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The Costs of Teenage Out-of-Wedlock Childbearing: Analysis with a Fixed-Effect Propensity Score Matching Estimator

by

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Abstract: Teen out-of-wedlock mothers have lower education and earnings than peers who have children later. This study uses the National Educational Longitudinal Survey of 1988 (NELS) to examine the extent to which the apparent effects of out-of-wedlock teen fertility are not causal, but are due to pre-existing disadvantages of the young women and their families. We use a novel fixed-effect matching method to study this problem. We find that mothers-to-be were substantially disadvantaged before their teen out-of-wedlock fertility. At the same time, we cannot rule out that out-of-wedlock fertility reduces education substantially, although far less than the cross-sectional comparisons of means suggest.

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Our most serious social problem [is] the epidemic of teen pregnancies and births where there is no marriage.

-- President Clinton, 1995 State of the Union Address

While teen mothers are very likely to live in poverty and experience other forms of adversity, our results imply that little of this would be changed just by getting teen mothers to delay their childbearing into adulthood.

-- Hotz, Sanders and McElroy, 1999

As the authors of both of the quotations above agree, teen mothers have lower average education and earnings than peers who have children later. At the same time, several studies find that much of the apparent bad effects of teen parenthood are not causal (Geronimus and Korenman, 1992 and 1993; Hotz, Mullin, and Sanders, 1997, Hoffman, *et al.*, 1993a, b; Hotz, Sanders and McElroy, 1999). That is, most teen mothers were disadvantaged before motherhood. On average, if these young mothers had delayed childbearing, it would not have avoided all the poor outcomes for themselves or their children. A key question is how much (if any) of the correlations are causal. Surprisingly, some analyses cannot reject that *none* of the disadvantage of teen mothers is due to young motherhood; it is perfectly possible that all the many disadvantages appear to be due to pre-existing disadvantages.

This study uses the National Education Longitudinal Survey (NELS) of 1988 to examine how much of the links between teen out-of-wedlock fertility and the young mothers= poor outcomes could have been predicted using pre-motherhood characteristics of the young women. We examine these issues using both parametric methods and a novel fixed-effects semi-nonparametric method based on matching.

Theory and Methods

The vast literature on teen pregnancies, as well as previous research with the NELS dataset we examine here, leads us to believe that young women who will become teen out-of-wedlock mothers had low observable predictors of their outcomes prior to their first childbirth. Moreover, in part due to these observable disadvantages, we expect young women who will become teen out-of-wedlock mothers had poor outcomes before their first childbirth such as low eighth grade tests scores and high probability of smoking and using drugs.

For example, the large literature on the "underclass" emphasizes a set of factors present in our least advantaged neighborhoods including low adult employment rates, high crime and gang activity, few adult role models, and poor schools. These factors, in turn, lead to a set of outcomes such as high rates of dropping out of high school, using drugs, committing crimes, and having a child out of wedlock. (Jencks and Peterson [1991] review this literature) Even in neighborhoods without such disadvantages, young women who are doing poorly academically are likely to find school more burdensome and to perceive the rewards to additional education as lower than their classmates.

Several previous studies have examined the proportion of young mother=s disadvantage that might or might not be related to their teen childbearing.

One set of studies compared the children of teen mothers with the children of the teen mothers= sisters who had children at an older age. Such a comparison implicitly controls for all aspects of the sisters= shared family background. In two of the three datasets examined, the children of the teen mother were not substantially disadvantaged compared to their cousins whose mother had children at a later age (Geronimus and Korenman, 1993). Moreover, in one dataset the young mothers were not disadvantaged compared with their sisters who delayed childbearing (Geronimus and Korenman, 1992). These results were not conclusive, as standard errors were often large and results varied by data set. Hoffman, *et al*., 1993a and b, agreed with the Geronimus and Korenman findings that much of the cross-sectional correlation of teen childbearing and poor outcomes is not causal, but they emphasized the advantages of the data set that finds the largest effects when controlling for family characteristics (*contra* see Geronimus and Korenman, 1993).

A second research stream used the incidence of miscarriage, an almost-natural experiment that delayed child-bearing by some teenage women (Hotz, Mullin, and Sanders, 1997). A miscarriage typically delays the age of first birth by several years. In the sample Hotz, *et al.*, studied, the children of teenagers who became pregnant, but whose first birth was delayed by miscarriage, did not have better outcomes than their peers who were born of younger mothers.

The conclusion of both sets of studies indicate that the apparent disadvantages of teen parenthood are due in large part to the disadvantages of the mothers involved, not to their young age. These studies are important to the understanding of the causal nature of teen parenthood, because standard cross-sectional results using regression or other techniques compare teen mothers of children out of wedlock with the population of non-mothers. Cross-sectional methods can lead to misleading results because most non-mothers are quite different from most mothers-to-be. Moreover, Aselecting a subset of comparison units similar to the treatment units is difficult because units must be compared across a high-dimensional set of pre-treatment characteristics.@ (Dehejia and Wahba, 1998, who describe the similar problem in evaluating training programs targeted at the disadvantaged).

Both of these sets of studies emphasize the importance of identifying a good Acontrol@ group. The Hotz, Mullin, and Sanders, 1997 uses a group of girls who became pregnant, but had a miscarriage as a control for those that experience the birth of a child. Presumably, these two groups did not differ in their likelihood of becoming a teen mom. The Geronimus and Korenman (1992, 1993) studies examined pairs of sisters to implicitly control for unobserved family background. Thus, the assumption is that these two sisters only differ with respect to the event of fertility. At the same time, the sister who had a child as a teenager often differed systematically in other ways from her sister (Geronimus and Korenman, 1993). Similarly, the studies by Hotz and colleagues depend on the assumption of miscarriages being random events, and Athere are important reasons for believing that this is not the case@ (Wolfe et al., 1999).

Both of these methods are powerful for identifying a control group, but neither method is available in our dataset. Thus, we use a propensity score matching method, described below, to identify a suitable comparison group. We extend existing matching methods to incorporate school fixed effects. Our method compares the outcomes of a teen mother with someone from her junior high school of the same race; this matching controls for many observable and unobservable features of the family and neighborhood. Moreover, we also match on a rich set of family and youth characteristics.

The advantage of this approach over those mentioned previously is that we are able to utilize significantly larger sample sizes to estimate more precisely the importance of out-of-wedlock fertility. At the same time, any non-experimental study is plagued by unobservable factors that may correlate with the observables. This study selects a very good control group, yet additional unobserved factors may affect both a young woman=s decision to have a child out of wedlock and her decision to continue her education. Thus, the current findings will remain an upper bound on the causal effect of teen out-of-wedlock pregnancy, not necessarily an unbiased estimate. For example, if our matching method estimates a gap in dropout rates that is half the gap in the raw data, it is possible that if we could match on more factors, the decline would be larger. At the same time, the facts that a very high proportion of teenage women have engaged in unprotected sex (U.S. Department of Health and Human Services, 1997) and most teen mothers claim they did not intend to become pregnant (GAO 1998) imply that pregnancy (and to a lesser extent childbirth) has some random component.

