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LABOR MARKET OUTCOMES AND WELFARE PARTICIPATION OF TEEN MOTHERS: EVIDENCE FROM GEORGIA

BY

DJESIKA DJATUGBE AMENDAH

A Dissertation Submitted in Partial Fulfillment
of the Requirements for the Degree
of Doctor of Philosophy
in the Andrew Young School of Policy Studies
of Georgia State University

GEORGIA STATE UNIVERSITY
2007

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ACCEPTANCE

This dissertation was prepared under the direction of the candidate's Dissertation Committee. It has been approved and accepted by all members of that committee, and it has been accepted in partial fulfillment of the requirements for the degree of Doctor of Philosophy in Economics in the Andrew Young School of Policy Studies of Georgia State University.

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ABSTRACT

LABOR MARKET AND WELFARE PARTICIPATION OF TEEN MOTHERS: EVIDENCE FROM GEORGIA

By

DJESIKA DJATUGBE AMENDAH
AUGUST, 2007

Committee Chair: Dr. Erdal Tekin

Major Department: Economics

This dissertation explores the effect of teen childbearing on the adult mother's employment, earnings and welfare participation. This study contributes to the literature on the consequence of teen childbearing by relying on original datasets and using an array of samples and econometric methods to test the robustness of the results. We use state administrative data from several sources including the Georgia subset of the Vital Statistics for the years 1994-2002, the Wage and Employer files for the years 1990-2003, and the Welfare dataset for the years 1990-2005. We select three samples. The first sample is constructed with sisters raised in families on welfare, where one sister is a teen mother and the other a non-teen mother. The second sample is composed of young mothers who were pregnant as teens and whose first pregnancy ended with either a birth (teen mothers) or a fetal death (non-teen mothers). A third sample is selected by the propensity score matching technique on a subset of the second sample.

For the labor market outcomes, this study suggests that teen childbearing has a negative effect on the employment and earnings of Blacks in the miscarriage sample and in the propensity score sample. However, white teen mothers are more likely to be

employed and to earn more than the white non-teen mothers in the miscarriage sample. In contrast, the sisters' sample does not show any statistical significant effect of teen childbearing on employment or earnings. These mixed results are probably due to the different distribution of the mothers' race and socioeconomic status before pregnancy. Concerning welfare receipt, very few mothers in the sisters' sample and no mothers in the propensity score sample receive welfare during the years of study. For the miscarriage sample, white teen mothers are less likely than the white non-teen mothers to receive welfare at any time. Blacks become less likely to receive welfare as their child's age increases. The effect on Blacks might be due to the welfare reform that tightened the rules for welfare eligibility.

This research suggests that preventing teenage childbearing in the Black and the low income populations may be improve the women's labor market outcomes examined. However, the small magnitude of the teen coefficients suggests that teen pregnancy prevention will not have a dramatic influence on the adult mothers' standards of living. As for welfare participation, teen mothers are no more likely to rely on public assistance than non-teen mothers so their welfare dependence should not be a concern.

