significant. If the mother (1) lived with both of her parents, (2) had a mother (the child’s grandmother) who graduated from high school, (3) is African American, or (4) is Catholic, the probability that the child is expected to graduate from high school increases and is statistically significant in each case. Although the education of the mother’s father (grandfather), the economic status of her family while she was growing up, and the frequency of her attendance at religious services have the expected sign, none of these variables is uniformly statistically significant. The higher the mother’s sentence completion score, the higher the probability that the child will graduate from high school, and this effect is significant. The policy variable—the unemployment rate in the neighborhood in which the child lives—has a distinctly negative effect on the probability that the child will graduate from high school, and it too is statistically significant.[6]

Table 3 presents our estimates of the effect of early fertility on the probability that a child will give birth as a teenager. The estimates we present define a teenager as less than 19 years old. (We also ran specifications defining a teen as less than 18 and less than 20; see below). These models were fit over the daughters in the sample; hence, the sample size is reduced from 1,705 to 873.

In the simple model in column 1, all of the early-fertility dummy variables indicating a birth prior to age 19 are statistically significant. The positive sign on these variables indicates that early childbearing by the mother increases the probability that her daughter will give birth as a teen. The test statistic for a log likelihood ratio test of the significance of the full set of the early childbearing variables exceeds the critical value at the .01 level, leading to rejection of the null hypothesis that early fertility of the mother has no effect on the outcome of the child.[7]

Again, as the additional, prebirth characteristics of the mother and the policy environment when the child was growing up are added in columns 2 and 3, the magnitudes of the probit coefficients on the early-fertility variables fall, as does the significance level. However, in all cases, the coefficients on the dummies for childbearing prior to age 20 are statistically significant at the .1 level.[8]

The estimated coefficient on being a firstborn child is not statistically significant. This again suggests that the impact of being born to an early-fertility mother is essentially the same for the first child and for the additional children. The control variables indicating the mother's prebirth characteristics are again signed as expected, though fewer of them are statistically significant than in the estimates in Table 2. The mother's test score and the grandfather's education are negatively related to the probability that the daughter will give birth as a teenager, and in each case the coefficient is statistically significant. Here, as opposed to the results in Table 2, the education of the grandmother and whether or not the mother's family was poor do not have a statistically significant effect on the outcome, although in both cases the signs are as expected. In this case, unlike the results for teen out-of-wedlock childbearing discussed below, none of the policy variables has a statistically significant effect on the probability that the daughter will give birth as a teenager.[9]

Table 4 presents our estimates of the effect of early fertility on the probability that a child will give birth out of wedlock as a teenager. Again the estimates we present define a teenager as under age

19. (We also ran specifications defining a teen as less than 18 and less than 20; see below.) These models were again fit over only the daughters in the sample, yielding a sample size of 873.

In the simple model in column 1, all of the early-fertility dummy variables indicating the mother gave birth prior to age 19 are statistically significant. The positive sign on these variables indicates that early childbearing by the mother increases the probability that her daughter will give birth out of wedlock as a teen.[10]

Again, adding the additional prebirth characteristics of the mother and her environment while growing up reduces the magnitude of the probit coefficients on the early childbearing dummy variables; in model 2, these individual variables are statistically significant at the .1 level.[11]

Being a firstborn child decreases the probability that the daughter will give birth out of wedlock as a teenager, but this variable has a statistically significant coefficient only in the simplest model of column 1. This again suggests that the impact of being born to an early-fertility mother is essentially the same for the first child and for the additional children. The control variables indicating the mother's prebirth characteristics are again signed as expected, though fewer of them are statistically significant than in the estimates in Table 2. If the mother is African American, the probability that her daughter will give birth out of wedlock as a teenager increases, and the coefficient is statistically significant in each of the specifications. The slope (or effect) values indicate that the probability of this outcome increases by 9–10 percentage points if the mother is African American. The mother's test score and the regularity of her attendance at religious services are both negatively related to the probability that the daughter will give birth out of wedlock as a teenager, and in each case the coefficient is statistically significant. Here, as opposed to the results in Table 2, the education of the mother's parents and whether or not her family was poor do not have a statistically significant effect on the outcome, although in both cases the signs are as expected.