Methods

The ideal experiment to test the effect of out-of-wedlock fertility would pick matched pairs of young women with identical schools, race, academic ability, family income, smoking behavior etc., and randomly have half of them carry a baby to term. To describe the Aideal@ experiment is to assure its impossibility (and ethical undesirability if possible).

The challenge, then, is to identify a good control group. We use a fixed-effects propensity-score matching model, and contrast its results with a standard parametric regression method. The standard parametric method estimates the coefficient of teen out-of-wedlock motherhood when predicting youth outcomes, and then examines how the estimated coefficient declines as additional controls are added. Thus, we, like the previous literature, estimate several nested logit models:

$$\Pr(y=1) = F(b_1 \cong \text{teen childbearing}), \tag{1}$$

$$\Pr(y=1) = F(b_2 \cong \text{teen childbearing} + C_2 \cong X), \tag{2}$$

$$\Pr(y=1) = F(b_3 \cong \text{teen childbearing} + C_3 \cong X + \textit{Jr. High Fixed Effects}). \tag{3}$$

where

y = outcome such as dropping out of high school, attending college

X = characteristics that preceded birth of the child such as parental education and demographic and eighth grade characteristics of family and child such as family income and child test scores in 1988

Jr. High Fixed Effects = a set of dummy variables for each junior high school,

and F(.) is the cumulative logistic distribution:

$$F(z) = e^z / (1 + e^z)$$

We focus on the logit coefficients from models (1) and (2) in terms of how they translate into predicted changes in probabilities of each outcome for teen out-of-wedlock mothers compared with similar others. In a fixed-effect logit (also known as conditional logit) such as model (3), the fixed effects for each junior high cannot be estimated; thus, only the effect sizes of other variables on the educational outcomes are estimable. Moreover, the estimated effects of teen childbearing on the log-odds of educational attainment (the coefficient β_3) cannot be directly translated into predicted changes in probabilities.

To the extent the correlation between teen childbearing and poor outcomes is causal, the coefficient estimates on teen childbearing should not change much when controlling for pre-existing characteristics of the family (β_1 should be near β_2 and β_3). Conversely, if the coefficients are strongly affected by the inclusion of pre-existing conditions, it suggests that most of the measured effects of teen childbearing are due to pre-childbearing disadvantages. This method is used by many prospective studies (e.g., Painter and Levine, 1999, and the studies cited in Wolfe, et al., 1999).

A fixed-effect propensity-score matching method. This standard method imposes strong restrictions on the functional form. Intuitively, information on women quite different from most mothers-to-be is used to estimate the counter-factual behavior of the mothers-to-be if they had not given birth out of wedlock. The assumption of a linear or logistic function permits data from all observations to be smoothed into one estimate, but the validity of that estimate is suspect if the smoothing function operates over long distances.

We used a variant of the method proposed by Rosenbaum and Rubin (1983) that requires weaker assumptions about functional forms. Assume that conditional on observable factors X, assignment to the treatment group (in this case, becoming a teen mother out of wedlock) is not correlated with unobservables that predict later education. In that case, all one must do to estimate the effects of teen motherhood is to match each treatment youth with a control who has the same observable characteristics. The mean difference in the treatment and matched controls= outcomes equals the true effect of teen motherhood on teen mothers. (Thus, we are estimating the effect of the Atreatment on the treated@ -- a distinction that will arise again below.)

Even if all important characteristics are observable, this method has the problem that the dataset contains many characteristics. Thus, few of the mothers-to-be have a control with precisely the same junior high school, maternal education, family income, etc. Rosenbaum and Rubin (1983) suggest the use of the propensity score to make matching feasible. The propensity score is the estimated probability of receiving the treatment (in this case, becoming a teen mother) given her observable characteristics. They proved that matching on the propensity score provides as powerful a control as matching on all observable characteristics. This technique reduces the problem from matching on the number of family and youth characteristics to matching on one dimension, the propensity score.

Dehejia and Wahba (1998) provide a second example where the matching method closely estimates the true treatment effects of a training program. Importantly, they find that the results are closer to the experimental results than the estimates from a regression.

Propensity score methods have two limitations when the sample is drawn in clusters; in this case, clustered by junior high school. First, the NELS samples only 26 or so students per junior high school, and the number of black and white females is much lower in most. With small samples per cluster and with a low base rate of teen fertility, the predicted teen motherhood rate of each junior high school is estimated very imprecisely. That is, most junior high schools with any teen mothers had only one or two mothers-to-be. This imprecision, in turn, will lead to matches of young women from very different schools and neighborhoods. For example, consider a young woman from a very advantaged high school that, by chance, had both of its teen mothers in the NELS sample. In the matching process they might be compared with young women from an extremely disadvantaged high school that, by chance, had none of its many teen mothers in the NELS sample. This problem can be partially alleviated by adding more controls that describe the school, the students, and their families. A better solution is to include a fixed effect for each junior high that captures all observed and unobserved aspects of the school and neighborhood. Thus, we are able to control both the characteristics of the student and their family and characteristics of their school and neighborhood.

Because the treatment of becoming or not becoming a teen mother is discrete, the propensity score is calculated with a logistic equation. To gain the benefits of matching in spite of these obstacles, we perform a two-stage matching that imposes the restriction that all matches occur within the junior high school. Specifically, to estimate the propensity score we used a conditional (fixed-effects) logit regression (Chamberlin, 1980), with a separate intercept a_i for each junior high school. Letting $T_{ij} = 1$ if observation j at junior high i is a teen mother (that is, treatment group), we have:

$$\Pr(T_{ij} = 1 \mid X_{ij}, a_i) = F(a_i + d \cong X_{ij}).$$

The coefficients $\underline{\wedge}$, but not the school-specific fixed effects a_i, can be recovered from this estimation. Fortunately, the differences in predicted probabilities for two women in the same junior high school *can* be recovered because the school-specific fixed effects a_i cancel out.

Thus, for each young woman i at high school j, we estimated her predicted probability of having a child out of wedlock ($T_{ij} = 1$) conditional on there being no other teen mother in her junior high school:

$$\Pr(T_{ij} = 1, T_{ik} = 0, k \neq j) = \frac{\exp(X_{ij} \cdot d)}{\sum_{k=i}^{N_i} \exp(X_{ik} \cdot d)}$$

where N_i is the number of classmates at junior high school i. We then matched each young mother-to-be with the young woman at her junior high school with the nearest propensity score.

We required that each treatment women have a match at her junior high school with a propensity score within 10 percentage points; otherwise we did not analyze the outcome for that unwed mother-to-be. Intuitively, consider an eighth grader who will soon have a child out of wedlock and already has low-income parents, low test scores and many behavioral problems in an otherwise advantaged junior high school where all the young women in the NELS sample were academically successful. In this case, we have no good control group for this mother-to-be. A parametric method uses assumptions on functional forms to utilize information on the quite-different girls in the high school, while our method does not make such assumptions.

We permit a single control to match more than one treatment. This method minimizes the distance between treatments and their controls, but at the possible loss of some efficiency. Dehejia and Wahba (1998) found that in their sample this nearest-match algorithm performed better than algorithms that permit several Afairly near@ controls to match a single treatment.