I. INTRODUCTION

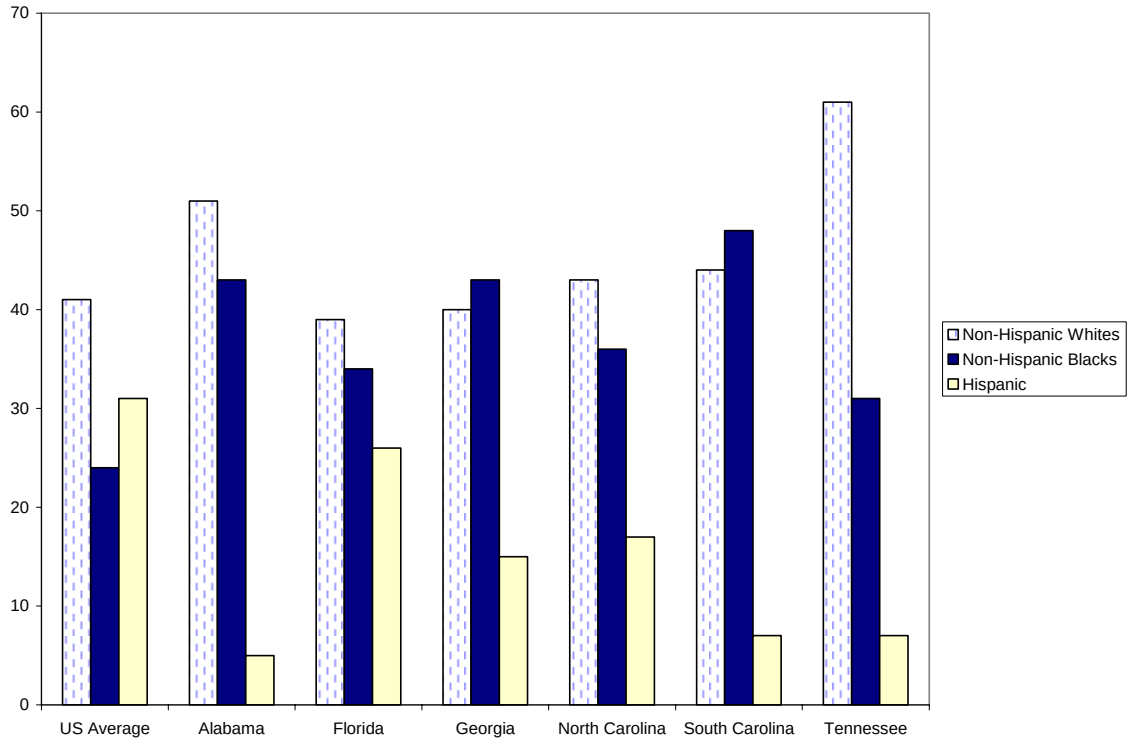
The United States has the highest rate of teenage childbearing among the industrialized countries, even though this rate has been declining in the last decade. In the mid-1990s, the birth rate per 1000 adolescents aged 15-19 was 54.4 in the U.S. but only 24.2 in Canada, 7.7 in Sweden, and 4.0 in Japan (Singh and Darroch 2000).

Evidence suggests that teenage childbearing is a life-altering event associated with substantial negative consequences for the mothers, the children, and the government. For instance, the poverty rate of women who were teen mothers exceeds the national average, even for former teen mothers who are working (Maynard 1997). Children born to teenage mothers are more likely to have a low birth weight, repeat a grade, perform poorly on standardized tests, and be abused or neglected (Moore, Ruane Donna Morrison, and Dungee 1996). Daughters of teenage mothers are more likely to bear children as teenagers (Haveman, Wolfe, and Peterson 1996), and the sons of teenage mothers are more likely to be imprisoned than other men born to non-teen mothers (Grogger 1996). Furthermore, 52% of female heads of households, who received public cash assistance in 1992 have been teenage mothers (cited by (Hotz 1996))**.** The welfare dependence of women heads of households, among other reasons, paved the way for the welfare reform that was enacted in 1996. This welfare reform, formally known as the Personal Responsibility and Work Opportunity Reconciliation Act (PRWORA), intends to reduce welfare dependence, out-of wedlock and teenage childbearing, and increase employment among the low-income population.

In this study, we explore how teenage childbearing impacts the mother's subsequent employment, earnings, and welfare participation. This research uses data

from the state of Georgia, which has a high rate of teenage childbearing. For instance, in 2002, the teen birth rate per 1,000 girls aged 15-19 was 56 in Georgia, while the national average was 43. Although the rates in Georgia seem high compared to the national average, they fall in the range observed in other neighboring states (The National Campaign to Prevent Teen Pregnancy Proportion of teen births by race/ethnicity 2002) (henceforth NCPTP).[1] Figure 1 shows the distribution of teen births by race and ethnic background in selected states.