Two of the policy variables—the unemployment rate in the neighborhood in which the child lives and the per capita level of family planning expenditures in the state in which the child lives—have statistically significant effects on the probability that the daughter will give birth out of wedlock as a teenager. An increase in the unemployment rate tends to increase the probability of a teen nonmarital birth, whereas increases in state family planning expenditures tend to reduce the probability. The generosity of state welfare spending appears to have no statistically significant effect on this outcome.

Table 5 presents our estimates of the effect of early fertility on the probability that a child will be economically inactive at age 24. These models were fit over only the children in the sample who were age 24 or older in 1988; hence, the sample size is reduced from 1,705 to 765.

As in Tables 2–4, in the simple model in column 1, all of the early-fertility dummy variables indicating a birth prior to age 19 are statistically significant. The positive sign on these variables indicates that early childbearing by the mother increases the probability that her child will be economically inactive as a young adult.[12] Being firstborn decreases the probability that the child will be economically inactive as a young adult, but this variable has a statistically significant coefficient only in the simplest model of column 1. This again suggests that the impact of being born to an early-fertility mother is essentially the same for the first child and for the additional children.

Again, adding the additional prebirth characteristics of the mother and her environment while growing up reduces the magnitude of the probit coefficients on the early childbearing dummy variables; in model 2, only one of these individual variables is statistically significant.[13]

Most of the control variables indicating the mother's prebirth characteristics are again signed as expected, though only three are statistically significant. The mother's test score and education are both negatively related to the probability that the child will be economically inactive as a young adult, and in each case the coefficient is statistically significant.

SIMULATION RESULTS

In Tables 6–9, we report the predicted effects of delays in childbearing by mothers who gave birth at age ≤21. Table 6 displays the simulated effects on the probability that the child will graduate from high school. Table 7 shows the effects of delay on the probability that the daughter will give birth as a teenager. Table 8 reports the effects of delay on the probability that the daughter will give birth as an out-of-wedlock teenager. Finally, Table 9 shows the effects of delay on the probability the child will be economically inactive at age 24. For these simulations, we grouped the children based on when their mothers first gave birth. We held constant all of the observed characteristics of the mothers who gave birth in each of the age categories, except for the dummy variables indicating when the mother first gave birth. We then used the previously estimated coefficients to obtain the predicted probability of each outcome (e.g., high school graduation) for each child under alternative sets of childbearing dummies and took the weighted average of the newly predicted probabilities for each group. Model 3 is the basis for the simulations.[14]

The effects of delays of different lengths in childbearing are shown in the tables. For example, in the top row of Table 6, we show that the probability of graduating from high school for a child born to a mother who gave birth at age ≤15 is about 71 percent. If her mother had delayed childbearing until age 16–17, the probability would rise to 76 percent, an increase of 5 percentage points. Similarly, if her mother had delayed childbearing until age 18–19, the probability that the child would graduate from high school would rise to 76.2 percent. Delay until age 20–21 or after age 22 would result in an increase in the probability to 82 percent.[15]

In Table 7, we report the effects of delays in childbearing on the daughters' probability of adolescent childbearing. Here we estimate that if the mothers with the earliest fertility delayed their childbearing until they were age 22 or older, the probability of their daughters having an adolescent

TABLE 6

Weighted Simulations of Impact Delaying Childbearing Has on High School Graduation of the Children: Full Sample

For Children of Mothers First Giving Birth While:	Number of Observations in Group	Estimated Probability for the Child if the Mother Delayed Her First Birth Until				
		Original	16–17	18–19	20–21	≥22
Age ≤15	98	.710	.760	.762	.819	.820
Age 16–17	262	.785		.786	.839	.840
Age 18–19	427	.832			.877	.878
Age 20–21	380	.885				.886