Assuming that a good match is found with in the junior high school, the estimated effect of teen motherhood on education (B_{match}) outcomes Y is the mean graduation rates of mothers-to-be (treatments) who have controls minus the mean graduation rates of controls (with some controls entering more than once):

$$\left[\sum_{i=1}^{N_{match}} Y_{i,treatment} - Y_{i,control}\right] \Big/ N_{match}$$

where N_{match} is the number of matched pairs.

This method also does not use information from junior high schools where no young women later gave birth out of wedlock or where all the young women in the NELS sample later gave birth. The fixed-effects (conditional) logit also has this feature.

Including the requirement for a match within a junior high school largely captures neighborhood effects. At the same time, 4.5 percent of the 1988 sample attended a private school, but less than 1 percent of teen moms. On the one hand, that means the school control for these teens does not capture characteristics of the physical neighborhood. At the same time, both the students and families of students in private school probably resemble others in the private school more than others in their neighborhoods, and the number of teen moms in private schools are small.

Statistical significance. As with any 2-by-2 matrix of outcomes, several tests for a statistically significant relationship between the treatment (teen motherhood) and the outcome (completing high school) exist (Stata, 408-409). Corresponding to each test is a different comparison: cell b vs. cell c, or b/(a+b) vs. c/(a+c), etc.

Two-by-two matrix of matched pairs= outcomes at end of high school

Entries are numbers of matched pairs with similar or dissimilar outcomes.*

N = # of matched pairs = a + b + c + d.

	Young women who would not soon become mothers (matched controls group)	
Mothers-to-be (treatment group)	**Dropped out**	**Graduated high school**
Dropped out	a	b
Graduated high school	c	d

Note: The tables report proportions in each cell, but numbers map more closely into the statistical tests.

The choice of comparisons matters when we compute similar tables with and without matching, and calculate the Aproportion@ of the gap that closed when moving to the matched sample. Different metrics of Agap@ will lead to different metrics of Aclosing the gap.@ This is the same issue that arises when comparing changes in logit coefficients vs. changes in the corresponding log-odds vs. changes in the corresponding dP/dX.

With matched case-control data, epidemiologists routinely calculate the test statistic McNemar=s $?^2 = (b-c) / (b+c)^2$. This statistic uses information from pairs where one dropped out and the other graduated. Like a conditional logit, it uses no information on pairs where both had the same outcome.

The confidence interval on the difference in dropout rates ((c+d) - (b+d)) is based on the estimated approximation to the standard error:

This calculation assumes the educational outcomes of teen mothers and their controls are not equal. The calculated standard error uses information on the number of pairs with identical outcomes as well as the proportions with different outcomes in estimating the precision of the estimate. That is, both the estimated standard error and McNemar=s ?^{2} indicate increased precision when the sample size grows. The confidence interval derived from the estimated standard error, but not McNemar=s ?^{2}, will also indicate a smaller and less significant gap in the probabilities of outcomes if more treatment people have the same outcome as their control. The standard errors are somewhat biased down because we do not adjust for the fact that the propensity scores are estimated and because we permit a control observation to match multiple treatments. Formula for additional test statistics are in Stata (1999, p. 408-9).

Data

The National Education Longitudinal Study of 1988 (NELS) is sponsored by the National Center for Education Statistics and carried out by the Bureau of the Census. NELS is designed to provide trend data about critical transitions experienced by young people as they develop, attend school, and embark on their careers. The base year (1988) survey was a multifaceted study with questionnaires for students, teachers, parents, and the school.

Sampling was first conducted at the school level and then at the student level within schools. The data were drawn from a nationally representative sample of 1,000 schools (800 public schools and 200 private schools, including parochial institutions). Within this school sample, 25,000 eighth grade students were selected at random. The three follow-ups revisited (most of) the same sample of students in 1990, 1992, and 1994; that is, when the respondents were typically in the tenth grade, in the twelfth grade, and roughly two years after high school graduation. A randomized sample of approximately 14,000 students were interviewed in the 1994 survey. These form the base sample for the estimation.

We restrict our sample to white and black non-Hispanics females (N = 5104) because sample sizes precluded separate analyses of teen childbearing for other demographic groups. In addition, we restrict our sample to those households in which the biological mother of the child is present and the family structure is clearly defined. Future research will test the robustness of these results to those families without the biological mother present.

Teen motherhood. The results we present are for those teens who experienced an out-of-wedlock birth. We also reran our models including young mothers who married prior to giving birth, and the results are not changed substantively. All regressions dropped young women who gave birth prior to the first wave of the survey in 1988.

Socioeconomic Status and Family Background: As noted by Hoffman, *et al*., (1993a and b), a common missing ingredient in most analyses of the impact of teen fertility on the achievement of young women is adequate measures of family background and parental involvement in education. Studies have either used a socioeconomic status index provided by the data set (e.g. Lee *et al*, 1994), created an *ad hoc* index of parent=s characteristics (e.g. Herrnstein and Murray, 1994), or used a limited set of family background measures which are intended to separate the effects of teen fertility on the achievement of youths from the effects of family background. This study employs a much more detailed measure of family background and family involvement in education which is intended to better isolate the effect of out-of-wedlock teen fertility on outcomes.

The measures of socioeconomic status are created from both the parent and student questionnaire. The set of variables include occupational status (using Duncan=s index), parental education, and family income. These variables are converted into z-scores with mean zero and standard deviation equal to one. When there are missing values for parental education because of a missing parent, these are given a z-score of 0 and categorical variables are included to note these important missing values.[1] To adjust family income for its size, family income is divided by the poverty line

1. For father=s education, this procedure is far from perfect. Most of these missing values are in female headed households. Furthermore, it may be the case that these values are missing in precisely those families which are the most disadvantaged because of the least connection to the father. This will cause the coefficient on single parent to biased upward. In addition, it is not clear in the NELS, whether the value for a step-family is taken from the step-father or the biological father. For these reasons, the analysis was replicated without the variable father=s education, and the differences in the results were small not statistically significant.

adjusted for family size. This is an improvement over most studies which simply include some measure of family income in their estimated models. The log of this income/needs ratio (hereafter, called income:needs ratio) is included for the student=s 8th grade year.

To supplement this fairly standard list, a wide range of measures are included which prior research suggests are indicators of advantages or disadvantages for young women. From the student questionnaire, there are a number of variables which are potentially important predictors of success. A first set of variables control for standard demographic characteristics: region, rural vs. urban vs. suburban, and a female categorical variable. A second set of variables are indirectly related to parental involvement in education, but are not exogenous to the outcome variable. These include whether a foreign language is spoken in the home, whether the mother or father is foreign born, the number of siblings, and whether the home has a library card, magazines, and many books.

From the parental questionnaire, indicators are obtained for whether the family was one of five religions, and any of four levels of religious observance. These variables may proxy for how closely a family is knit as well as proxy for the social capital (Coleman, 1990) available to the children. A categorical variable indicating whether the mother had been a teen when the young woman was born is included. (Unfortunately, the dataset does not indicate whether the parents were married when the young woman was born.)