Figure 1 Percentage of Teen Birth by Race and Ethnicity in Selected States, 2003

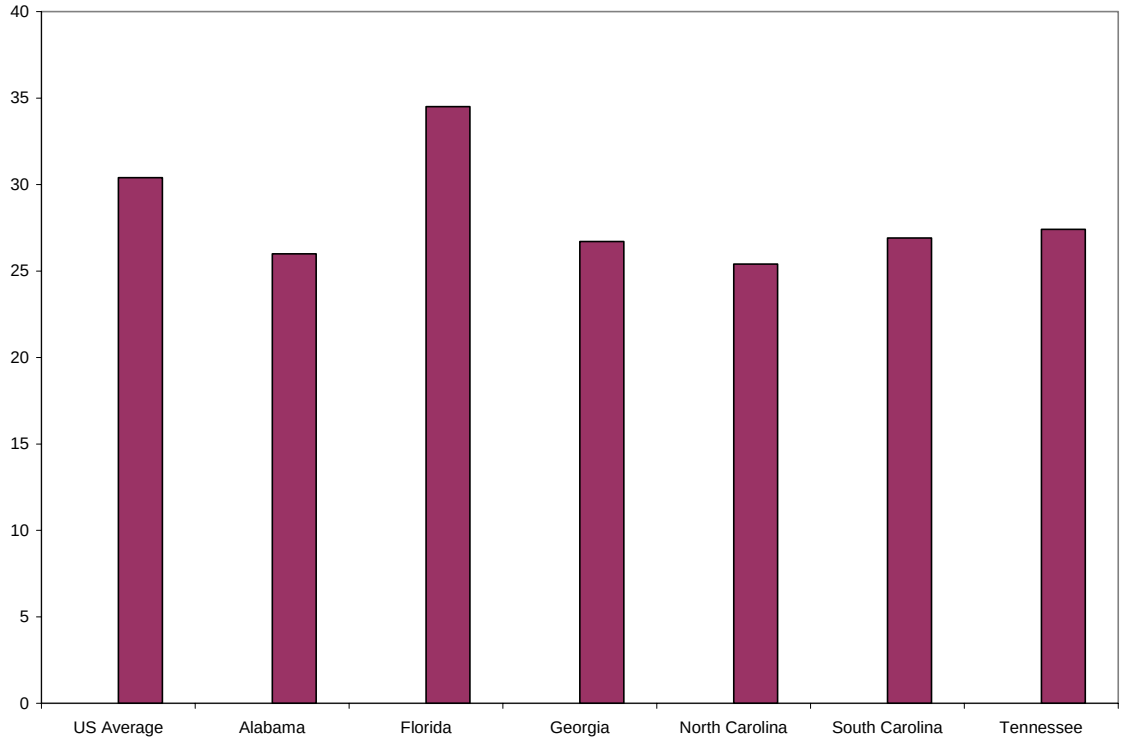


Source: The National Campaign to Prevent Teen Pregnancy

[1] See http://www.teenpregnancy.org/america/statisticsDisplay.asp?ID=4&sID=43 (accessed on 5/9/2007) for more detail.

Between 1991 and 2002, the rate of births to teenage mothers in the U.S. has declined by 30% but in Georgia the decline has been 27%, less than the national average. The change in birth rate in Georgia is similar to that of its neighbors excepted Florida where the rate of teen childbearing decreased by 35%, more than the national average (NCPTP (Change in teen birth rates by race/ethnicity 2002).

Figure 2 Change in Teen Birth Rates per 1000 Girls aged 15-19 in Selected States, 1991-2002



Source: The National Campaign to Prevent Teen Pregnancy[2]

[2] See http://www.teenpregnancy.org/america/statisticsDisplay.asp?ID=4&sID=42 (accessed on 5/9/2007)

A tabulation by ethnicity shows that while the teenage childbearing rate for women of Hispanic descent aged 15-19 fell by 18% between 1990 and 2003 in the U.S., this rate actually increased in Georgia by 109% (Change in teen birth rates by race/ethnicity 2002).[3]