TABLE 7

Weighted Simulations of Impact Delaying Child Bearing Has on Adolescent Childbearing: Female Sample Female Sample

Age of Daughter at Childbearing	Age at Which Mother First Gave Birth	Number of Observations in Original Group	Estimated Probability for the Child if the Mother Delayed Her First Birth Until: Original	16–17	18–19	20–21	>22
<19	≤15	50	.279	.255	.234	.200	.166
	16–17	137	.248		.227	.193	.159
	18–19	203	.168			.139	.112
	20–21	203	.141				.113
<20	≤15	50	.358	.291	.305	.255	.222
	16–17	137	.286		.300	.250	.217
	18–19	203	.229			.185	.157
	20–21	203	.189				.161
<18	≤15	50	.185	.169	.143	.142	.129
	16–17	137	.158		.133	.132	.119
	18–19	203	.089			.089	.079
	20–21	203	.090				.080

TABLE 8

Weighted Simulations of Impact Delaying Childbearing Has on Adolescent Out-of-Wedlock Childbearing: Female Sample

Age of Daughter at Childbearing	Age at Which Mother First Gave Birth	Number of Observations in Original Group	Estimated Probability for the Child if the Mother Delayed Her First Birth Until				
			Original	16–17	18–19	20–21	>22
<19	≤15	50	.205	.175	.171	.160	.126
	16–17	137	.164		.159	.148	.116
	18–19	203	.104			.095	.071
	20–21	203	.095				.071
<20	≤15	50	.234	.200	.205	.189	.164
	16–17	137	.193		.197	.181	.156
	18–19	203	.130			.117	.098
	20–21	203	.116				.097
<18	≤15	50	.142	.116	.116	.128	.102
	16–17	137	.098		.098	.110	.085
	18–19	203	.060			.068	.051
	20–21	203	.070				.053

TABLE 9

Weighted Simulations of Impact Delaying Childbearing Has on Economic Inactivity at Age 24 or Older (N = 513)

Age at Which Mother First Gave Birth	Number of Observations in Original Group	Estimated Probability for the Child if the Mother Delayed Her First Birth Until: Original	16–17	18–19	20–21	>22
≤15	45	.376	.314	.345	.258	.253
16–17	108	.262		.290	.212	.207
18–19	187	.242			.171	.167
20–21	173	.171				.167

birth would drop by over 11 percentage points. The other entries in the table can be interpreted similarly. We also present estimates using two alternative definitions of teen birth: under age 18 and under age 20. These results show similar patterns to that for age <19.

In Table 8, we show the effects of delays in childbearing on the daughters' probability of adolescent out-of-wedlock childbearing. Here we estimate that if the mothers with the earliest fertility delayed their childbearing until they were age ≥22, the probability of their daughters having an adolescent out-of-wedlock birth would drop by 7.9 percentage points. The other entries in the table can be interpreted similarly. Again, when we use the two alternative definitions of teen out-of-wedlock birth, the results show patterns similar to that for age ≤19, although the magnitudes of the changes are somewhat smaller.

In Table 9, we report the effects of delays in childbearing on the probability of the child being economically inactive at age 24. The estimates show that if the mothers with the earliest fertility delayed childbearing until age ≥22, the probability of their children being economically inactive would drop by about 12.3 percentage points. In this table, uncertainty as to the relative magnitude of the effects of early fertility while ages 16–17 leads to a strange result. A one- to two-year delay in childbearing by mothers who had their first child while ages 16–17 appears to increase the probability of their children being economically inactive. This suggests that the most reliable estimates in this table are probably those based on the statistically significant estimated coefficient for the children of mothers who first became mothers at ages 18–19. For this group, delayed childbearing by the mothers is estimated to decrease the probability of the child being economically inactive by about 7.5 percentage points.

The simulated results for both African Americans and non–African Americans were also estimated based on equation estimations on these subsamples but are not shown in the paper. Most of the coefficients relevant for simulating these results are not statistically significant for African Americans, which may be attributable to small sample sizes in many of the age-at-first-birth categories.