The final three variables measure parents= involvement in the young woman=s life and education. The first variable is equal to one if the parent belonged to a parent-teacher association or related organization, or volunteered at school. The second variable is equal to one if the parent helps the child with homework. Finally, a categorical variable for whether the child had participated in clubs such as Boy or Girl Scouts during elementary school is included to proxy for the quantity of time spent with the child outside of the home.

Eighth-Grade Status: We analyze five measures of student status in eighth grade: whether she had behavioral problems (coded as present if the student had been disciplined at school more than three times or if the parents considered the child to have severe behavioral problems), emotional problems (coded as present if the parent said that the student had an emotional problem which could inhibit learning), smoked cigarettes, used drugs (marijuana, and harder drugs), and the student's test scores. The student=s test scores are taken from a set of cognitive math and reading tests taken in eighth grade (see Levine and Painter, 1999, for a full description of the cognitive tests).

Educational outcomes: We focus primarily on two educational outcomes of the youth in 1994 (roughly age 20). The first is whether the young woman dropped out of high school; that is, had no high school diploma by age 20. (We examine GED recipiency only briefly below.) Second, we examine the proportion who had started college by 1994.

Summary statistics for the analysis variables are presented in Table 1. The means are for the entire sample we analyze. Approximately ten percent of the sample dropped out of high school, while three fourths of the sample (and a higher proportion of the high school graduates) had attended some college by age 20. Ten percent of the young women had a child out of wedlock while a teenager.

Results

Unmarried teen mothers suffered far worse outcomes than their peers who did not have children out of wedlock. Teen out-of-wedlock mothers had a dropout rate of 38.6%, 8 times the rate of other young women (6.6%). In other words, teen mothers make up 8% of the sample, but 38% of the dropouts. Among high school graduates, young mothers= rate of entering college by age 20 was less than half that of their peers (35% vs. 80%).

Although prior researchers have not achieved consensus on the precise extent to which the correlation is causal, all agree that much or most of the correlation is not causal (see cites above).[2] Consistent with these prior findings, the NELS data shows unwed mothers-to-be were disadvantaged in eighth grade, before they gave birth (Table 1). Compared to young women who would not give birth out of wedlock before age 20, in eighth grade teen-mothers-to-be were twice as likely to be living with

2. Most past researchers have examined all teen births, while we examine only teen births out of wedlock. Some past researchers have looked at long-term effects on teen mothers, while our dataset only contains data on short-term effects. Most past researchers have compared teen mothers to mothers who had first births in their twenties. Our comparison group includes all other women. For all of these reasons, we probably have a larger gap in education outcomes than in other datasets. Nevertheless, these differences in data should not affect our main result. For example, when we examine all teen mothers (wed or unwed), our basic results are unchanged.

a single mother (21% vs. 9.5%), both of their parents= education was .4 standard deviation lower than their peers= parents, and their parents reported somewhat lower parental involvement. The family=s income:needs ratios were less than half that of their peers.

Moreover, prior to giving births out of wedlock, the teen mothers-to-be exhibited less socially desirable behaviors and lower academic achievement than their peers. By eighth grade they had a half of a standard deviation lower test scores than young women who would not have a child out of wedlock. There were also three times as likely to smoke (15% vs. 5%), although self-reported drug use was similar (about 9.5%). Their parents and teachers were twice as likely to report behavior problems (11.7 vs. 5.5 %) and their rate of severe emotional problems, although low, was more than triple that of their peers (3.8 vs. 1.1%).

Logit results. The logit results show the effect of out-of-wedlock teen motherhood on high school dropping out fell from 32.0 percentage points in the raw data to 11.8 percentage points when controlling for demographic and eighth grade characteristics of the young women and their families (Table 3). These are the estimated logit effects when the logit coefficients are evaluated at the sample mean, as most social scientists do. As such, they correspond to the thought experiment of estimating the effect of the Atreatment on the untreated@ - how teen fertility out of wedlock affects non-mothers. This 63% decline is roughly consistent with findings from quasi-experimental methods (Hotz, et al., 1997) or from methods using sisters as matches (Geronimus and Korenman, 1992, 1993).

Importantly, the estimated effects of teen pregnancy are larger if we evaluate the logit coefficients at the mean of the sample of mothers-to-be. The estimated increase in the probability of dropping out due to having a child out of wedlock is 16.4 percentage points, instead of the 11.8 percentage points when evaluated at the characteristics of the mean woman. Correspondingly, even our very good controls matter less when we evaluate the logit coefficients at the average characteristics of the mothers-to-be.

Similarly, the effect of teen pregnancy on college attendance is 45.5 percentage point in the raw data (Table 1), and declines by more than half to 19.2 percentage points with the logit coefficients are evaluated at the sample mean. As with dropouts, the effect size rises to 31 percentage points when evaluated at the characteristics of the average teen mother-to-be. The estimates when we evaluate the logit coefficients at the average characteristics of the mothers-to-be are closer to what the data can actually answer, as we do not estimate the effects of out-of-wedlock childbirth on non-mothers.

In results not shown, we also estimated the standard parametric model with junior high level fixed effects. While these results are not directly comparable because we are not able to estimate marginal effects without being able to recover the fixed effects, evaluating the estimates for the dropout equation in terms of log odds reveals that the junior high fixed effects reduces the odds ratio for having a child out of wedlock from 4.4 to 4.3. Thus, we conclude that including the fixed effects would close the gap only slightly more than was eliminated with the larger set of family characteristics and eighth grade outcomes of the youth.

Semi-parametric fixed-effect matching method

A contribution of this paper is to compare the estimated effect size using the alternative fixed-effect matching method. Our matching procedure restricted the sample to the 275 young mother-to-be who had a classmate in junior high in this sample of the same race with a similar predicted probability of teen motherhood.

Our first-stage conditional logit estimates of the probability of teen motherhood are presented in Table 4. As others have found and as showed up in the means, young women are more likely to become teen mothers if they come from single-parent homes, if they are black, and if they have low incomes, and so forth.

To identify appropriate matches, we first set the cut-off for Asimilar@ probability at 10 percentage points in predicting the likelihood of teen motherhood and experimented to be sure other values did not appreciably change the results. We also required that matches be of the same race and attend the same junior high school. Fifty-five percent (275 of 503) of the young mothers-to-be had matches within this cutoff. In addition, 16 percent of the controls served as matches to more than one mother-to-be.

The cutoff of .10 in predicted probability of teen motherhood is substantively neither enormous nor small. It is roughly one standard deviation in the predicted probability of teen motherhood, as estimated in Table 4. That is, if we think of the predicted probability of teen motherhood as an index of Adisadvantage@ with weights chosen by the logit equation predicting teen motherhood, matches are constrained to be within one standard deviation on this index. It also equals roughly the effect of a one standard deviation decline in family income, or the move from an intact family to one with only a single mother (but because these are regression effects holding other factors constant, this simulated effect is that of losing a father without the corresponding large reduction in income that usually accompanies family break-up).

Our mothers-to-be and their matches were (as expected) much closer on observable pre-fertility behaviors than mothers-to-be were with other young women (comparing Tables 1 and 2). Of the 42 comparisons we made between mothers-to-be and their matches, none of the differences was statistically significant at the 5 percent level In contrast, teen mothers were statistically significantly different from (and disadvantaged relative to) their peers on average on 27 of the 42 measures (Table 1).