This dissertation uses data from several sources including the Georgia subset of the Vital Statistics collected by the Centers for Disease Control and Prevention for the U.S. (1994-2002), the Wage and Employer files (1990-2003) from the Department of Labor, and the Welfare dataset (1990-2005) from the Department of Human Resources. The administrative datasets pertain to the population of Georgia and contain a large number of observations. Compared to survey data, they are more accurate since the information is not completely self-reported. Unfortunately, the administrative data lack the extensive and updated background information on the individuals which is available with survey data. We merge the four administrative datasets and select three samples. The first sample is constructed with sisters raised in families on welfare, where one sister is a teen mother and the other a non-teen mother. The second sample is composed of young mothers who were pregnant as teens and whose first pregnancy ended with either a birth (teen mothers) or a fetal death (non-teen mothers). A third sample is selected by the propensity score matching technique on a subset of the second sample. Further description of the data is provided in Chapter 3.

This study contributes to the existing literature by using original administrative datasets, several different samples, and panel data techniques to test the robustness of the results. To the best of our knowledge, this has not been done before. The results from this

---

[3] This might be related to the large influx of Hispanic immigrants in Georgia. The state's total population increased by 26.4% between 1990 and 2000 according to the Census Bureau.

study add to the ongoing debate on the consequences of teenage childbearing and offer useful insights for policy makers in Georgia and in states facing similar policy concerns.

This dissertation is organized as follows. Chapter 2 presents the literature review and introduces the theoretical model. Chapter 3 presents the data, the empirical methodology and estimation. Chapter 4 presents the results and discusses them, and Chapter 5 concludes. The appendixes pertain to the limitations of the data and the technical background for data processing and the complete tables of the econometric results.

II. LITERATURE REVIEW

The literature review draws from three bodies of research: the consequences of teenage childbearing on the adult mothers' outcomes, the labor market outcomes of youth and women, and the effect of welfare on out-of-wedlock childbearing and mothers' labor supply.

Consequences of Teenage Childbearing

Most of the literature on teenage pregnancy/childbearing considers a woman who first gives birth before the age of eighteen as a teenage mother. We adopt this convention. Research literature in the 1970s and 1980s suggests that teenage childbearing significantly reduces young mothers' subsequent educational attainment, probability of marriage, and family income, while increasing their probability of receiving welfare support. See Bronars and Grogger (1994), Geronimus and Korenman (1992), for a review. These severe costs of teen childbearing have been estimated using cross-section analyses. From the early 1990s, however, "revisionist" studies argue that earlier estimates overstate the consequence of teen childbearing because of methodological issues. These earlier estimates are obtained with regression methods that control for observed characteristics, but fail to account appropriately for heterogeneity in the population of mothers. Teenage childbearing is not randomly distributed across the general population of young women; rather, teen mothers are more likely to have been raised by single mothers. Besides, unmarried teen mothers' parents are more likely to have a lower education attainment and a lower income (An, Haveman, and Wolfe 1993).

Revisionist studies of the costs of teenage childbearing use family fixed effects, and natural experiments to control for the endogeneity of teen childbearing. Geronimus and Korenman (1992) compare socioeconomic outcomes of sister pairs, one a teen mother and the other a non-teen mother. By so doing, they control for unobserved family effects. Their study uses three survey datasets, namely, the National Longitudinal Survey Young Women's Sample (NLSYW), the Panel Study of Income Dynamics (PSID) (including the Survey of Economic Opportunities with oversampling of minority and disadvantaged), and the National Longitudinal Survey Youth Sample (NLSY). The authors analyze income, educational attainment, employment status, and marital status. First, they compare teen mothers to all mothers in the sample, then they include the mothers' family backgrounds and finally, they compare teen mothers to their sisters who are not teen mothers. When teen mothers are compared to all other mothers controlling only for race, age, and urban/rural living area, substantial differences appear between the outcomes of the teen mothers and the non-teen mothers. But when family backgrounds are added (parents' education and family structure), the difference decreases, and it decreases even further when pairs of sisters are compared. Thus, family characteristics are important determinants of teenage childbearing. This sister study, however, presents a shortcoming — the results are different across the three datasets used. The authors attribute the variation in the results to the differences in the survey sampling and the small sample size of some analyses. The number of observations in their paper ranges from 258 to 680, but the sisters' sample sizes decrease considerably for some outcomes. For example, the analysis of welfare receipt for the sisters' sample is based on 19 pairs of sisters in the PSID dataset.