ESTIMATES OF THE BENEFITS OF DELAYING BIRTHS

The simulation results presented above indicate that in a variety of dimensions—schooling attainments, early fertility, early nonmarital fertility, and economic activity—being the child of a mother who gave birth as a teenager has adverse effects. In all of these dimensions, children's attainments would have been greater if their mothers had delayed giving birth until reaching, say, age 20–21 or older. Viewed alternatively, when a mother gives birth before that age, our evidence suggests that the child—and hence society—bears a cost that could be avoided if the mother's childbearing had been delayed.

So far, our estimates of these "costs" of mother's early childbearing (or, conversely, the benefits of delayed childbearing) have been stated in terms of the child's schooling, early childbearing, early nonmarital childbearing among daughters, and changes in economic activity when a young adult. For policy purposes, it would be helpful if the burden implied by these negative effects of early childbearing (or benefits of delays in childbearing), on either the children or the society, could be stated in dollar terms. If this were done, policymakers could compare the reductions in costs (increases in benefits) in these dimensions with the costs of policies that might be able to secure a reduction in the incidence of early childbearing.

Unfortunately, placing dollar values on these intergenerational attainment effects is very problematic. Stipulating the dollar value of the benefits to society of reducing the prevalence of economic inactivity or early childbearing in the next generation must of necessity be based on numerous assumptions, few of which are verifiable. This problem is no less difficult than that faced by researchers who are asked to tell policymakers the cost of, say, an anticipated increase in the probability of a disaster, such as long-run global warming or a nuclear meltdown in some Chicago-area facility in the year 2010.

Moreover, serious ethical considerations are involved in making such estimates. Because many of the benefits that might be obtained from finding a way to reduce the incidence of early childbearing accrue to people who have not yet been born, the researcher has the impossible task of imputing to them values that they might not have. One of these difficulties is that of translating into today's values benefits or costs that occur far into the future. Because subsequent generations might value the passage of time quite differently than do people living today, one is left with a difficult and ultimately unresolvable dilemma.

Yet without some discussion of these benefits and costs in dollar terms, a realistic sense of the magnitude of the issues with which we are concerned may be difficult to obtain. Hence, we present tentative estimates of the benefits (in dollars), to both society and taxpayers, of a particular policy scenario: the delay until age 20–21 of all births in a year to women who are less than 20–21 years old when they give birth. These benefit estimates can equally well be thought of as the costs to society and taxpayers of the present and observed annual incidence of childbearing that occurs before the mother is age 20–21.

Although it would be helpful to have dollar estimates of benefits and costs for all of the outcomes we have estimated—schooling attainment, early childbearing, early nonmarital childbearing, and economic inactivity—we judge that responsible estimates are feasible for only the education outcome.[16] For early or nonmarital childbearing or economic inactivity of the next generation of young adults, the high potential for erroneous and misleading cost or benefit values of reductions in incidence precludes arriving at meaningful dollar estimates of these changes (see endnote 16 for a rough calculation of the costs of early childbearing. These however, involve double counting with the estimate presented below). We therefore present estimates of the dollar benefits society and taxpayers would accrue from the increased productivity if the births of children who are born to early-fertility mothers were delayed until the mother was at least 20–21 years of age. The gain in economic productivity is measured as the increase in earnings of these children, attributable to the increase in their schooling levels that we predict will occur from the delay in mothers' childbearing until ages 20–21.

To obtain these benefits (or, alternatively, the cost estimates associated with early childbearing), we first fit a tobit model similar to model 3, described earlier in this paper. Although the estimates above focused on the likelihood of high school graduation, here we use years of education as the dependent variable.[17]

Using this estimated equation and holding the other variables constant, we simulate the number of years of schooling each of the children born to an early-fertility mother might have completed had the mother delayed giving birth until age 20–21. We then multiply these predicted increases in schooling levels by the number of children born each year to mothers who would belong to each of the early-fertility age groups.[18] Summing across the birth-age groups, we obtain an estimate of the total increase in the years of education that would be experienced for children born to early-fertility mothers had their birth been delayed.