Importantly, our matching method was less likely to find a close match when the teen mother-to-be was very disadvantaged; thus, our matching method examines a less-disadvantaged set of teen mothers than the average teen mother.

Results: The fixed-effect matching method found the gap in dropout rates between teen mothers and their matches was 18.2 percentage points, a bit over half the 32 percentage point raw gap from the entire sample (Table 5A). This 18.2 percentage points effect size of teen pregnancy is larger than the 11.8 percentage point estimate from the logit evaluated at the sample means, and the difference is statistically significant. At the same time, the 18.2 percentage point effect size is similar to the effect size from the logit when the logit coefficients are evaluated at the characteristics of the mean mother-to-be. This convergence is to be expected as the latter logit results, like the matching model, tries to estimate the effect of the treatment on the treated, while the former logit estimates the effect of the treatment on the average.

The matching methods 95 percent confidence interval stretches about 7 percentage points in each direction, triple the confidence interval from the logit. The decreased precision and higher standard errors of the estimates is due to the restricted sample size of 550 young women (275 pairs) for the matching as opposed to over 5000 women used in the logit. At the same time, most of the additional women analyzed in the logit sample are quite different from mothers-to-be. Thus, standard errors may be optimistic when their characteristics and outcomes help predict the behavior of teen mothers.

The raw gap in college attendance was 45 percentage points, while the gap estimated by the matching method was a much lower 21 percentage points. Not all of this gap would be predicted by the 18 percentage point gap in high school graduation. That is, among high school graduates, the rate of starting college was still 17 percentage points lower among teen mothers than among similar young woman.

The estimated effect of teen pregnancy on college attendance from the matching model (21 percentage points) is smaller than the logit effect when the logit coefficient is evaluated at the mean characteristics of teen mothers (31 percentage points, gap statistically significant). This result suggests the importance of using the matching model.

The raw gap in college attendance showed that on average teen out-of-wedlock mothers were 45 percentage points less likely to attend college than were their peers. The gap estimated by the matching method remained large, but was a much lower 21 percentage points. Thus, the fixed-effect matching method coupled with the implicit controls reduce the gap in college attendance by just over half.

The 21 percentage point gap in college attendance in the matching sample is somewhat larger than the 18 percentage point gap in high school graduation. This rise in non-enrollment is because among high school graduates, the rate of starting college was still 16 percentage points lower among teen mothers than among similar young woman. This comparison is no longer among completely matched pairs, but if the least advantaged are most likely to drop out, the higher dropout rate among teen mothers suggests that the remaining sample should be less disadvantaged than the controls who graduated high school. Interestingly, in both samples, 16 percent of dropouts reported attending some college classes; GED recipiency is discussed below.

Robustness tests

We performed a number of robustness tests of both the logit and matching results.

GED: It is possible that some of the higher dropout rate we observe in teenagers who had children is a short-run effect due to disruption, but that the effect of teen childbearing later declines. If the effects of teen childbearing declines, then teen mothers who dropped out of high school would be more likely to return for a GED degree than other female dropouts. We found no evidence for teen mothers= have a higher rate of returning to school. In fact, among those without a high school diploma by 1994 (that is, roughly at age 20), 30% of the teen mothers and 38% of other female dropouts had a GED (Table 1, difference not significant). The relative advantage (and its lack of statistical significance) of the non-teen-mother dropouts reappeared when looking at the matched sample (Table 2). Studies with more years of data can examine longer-term catch-up, as in Geronimus and Korenman (1992).

Including married teen mothers: We reran our results including young mothers who married prior to giving birth. This expansion included both women married before conception and those married between conception and birth. Results were unchanged.

Varying coefficients by group: It is possible that the effects of family characteristics on youth outcomes differs among family types. For example parental income or education could be much more important for teen mothers. Due to limited degrees of freedom we were unable to test a full set up interactions. Instead, we constructed a composite measure family socioeconomic status that averaged standardized versions of parental education, family income and parental occupational status. (Details of this variable=s construction are found in Levine and Painter, 1999.) The interaction between teen motherhood and this composite socioeconomic status measure was [not significant] in predicting later education.

Several studies find that the effects of teen motherhood on graduation to vary by race (GAO 1998). The matching and logit procedures correctly reproduce the average result, but it remains interesting to see if the results differ by race. We do not have enough degrees of freedom to permit estimation of the interaction of race and status as an out-of-wedlock teenmom in the matching model to be estimated precisely, and logit precision can be misleading as we discussed.

Wider cutoffs: We reran the results using the somewhat larger sample of young women who had a match within .20, not .10, in the predicted probability of becoming a teen out-of-wedlock mother. The advantage of this cutoff is that the sample grew from 275 with the .10 cutoff to 341 with .20 cutoff. The disadvantage was that the mothers-to-be and their matches now differed more on observable characteristics. The gap in the two groups= mean predicted probability of out-of-wedlock motherhood was 4.2 percentage points, which was statistically significant at the 5 percent level.

With the cutoff of .20 and slightly poorer matches but a larger sample size, the estimated effect of motherhood out of wedlock was 18.8 percent, which is substantively and statistically similar to the results with cutoff equal to the more conservative .10. This effect size is also similar to the "treatment on the treated" calculations of the effect of motherhood on dropping out from the logit coefficients.

This effect size after matching remains a bit over half the total cross-sectional effect of teen motherhood in the representative sample. Thus, the controls explain less than in the naive logit, and about the same as with the smaller cutoff. As we expect, the less-perfect matching implies a slightly larger gap.

Imperfect matching: The baseline results only used matches when their predicted probability of teen pregnancy was within .10 gap of that of the teen mothers-to-be. As noted above, with this rule the mean predicted probabilities were substantively close and statistically insignificant. Nevertheless, on most measures the teen mothers were slightly less advantaged than were their matches.

We thus ran the analyses of the matched pairs including the predicted probability of teen pregnancy as an additional regressor. This regression is a conditional logit with fixed effects for each pair. (Note that with no additional regressors, this fixed-effect logit analysis corresponds to the analysis of Tables 5A and 5B.)

The coefficient on child-out of wedlock declined by a substantively small and statistically insignificant amount when we added the predicted probability of having a child out of wedlock to the logistic regression predicting dropping out of high school. (Results available on request.)

Discussion

Rates of teen pregnancy are very high in the U.S. Approximately two in five young women will become pregnant before they are 20. About half of these pregnancies will end in abortion, and half in a live birth (Sylvester, 1994). Moreover, approximately one in five white children is born out of wedlock, roughly the same rate of fertility out of wedlock that Black women had when Moynihan decried the death of the Black family in 1967. Moreover, about three out of five Black children are born out of wedlock.[3]

These results support prior findings that a substantial portion of the relation between teen childbearing and high school completion is due to pre-existing disadvantages of the young women, not due to the childbirth itself. At the same time, about half the very large disadvantages remain using all methods regardless of controls (see Figure 1). We find a smaller portion of the gap in high school completion between non-teen moms and teen moms can be attributed to disadvantage than studies like Hoffman, *et al*., (1993a and b). This likely due to the fact that their parametric methods are using information from non-teen moms that are quite different from the population of teen mothers in the sample.