Grogger and Bronars (1993) exploit the birth of twins as a natural experiment to evaluate the consequences of teenage childbearing on the mothers' labor force participation, fertility, probability of marriage, and welfare participation in the short run (children aged 0 - 3 years) and in the long run (children aged 10-13 years). The comparison at the children's different ages allows the authors to analyze life cycle effects. Twin birth at the mother's first childbearing occurs randomly—i.e. one of the babies is unexpected at the time of conception. Thus, by comparing mothers of twins to mothers of singletons, researchers can estimate the cost of an unplanned child on the mothers' socioeconomic outcomes. Using the 1970 and 1980 Census data, they find that early childbearing consequences differ by race: white teenage mothers have a subsequent higher fertility than black mothers, while black teenage mothers have significantly less chance of getting married later on in life. Although the birth of twins decreases the probability of labor force participation of all mothers in the short run, this effect is persistent only for black mothers from the earlier cohort. In addition, early childbearing increases black mothers' probability of receiving welfare and being poor in the long run.

The same authors (Bronars and Grogger 1994) again use twin births to examine the consequences of premarital childbearing on all mothers (and not only teenagers). They conclude that twin birth has a negative effect on labor-force participation, poverty status, and welfare receipt of unmarried mothers, but not on married mothers. Note that unmarried childbearing's consequences on labor market outcomes differ by race. For whites, the negative consequences are substantial in the short run but smaller in the long run, while these negative impacts are persistent for blacks. Overall, the consequences of unwed motherhood are smaller than previously calculated. However, the authors

acknowledge that their results are conservative because of the potential non-linearity of the costs of children: an additional child may be less costly to a mother than to a childless woman.

Hotz et al. (1996, 1999) use the occurrence of a miscarriage as an instrumental variable to assess the impact of teenage childbearing on the mothers' subsequent labor market outcomes and welfare participation. A pregnancy can end in a birth, a miscarriage, or an abortion. By comparing teen mothers to other women who have been pregnant as teens but whose first birth was delayed either by a miscarriage or an abortion, researchers can estimate the cost of teenage childbearing while controlling for self-selection into teen motherhood. This self-selection occurs in two steps: the first one relates to teen pregnancy (not all teenagers become pregnant), and the second regards childbearing (all pregnant women do not carry their pregnancy to term). Women who have been pregnant as teens and have had either a miscarriage or an abortion constitute a good counterfactual group for teen mothers under the assumptions that all miscarriages are random, all fertility events are correctly reported, and both miscarriage and abortion have the same effect on outcomes. In addition, the miscarriage event constitutes an appropriate instrumental variable to teen childbearing because it is correlated with teen pregnancy but not with the adult woman's socioeconomic outcomes. Hotz et. al use NLSY data with a sample size of 1042 young women who were pregnant as teens. Among these, 778 became teen mothers while 264 of the women had a first birth that was delayed either by a miscarriage (N=72) or an abortion (N=192). The authors find that teenage childbearing does not have a persistent effect on labor market activity although it rearranges its timing. Between the ages of 26 and 34 years, teenage mothers actually earn

significantly more than non-teen mothers. Through the age of 34 years, teenage mothers are no more likely to receive public assistance than those who have delayed birth. By age 34, teenage mothers are as likely as non-teenage mothers to have finished high school with a General Equivalency Diploma (GED) rather than standard high school diploma. The persistent negative outcomes for the teenage mothers are their subsequent higher fertility and the lower prospects of marriage. The magnitudes of these effects however, are not large.