The next step is to transform the resulting estimate of the increase in years of schooling for each of the children into an estimate of the increased lifetime productivity or earnings of each child attributable to the simulated delay in their mothers' childbearing until ages 20–21. To accomplish this, we multiply the estimated change in years of education for each child by a projection of the increase in the present value of the child's lifetime earnings attributable to an incremental year of education.[19] The resulting dollar estimates are then converted to 1994 values.

These dollar estimates are shown in the first row of Table 10, for discount rates of 3 and 5 percent. Because the change in childbearing behavior that we are analyzing is the delay of birth by the mother, the increment in earnings streams is discounted to that point in time. We designate this point in time as children's age 0. Using a discount rate of 3 percent, we calculate the benefits of delaying childbearing to the mother's age 20–21 for all children born to younger mothers to be just under $5 billion; a similar calculation using a 5 percent discount rate yields an estimate of slightly more than $2 billion.[20]

An alternative calculation would answer the question of the benefits to taxpayers from the increased tax revenue attributable to the increased earnings from the delayed birth. Following the procedures for this calculation used by other authors in this project, we estimate the present value of the additional taxes likely to be paid to the government as 23 percent of the estimated increase in the present value of earnings. The resulting estimates of the benefits of delayed childbearing are shown in the second row of Table 10.

CONCLUSION

Our results provide evidence that having a mother who first gave birth as a teen has negative consequences for her children. This is so even after taking into account the differences we observe in the backgrounds of these mothers compared to later-fertility mothers. On a statistical basis, the impact is more significant for the child's education level than for the daughter's fertility behavior or the child's economic inactivity at age 24. If teenagers could be convinced to postpone childbearing, their children (and hence society) would have improved life chances and outcomes.

For example, if teenagers who gave birth before age 15 could be induced to postpone their first births to ages 16–17, the probability that their children would graduate from high school would

TABLE 10

Estimates of the Present Value of Benefits of Delaying Early Childbearing until Mothers' Ages 20–21, in Billions of 1994 Dollars

	Using a Real Discount Rate of: 5 percent	3 percent
Value of increased earnings stream discounted to children's age 0	$2.26	$4.86
Value of increased taxes to government discounted to children's age 0	.52	1.12

increase by about 7 percent, or from .71 to .76. Similarly, we expect that the probability that their daughters would give birth by age 19 would be decreased by about 9 percent, and we expect an even larger decrease, about 16 percent, in the probability that the daughters would give birth out of wedlock by age 19. The biggest estimated impact is on reducing the daughter's probability of giving birth out of wedlock at an early age (before age 19). We also expect that the probability of children being economically inactive as young adults would decrease by about 16 percent.

If teenagers who are currently having their first birth between the ages of 16 and 17 could be induced to postpone that birth until they are 18–19, the expected increase in the probability of their children graduating from high school is quite small; however, postponement until ages 20 or more leads to sizable expected increases of about 7 percent, or from .785 to .839. In the case of subsequent early fertility for the daughters born to these teenage mothers, a one- to two-year postponement of the age when the mother first gave birth (from 16–17 to 18–19) is not expected to have a sizable impact on her daughter's probability of giving birth as a teen; however, a shift to age 20 or older again has a much larger expected impact.

Early-teen mothers differ from women who first give birth at later ages. Nevertheless, a policy to postpone their initial age at first birth is expected to have sizable impacts on the future attainments of their children. Beyond this, if young teens do not give birth at these young ages, they may change their life course in other ways as well (e.g., increase their own levels of schooling and job opportunities). Such changes could have additional positive impacts on the well-being of their children.