This analysis has provided two primary contributions to the literature on the impact of out-of-wedlock fertility on educational outcomes. First, we use the NELS, which has extremely good measures of the characteristics of young women and their families. The junior high fixed effects provide complete controls for school and for many neighborhood characteristics -- a major advance on previous prospective studies. Second, we use a propensity score method that is less sensitive to functional forms than standard regression analysis.

Nevertheless, our analysis may omit some important characteristics. Thus, the true causal links between teen childbearing and low maternal education may be lower than we estimate. Similar critiques

3. Importantly, the rising share of Black births that are out of wedlock is due to a small increase in rates of out-of-wedlock births over the last 30 years and a dramatic decline in births within marriageCfalling by two thirds since the 1950s.

hold, for example, in studies that use sisters as matches; it is likely the sister who had a child out of wedlock or as a teenager differed from her non-fertile sisters in ways not measured in the dataset.

Policy implications. From a policy perspective, we (like others) find enormous nonrandom selection into teen motherhood. That is, young mothers end up with lower education, but had many disadvantages that predicted low education prior to giving birth. Thus, half or more of young mothers= disadvantages would not have been eliminated by the young women waiting until their twenties to have children.

At the same time, almost all point estimates both in this study and in its predecessors indicate substantial disadvantages remain that are plausibly due to becoming a teen mother. Thus, policy-makers should not ignore the potential effectiveness of policies that delay first births in affecting some young women=s education and other outcomes. The question is what to do with these findings.

Out-of-wedlock teen parenting is the result of a complex set of factors. Many of these factors reflect disadvantages that society should reduce, regardless of their effects on education. For example, roughly half of teen out-of-wedlock births are to women who were sexually molested at some time (Sylvester, 1994). Many young women (and men) do not believe that they are likely to be able to succeed academically in high school, nor that a high school diploma will lead to further education or career success. Many young women (and men) do not have the basic information on pregnancy and sexuality, are not supported by peer groups that encourage wise choices such as delaying the start of sexual activity, and (when sexually active) do not have access to contraception.

On the one hand, the precise cost-benefit analysis for policies to address these problems depends in part on the causal links between teen out-of-wedlock pregnancy and educational attainment. On the other hand, reducing sexual molestation, improving young peoples= perceptions (and the reality) that Aplaying by the rules@ has positive payoffs, and giving young people the skills and knowledge to handle their sexuality wisely are policies that make sense regardless of how much of the correlation between teen pregnancy and educational attainment is causal.

Extensions. Future versions of this paper will add Hispanics as an additional category, as well as examine father-only families. We will examine differences in effects by racial group and by socioeconomic status. We will examine if relative socioeconomic status in one=s high school affects teen motherhood or high school completion.

Table 1: Summary Statistics by Fertility Status

Entire sample

	All Females	Non teen mothers	Mothers-to-be
N	5104	4601	503
Family Structure			
Persistently Intact	0.687	0.713	0.453 *
Divorced during High School	0.044	0.043	0.054
Persistently Female Headed	0.152	0.135	0.304 *
Remarried during High School	0.017	0.017	0.014
Persistently Stepfather	0.087	0.080	0.149 *
Divorced from Stepfather during High School	0.013	0.012	0.026 *
Family in 1988 (Young woman in eighth grade)			
Ethnicity - African American	0.119	0.100	0.292 *
Parental Involvement in Education	0.571	0.585	0.441 *
Parents help with homework	0.429	0.427	0.449
Parents and children are involved in clubs	0.908	0.916	0.839 *
Mother's education (z)	0.087	0.134	-0.338 *
Father's education (z)	0.074	0.113	-0.272 *
Mother was a teen when this daughter was born	0.113	0.102	0.215 *
Eighth grade income/needs	1.038	1.112	0.364 *
Father foreign born	0.061	0.062	0.053
Mother foreign born	0.057	0.058	0.054
Live in the south (Omitted category is northeast)	0.361	0.357	0.393

Table 1: Summary Statistics by Fertility Status

Entire sample

	All Females	Non teen mothers	Mothers-to-be
Live in the west	0.133	0.134	0.131
Live in the central	0.319	0.317	0.340
Live in urban area (Omitted category is suburb)	0.220	0.216	0.261
Live in rural area	0.353	0.349	0.390
Oldest child	0.326	0.330	0.285
Father's occupation {z}	0.042	0.080	-0.291 *
Father unemployed	0.051	0.046	0.090 *
Mother's occupation {z}	0.040	0.086	-0.356 *
Mother unemployed	0.287	0.280	0.347 *
Religious affiliation - Baptist (Omitted religion is other Protestant)	0.231	0.217	0.355 *
Religious affiliation - Catholic	0.277	0.287	0.193 *
Religious affiliation - Other religion	0.099	0.096	0.124
Religious affiliation - Missing religion	0.032	0.032	0.038
Religious affiliation - No religion	0.023	0.022	0.030
Religiosity - very religious (Omitted religiosity is ANot at all religious@)	0.453	0.475	0.261 *
Religiosity - religious	0.158	0.158	0.158
Religiosity - somewhat religious	0.168	0.165	0.193
Number of siblings	2.129	2.063	2.705 *
More than 50 books in home	0.919	0.930	0.826 *
Has at least one magazine subscription	0.798	0.818	0.627 *
Family has a public library card	0.843	0.854	0.750 *
Young woman in 1988 (That is, in eighth grade)			
Behavioral problems reported by teacher or parents	0.069	0.060	0.153 *
Cigarette smoking	0.050	0.044	0.109 *

Table 1: Summary Statistics by Fertility Status

Entire sample

	All Females	Non teen mothers	Mothers-to-be
Emotional problems	0.015	0.013	0.040 *
Drug use	0.090	0.091	0.076 *
Eighth grade test scores (z)	0.137	0.215	-0.581 *
Predicted probability of a having a child out of wedlock			
Predicted probability of a having a child out of wedlock based on characteristics of the young woman and her family; coefficients from Table 4.	0.140	0.274	0.104 *
Outcomes 1992-94 (Aged roughly 18 to 20)			
Dropout	0.099	0.066	0.386 *
College attender	0.753	0.800	0.345 *
College attender (among those with a high school diploma)	0.815	0.841	0.471 *
Received a GED (among those without a high school diploma)	0.345	0.376	0.297

* represents that the value for mothers-to-be is significantly different from non-teen mothers at the 5 percent level. All variables above the row AYoung woman outcomes@ are controls in tables 3 and 4.