Notes

1. We also considered a model in which important unobserved premotherhood differences between adolescent and older mothers would make the outcomes of the children differ. To estimate the effect of being born to an early-fertility mother while ensuring that we were not capturing effects appropriately attributable to unobserved differences, we used a two-step estimation procedure. In the first step, we estimated an equation relating whether the mother was an adolescent mother to the characteristics we observe that might affect her child directly and to other factors we think would influence the likelihood of her being an adolescent mother but that would not directly affect her children. In the second step, we estimated an equation relating the outcome measure of the child to the predicted probability from the first equation and again included observed characteristics of the mother that are expected to affect her child directly. The coefficient on the predicted probability variable thus captures only the indirect effect of the observed factors that affect the probability of early-fertility motherhood. (This indirect effect, therefore, does not include any part of the effect that is due to unobserved variables or shocks in the error term.) Because of the difficulty of determining why some mothers become early-fertility mothers and others do not, these estimations were not satisfying. Hence, we cannot rule out the possibility that unobserved characteristics are the true cause of both the mother's early fertility and the children's subsequent disadvantages. Further details and the estimates from these equations are available from the authors upon request.

2. Data on state welfare generosity were obtained from Robert Moffitt. Data on state spending for family planning services come from *Family Planning Perspectives*. State population and price index data come from the *Statistical Abstract of the United States*.

3. The models were also estimated over the African American and white samples; where relevant, the results of these estimates will be discussed even though they are not shown.

4. As a set, these early childbearing variables are statistically significant at the .01 level, when a log

likelihood ratio test of the null hypothesis of no significant effect of early childbearing is tested. The critical value for the log likelihood ratio test at the .01 level is 13.28; the test statistic equals 21.8.

5. For example, the first slope shown in Table 2 is -.123. This indicates that if a woman with characteristics similar to the mean of our sample gave birth at age ≤15 years instead of delaying birth until age 22 or older (the omitted age of birth category), the probability that her child would graduate from high school would decrease by 12.3 percentage points—from, say, 87.3 percent to 75 percent. Similarly, if this mother had delayed childbearing until age 18–19, the probability that her child would graduate from high school would increase from this lower probability by about 5.9 percentage points (the slope of the ages 18–19 variable [-.064] less the slope of the age ≤15 variable [-.123] equals .059)—from, say, 75 percent to 80.9 percent.

6. For the results in columns 2 and 3 of Table 2, tests of structural difference in the parameters for these equations and estimates based on subsamples of African Americans and non–African Americans could not reject the null hypothesis of no structural difference. The chi-square test statistics for these equations are 15 and 13, and the .1 critical values are 25 and 26.

7. The critical value for the log likelihood test at the .01 level is 13.28; the test statistic equals 22.99.

8. In model 2, the set of early childbearing variables passes the log likelihood ratio test, again rejecting the null hypothesis that age of motherhood does not matter. The log likelihood ratio test statistic for whether the four estimated coefficients on the early-fertility dummy variables are statistically different from zero for model 2 is 8, and the .1 critical value is 7.78. The test statistic for model 3 is 6.7 and therefore is only statistically significant at the .15 level.

9. However, for the results in column 3 of Table 3, a test of structural difference in the parameters for this equation and estimates based on subsamples of African Americans and non–African Americans rejected the null hypothesis of no structural difference. The chi-square test statistic for the third model is 31.98 (versus only 19.38 for the second model, which doesn't include the policy variables) and so

rejects the null hypothesis at the .05 level, for which the critical value is 25. In the estimates based on non–African Americans, an increase in the unemployment rate tends to increase the probability of a teen birth; in the estimates based on African Americans, increases in state family planning expenditures tend to reduce the probability. The generosity of state welfare spending appears to have no statistically significant effect on this outcome in any of the estimations.

10. The test statistic for a log likelihood ratio test of the significance of the full set of the early childbearing variables exceeds the critical value at the .01 level, leading to rejection of the null hypothesis that early fertility of the mother has no effect on the outcome of the child. The critical value for the log likelihood test at the .01 level is 13.28; the test statistic equals 18.95.

11. As a set, the log likelihood ratio test indicates rejection of the null hypothesis at the .05 level. We also estimated several variants of these models. We considered variants using out-of-wedlock childbearing by the daughters when they were ≤19 and ≤17 as the dependent variables and variants using one dummy variable for early maternal fertility based on whether the mother had her first child ≤19, ≤18, and ≤17. In addition, we considered each of these variants for the full sample and for separate subsamples of non–African Americans and African Americans. Tests for structural differences in the parameters for these equations and estimates based on subsamples of African Americans and non–African Americans rejected the null hypothesis of no structural differences. The chi-square test statistics for the second and third models are 26.5 and 37.25 and so reject the null hypotheses at, respectively, the .05 and .01 levels. The .05 critical value for model 2 is 25, and the .01 critical value for model 3 is 35. From these we learned that the relationship between the mother's early-fertility and adolescent out-of-wedlock childbearing for the daughters is strongest for non–African Americans. For that sample, we found the early fertility dummies jointly statistically significant from zero for all three models when looking at out-of-wedlock childbearing at age ≤18 (with significance levels of .05, .05, and .04) and at age ≤17 (with significance levels of .012, .015, and .013).

When one dummy variable for having an early-fertility mother is used in these equations, the estimated coefficient is also statistically significant.

Estimates for out-of-wedlock childbearing at age $\leq$19 are jointly significant from zero only for the full sample using the first model, although for non–African Americans several estimated coefficients on the dummy variables are individually statistically significant in each of the three models. For the subsample of African Americans, the estimated coefficients on the dummy variables for early maternal fertility are not statistically significant in any of these estimations.

12. The test statistic for a log likelihood ratio test of the significance of the full set of the early childbearing variables exceeds the critical value at the .01 level, leading to rejection of the null hypothesis that early fertility of the mother has no effect on the outcome of the child. The critical value for the log likelihood test at the .01 level is 13.28; the test statistic equals 15.07.

13. As a set, the log likelihood ratio test does not indicate rejection of the null hypothesis for model 2 or model 3. The log likelihood ratio test statistics for models 2 and 3 are both 5.9 and so would only be significant at the .2 level.

14. The weights on the PSID are intended to represent proportions of the U.S. population. Even though some of the coefficients are not statistically significant, they are our best predictor of the likely impact on children of the mother postponing her first birth. Nevertheless, the lack of significance reduces the confidence one should place in some of these results. One further caveat also applies: while we include a broad set of background factors of the mother, unobserved factors may still play a role. To the extent this is the case, our simulations may over- or underestimate the expected change due to delay in childbearing.

15. Mothers who first gave birth while less than 15 years old tended to have other characteristics that put their children at a disadvantage. Hence, while delaying childbearing increases the probability of the children graduating, it does not mean the children will have as great a chance of graduating as the

children of mothers in the other groups. For example although delaying childbearing until 20 or 21 raises the probability of their children graduating from high school by 10.9 percentage points, this is less than the 17.5 percentage points difference in the probabilities of graduation for children in the different groups.

16. In a related paper, Joseph Hotz, Susan McElroy, and Seth Sanders (1995) find that mothers who give birth prior to adulthood draw more on governmental resources for welfare assistance than they contribute in taxes over their lifetime. From this calculation they conclude that “teen mothers, on average, are a net cost to government” (p. 45). Using a discount rate of 5 percent and an assumed tax rate of 23 percent, they calculate the discounted present value of the net fiscal burden of a teen mother to be about $34,000 in 1993 dollars. This estimate rests on their projections of the lifetime earnings of teen mothers and the costs of their participation in welfare programs. Using these same assumptions, the present discounted value of the demands on welfare benefits is estimated to be $72,624, and tax contributions are estimated at about $39,000.