Table 2: Summary Statistics by Fertility Status
Matched sample

	Mothers-to-be	Matched non-teen-mothers
N	275	275
Family Structure		
Persistently Intact	0.556	0.583
Divorced from Intact during High School	0.062	0.084
Persistently Female Headed	0.211	0.185
Remarried during High School	0.011	0.029
Persistently Stepfather	0.138	0.091
Divorced from Stepfather during High School	0.022	0.025
Family in 1988 (Young woman in eighth grade)		
Ethnicity - African American (Note: all pairs were matched on race.)	0.200	0.200
Parental Involvement in Education	0.516	0.509
Parents help with homework	0.425	0.447
Parents and children are involved in clubs	0.862	0.902
Mother's education (z)	-0.206	-0.103
Father's education (z)	-0.222	-0.164
Mother was a teen when this daughter was born	0.178	0.163
Eighth grade income/needs	0.657	0.797
Father foreign born	0.047	0.062
Mother foreign born	0.029	0.044
Live in the south (Omitted category is northeast)	0.385	0.385
Live in the west	0.131	0.131
Live in the central	0.327	0.327
Live in urban area (Omitted category is suburb)	0.211	0.211
Live in rural area	0.429	0.429
Oldest child	0.305	0.338
Father's occupation {z}	-0.292	-0.147
Father unemployed	0.076	0.087
Mother's occupation {z}	-0.176	-0.070
Mother unemployed	0.287	0.327
Religious affiliation - Baptist (Missing is other Protestant)	0.298	0.280

Table 2: Summary Statistics by Fertility Status
Matched sample

	Mothers-to-be	Matched non-teen-mothers
Religious affiliation - Catholic	0.218	0.222
Religious affiliation - Other religion	0.138	0.145
Religious affiliation - Missing religion	0.044	0.040
Religious affiliation - No religion	0.029	0.022
Religiosity - very religious	0.335	0.349
Religiosity - religious	0.182	0.232
Religiosity - somewhat religious	0.192	0.185
Number of siblings	2.338	2.382
More than 50 books in home	0.894	0.898
Has at least one magazine subscription	0.687	0.727
Family has a public library card	0.811	0.789
Young woman in 1988 (That is, in eighth grade)		
Behavioral Problems	0.069	0.072
Cigarette smoking	0.065	0.065
Emotional problems	0.011	0.018
Drug use	0.080	0.112
Eighth grade test scores (z)	-0.399	-0.343
Predicted probability of a having a child out of wedlock		
Predicted Probability of a having a child out of wedlock based on characteristics of the young woman and her family; coefficients from Table 4.	0.140	0.127
Educational Outcomes 1992-94 (Aged roughly 18 to 20)		
Dropout	0.298	0.116 *
College attender	0.404	0.611*
College attender (among those with a diploma B not necessarily matched, N = 193 and 243)	0.508	0.671*
Received a GED (among those without a diploma -- not necessarily matched, N = 82 and 32)	0.329	0.406

***** represents that the t-test on the mean value for mothers to be is significantly different from matched non-teen mothers at the 5 percent level.

Table 3
Logit Results on how Controls Affect The Coefficient on Teen Fertility
for Dropout and Started College
Coefficients report the dP/dX from Logit equation evaluated at the mean of the sample.
Reference group is young women who did not have a child out of wedlock.

	No controls	Controlling for demographic and eighth grade characteristics of family and child (Evaluated at the mean of the sample)	Controlling for demographic and eighth grade characteristics of family and child (Evaluated at the mean of teen moms)
Dropout (N = 5157)			
Had a Child out of Wedlock	0.320 ** (0.016)	0.118 ** (0.011)	0.164 ** (0.011)
Started college (N = 5157)			
Had a Child out of Wedlock	-0.455 ** (0.022)	-0.192 ** (0.018)	-0.310 ** (0.018)

Notes: Eighth grade characteristics of family and child include all controls listed such in Table 1.
* represents different from zero at the 5 percent level.
a represents difference from the column with no controls and the column with full controls is significant at the 5 percent level.

* The dp/dx for dropout is .167 when evaluated at characteristics of the mean teen mom vs .118 for the characteristics of the mean girls. The dp/dx for college attendance is -.288 when evaluated at characteristics of the mean teen mom vs -.192 for the characteristics of the mean girls.
* This 20 percentage point drop is >> 5 p..p. from effect of match because the 503 moms here have the least advantaged in the sample, and controls Apick up@ that gap. The 275 have already knocked out those moms.

Table 4: Predicted Probability of a having a child out of wedlock

Conditional Logit Estimates
(N=2388)

	Odds Ratio	Standard Error
Family Structure		
Divorced from Intact during High School	1.654	0.464
Persistently Female Headed	1.666 *	0.315
Remarried during High School	0.771	0.392
Persistently Stepfather	1.611*	0.317
Divorced from Stepfather during High School	1.521	0.627
Family in 1988 (Young woman in eighth grade)		
Ethnicity - African American	2.254 *	0.528
Parental Involvement in Education	0.898	0.121
Parents and children are involved in clubs	0.988	0.186
Mother's education (z)	1.020	0.105
Father's education (z)	0.982	0.116
Mother was a teen when this daughter was born	1.177	0.205
Eighth grade income/needs	0.874	0.081
Father foreign born	1.285	0.447
Mother foreign born	1.115	0.164
Oldest child	0.752	0.253
Father's occupation {z}	0.877	0.078
Father unemployed	1.135	0.271
Mother's occupation {z}	0.885	0.064
Mother unemployed	1.226	0.178
Religious affiliation - Baptist (Missing is other Protestant)	1.329	0.244
Religious affiliation - Catholic	1.149	0.232
Religious affiliation - Other religion	1.449	0.326
Religious affiliation - Missing religion	0.801	0.277
Religious affiliation - No religion	1.331	0.503
Religiosity - very religious	0.465 *	0.081
Religiosity - religious	0.626 *	0.120
Religiosity - somewhat religious	0.816	0.150
Number of siblings	1.162 *	0.046
More than 50 books in home	0.844	0.159
Has at least one magazine subscription	0.873	0.127

Table 4: Predicted Probability of a having a child out of wedlock

Conditional Logit Estimates
(N=2388)

	Odds Ratio	Standard Error
Family has a public library card	0.926	0.151
Young woman in 1988 (That is, in eighth grade)		
Behavioral Problems	1.909 *	0.402
Cigarette smoking	2.308 *	0.552
Emotional problems	1.037	0.378
Eighth grade test scores (z)	0.549 *	0.047

***** represents statistically significant at the 5 percent level.
Pseudo-R^2 = .21

Table 5A: Results from Matching

Two-by-two matrix of matched pairs= outcomes at end of high school
Entries are proportions of matched pairs with similar or dissimilar outcomes
N = 275 pairs

	Young women who would not soon become unwed mothers (matched controls group)	
Mothers-to-be (treatment group)	**Dropped out**	**Graduated high school**
Dropped out	0.055	0.244
Graduated high school	0.062	0.640

Proportion who dropped out:

Teen mothers	.298		
Matched controls	.116	[95% conf. interval]	
	---------	--------------------	
Difference	.182**	.117	.247
Ratio	2.56**	1.80	3.64
Odds ratio	3.941	2.288	7.160
McNemar's $?^2(1)$	29.76**		

Notes: Odds ratio = % of pairs where control graduated and mother-to-be dropped out / % of pairs where mother-to-be graduated and control dropped out (that is, .244 / .062).
McNemar=s $?^2$ tests if the odds ratio equals 1.
Confidence intervals and test statistics are described further in the text.
Sums may not total due to rounding.
** implies rejects the hypothesis of that the ratio or odds ratio of proportions equals one or that the difference in proportions equals zero at the 1% level.