The authors then compare these tax contributions and welfare costs with analogous estimates of contributions and welfare costs for women with similar characteristics who delayed their childbearing until adulthood. The $73,000 of welfare costs for the teen mothers falls to about $65,375 for women who delay their childbearing until adulthood. However, the authors find that mothers who delay their childbearing until adulthood earn *less* over their lifetime than do the teen mothers and hence contribute less in the way of taxes; for these adult mothers, the discounted present value of tax contributions is about $31,000, or about $8,000 less than the contributions of the teen mothers. These adult mothers are also found to be “a net cost to government”—indeed, a net cost of $35,000, or about $1,000 *more costly* than the teen mothers.

From the government’s point of view then, both teen mothers and mothers who delay childbearing are costly, with the costs of adult mothers exceeding the costs of teen mothers.

If one accepts these estimates as accurate and assumes that the welfare system now in place will be in place when the children of both teen and adult mothers become eligible for benefits, the discounted present value of the increased welfare costs attributable to the increased early childbearing of the children of teen mothers can be calculated. This calculation would involve discounting from the average age of a teen birth, or for about 17.98 years, the $7,249 of net increased welfare costs of teen mothers relative to adult mothers ($73,000 – $66,000). Using a 5 percent discount rate, this value equals about $3,015. Multiplying this value by the number of daughters born to teen mothers each year weighted by the increased probability of the daughters becoming teen mothers themselves gives a value of the additional welfare costs to government of the early childbearing of the children of teen mothers: $48.7 to 105.3 million in 1994 dollars depending on the method used to estimate the number of daughters born to early-fertility mothers each year.

To calculate of the additional tax contributions of the children of teen mothers deriving from their increased productivity and earnings using an equivalent procedure would be double counting; our estimates of increased governmental revenues from the increased earnings of the children of teen mothers operating through the increases in their educational attainment already capture this value. Note that our estimates of the increased productivity and earnings attributable to the increased education of children from delaying childbearing are different in both sign and magnitude from those estimated by Hotz, McElroy, and Sanders.

17. In this tobit analysis, the dependent variable (years of education completed) was limited to range from 0 to 14 because at the youngest age of children in our sample (age 21) they could still be in school and hence not have completed their education. At this age they have at most completed 15–16 years of education if they persistently attended school. The choice of 14 years as the upper truncation is consistent with an interruption of a year or two. In this estimation (as in the high school graduation

specification presented in Table 6), the coefficients on the early-fertility dummy variables were negative and statistically significant at the .05 level. These estimated equations are available from the authors upon request.

18. The number of children born to each age group of early-fertility mothers is based on the number of first births to women in each age group plus the number of higher birth order births to women in each of the age groups that suggest the mother is in an early-fertility birth group. This calculation is based on data taken from Table 1-53 in U.S. Department of HHS (1994). An alternative method would approximately double the number of children.

19. For the earnings increases attributable to increased years of schooling, we used estimates developed by the Children's Defense Fund to measure the benefits attributable to reducing children's poverty. Their estimates are based on measures taken from Bureau of the Census earnings profiles for men and women. By multiplying the simulated increases in education by estimates of the present value of the increased future earnings stream related to increased schooling (allowing for 1 percent annual growth in overall productivity, the probability of surviving to various ages, and the probability of being employed at various ages), we obtain an estimate of the benefits of the additional productivity benefits of the increased schooling attributable to delayed childbearing. For additional details on the calculation, see Children's Defense Fund (1995, pp. 141–43). This calculation assumes that the increased earnings attributable to additional education come from increases in the wage rate of more highly schooled workers and not an increase in their work hours. The calculation also ignores the costs to society of providing the additional schooling.

20. There is a question as to what is the most appropriate base year (age of future child) for purposes of discounting the changed earnings stream. One could argue that both the earnings of the child whom we observe and those of the unobserved hypothical child (the child whose birth is delayed) should be discounted back to the year at which the mother delayed birth. Our calculations assume that the

benefits of the delayed birth reflect the present value of the earnings of the counterfactual child at the time of his or her birth less the present value of the factual child at the time of his or her birth. A calculation reflecting the difference in present values at the time of the decision to delay the birth would result in slightly smaller values for both discount rates.

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