Table 5B: Fixed-Effect Matching and College

Two-by-two matrix of possible college attendance

Entries are proportions of matched pairs with similar or dissimilar college attendance by 1994 (roughly age 20).
N = 275 pairs

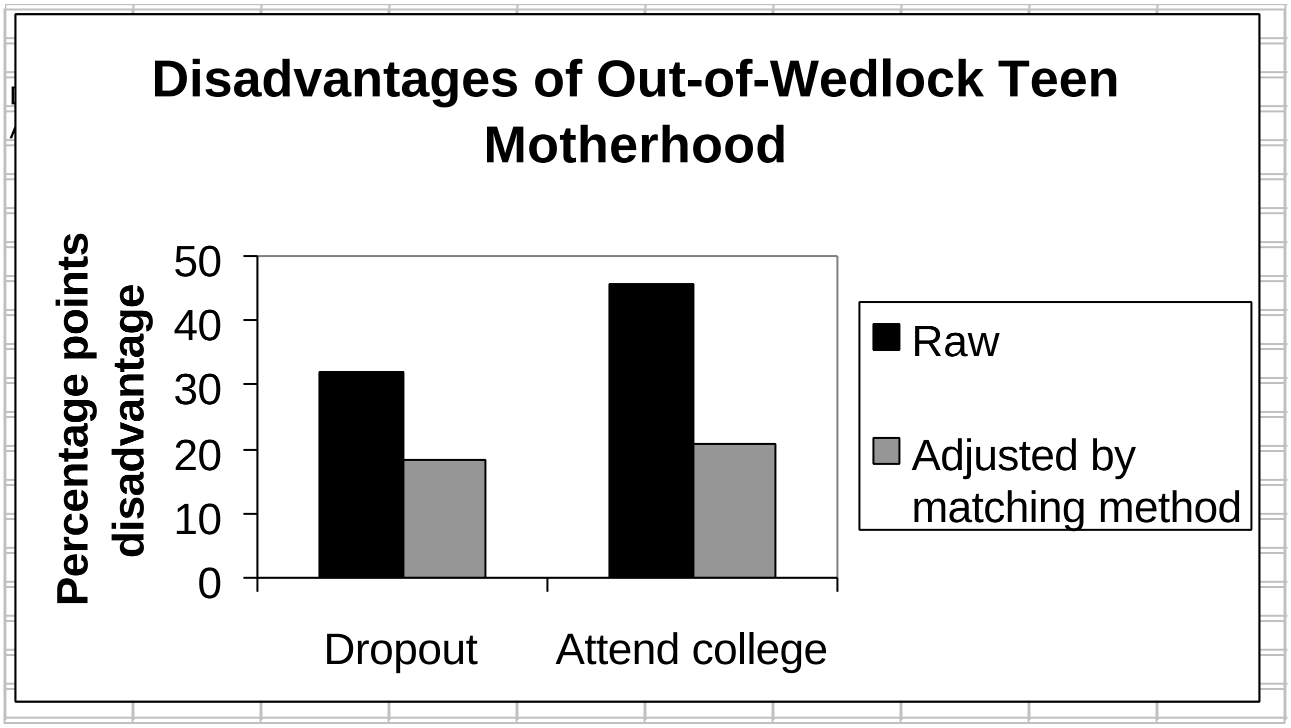
	Young women who would not soon become unwed mothers (Matched control group)	
Mothers-to-be (treatment group)	Did not attend College	Attended College
Did not attend College	0.277	0.127
Attended College	0.262	0.335

Proportion attending college

		[95% conf. interval]		
Teen mothers	.404			
Matched Controls	.611			
Difference	-.207	-.287	-.127	
Ratio	.661	.562	.777	
Odds ratio	.380	.250	.567	(exact)
McNemar's ?^{2}(1)	25.58 **			

See notes to table 5A.

Figure 1



Disadvantages of Out-of-Wedlock Teen Motherhood
Percentage points disadvantage
50
40
30
20
10
0
Dropout
Attend college
Raw
Adjusted by matching method

References

Bassuk, Ellen L., Angela Browne, and John C. Buckner, Single Mothers and Welfare,@ *Scientific American*, October 1996, pp. 60-67.

Chamberlin, G. (1980): AAnalysis of Covariance with Qualitative Data,@ *Review of Economic Studies*, 47, pp. 225-238.

Dehejia, Rajeev and Sadek Wahba, APropensity Score Matching Methods for Non-experimental Causal Studies, NBER Working Paper No. W6829, December 1998.

Geronimus, Arline T; Korenman, Sanders. "The socioeconomic costs of teenage childbearing: Evidence and interpretation." *Demography*, 30, 2 (May 1993): 281-290.

Geronimus, Arline T.; Korenman, Sanders. "The Socioeconomic Consequences of Teen Childbearing Reconsidered," *Quarterly Journal of Economics*, 107, 4 (Nov 1992):1187-1214.

Hoffman, Saul D; Foster, E Michael; Furstenberg, Frank F Jr., "Reevaluating the costs of teenage childbearing." *Demography*, 30, 1 (Feb 1993): 1-13.

Hoffman, Saul D; Foster, E Michael; Furstenberg, Frank F Jr., "Reevaluating the costs of teenage childbearing: Response to Geronimus and Korenman." *Demography* 30, 2 (May 1993): 291-296.

Hotz, J., C. Mullin, and S. Sanders (1997): "Bounding Causal Effects Using Data from a Contaminated Natural Experiment: Analyzing the Effects of Teenage Childbearing," *Review of Economic Studies*; 64(4), 575-603.

Jencks, C.. and P. E. Peterson (1991), eds., *The Urban Underclass*, Brookings, DC.

Painter Gary, and David I. Levine, AFamily Structure and Youths= Outcomes: Which Correlations are Causal?@ *Journal of Human Resources*, forthcoming

Rosenbaum, P. and D. Rubin, AThe Central Role of the Propensity Score in Observational Studies for Causal Effects,@ *Biometrika*, 70, 1983, 41-55.

Stata, *Stata Reference Manual Release 6*, College Station TX, 1999.

Sylvester, Kathy, *Teenage Pregnancy a Preventable Calamity*, Progressive Policy Institute Policy Report, Washington DC, November 1994.[http://www.dlcppi.org/texts/social/teenpreg.txt]

U.S. Department of Health and Human Services, "Fertility, Family Planning, and Women's Health: New Data From the 1995 National Survey of Family Growth," Vital and Health Statistics Series, 23(19) [DHHS Publication No. (PHS) 97-1995], (June 1997). http://www.cdc.gov/nchswww/data/ sr23_19.pdf.

U.S. General Accounting Office [GAO], *Teen Mothers: Selected Socio-Demographic Characteristics and Risk Factors*, Letter Report, 06/30/98, GAO/HEHS-98-141, 1998.

Wolfe, Barbara, Karen Pence, and Robert Haveman, AYouth Responses to Expected Income and >Relationship= Consequences in Nonmarital Childbearing Choices: Are Youths Rational?@ University of WisconsinBMadison, 1999.