The revisionist results of small negative and mitigated effects of teenage childbearing on adult outcomes have come under criticism. Furstenberg (1991) acknowledges the phenomenon of self-selection into teenage childbearing and concludes that teenage mothers may be able to "salvage" their life later on. Nonetheless, he insists that teenage mothers might still be better off by delaying their first birth. Hoffman (1998) questions some methodological aspects of the revisionist studies that may bias their estimates downward. For instance, Geronimus and Korenman's (1992) paper uses a small sample of co-residing pairs of sisters. The results based on sister-pairs are skewed toward large families with at least two daughters. Besides, these sisters may not be representative of all the sisters of the teen mothers. Maybe only the least successful stay home with their biological parents. As for the study based on twin births by Grogger and Bronars (1993), the existence of economies of scale in childrearing may understate the estimates. The miscarriage-based study by Hotz et al. (1996) presents three types of potential problems: a small sample size, contamination of the treatment group (one third of the counterfactual group ended up having their first child before the age eighteen), and concerns about the accuracy of self-reported data on abortion and miscarriage. According to Hoffman

(1998), national data reveals that about 40% of teenage pregnancies end in abortion and 12% in miscarriage, while in this dataset only 25% of teenage mothers have had an abortion and 7% a miscarriage. Moreover, a miscarriage postpones a birth for three to four years on average in this sample. In reality, the delay can be as short as three to four months. Later, Hoffman (forthcoming) in a re-estimation of the miscarriage study finds that other issues with data construction, variable coding and earnings scaling mar the results found by Hotz et al. (1996). Overall, Hoffman (1998) concludes that even if teenage childbearing costs are smaller than previously estimated, they may not be small in absolute terms.

Wallace (2002) uses the baseline estimates obtained from existing studies to evaluate the cost of teenage childbearing in Georgia. She uses administrative data and computes the total cost net of payments made by the mothers. These costs are borne by the mothers, the children, the fathers of the children, and the government. She finds that had the teenage mothers delayed the first childbearing till the age of twenty or twenty-one, they would have saved society on average $38 to $60 million a year, mainly in the potential costs of incarceration of boys born to teen mothers.

This dissertation uses the same Georgia administrative data as Wallace (2002). The Vital Statistics are more accurate than the survey data in terms of reproductive health outcomes and usually serve as a baseline for comparison. See Hotz, Sanders and Williams (1999); Grogger and Bronars (1993); Hoffman (1998). Furthermore, the data used in this study are more recent than those used in previous research. Using more current data is important because the welfare reform of 1996 and the deterioration of the labor market of low-skilled workers changed the policy environment substantially.

Therefore, making inferences on the post-reform environment using pre-reform data may not be appropriate.

Employment of Youth and Women

Labor market analysis usually focuses on employment, unemployment, and those out of the labor force. Economists define unemployment as a condition where individuals aged sixteen or older are available for work and are actively seeking work, but are not currently employed. Clark and Summers (1979) argue that this definition of unemployment is different from the survey respondents' understanding of it and this may lead to bias in the labor market analysis. Therefore, research should distinguish only between employment and nonemployment. Rees (1986) reinforces this conclusion by explaining that for young people, the difference between being unemployed and out of the labor force is not well measured. A point in case is that (un)employment rates are different across the National Longitudinal Survey and the Current Population Survey. Hence, Rees (1986) examines youth joblessness or nonemployment rather than unemployment. The binary categories—employment and nonemployment—have been used to analyze women's labor market attachment as well. Corcoran (1982) uses this classification with the NLSY data to investigate the subsequent employment and wage consequences of teenage women's nonemployment. Young women aged 14-24 were interviewed between 1968 and 1973 and again in 1975. The analysis is restricted to women with less than fourteen years of education although the author acknowledges that this might introduce a selection bias because education is a strong predictor of women's labor supply. She finds that early labor market experiences persisted even beyond

adjacent years implying a large opportunity cost of work that appear, later in the form of lower wages. These studies offer useful results because they concentrate on the work and nonwork analysis of youth and women. However, they are based on data collected three to four decades ago on women born as early as 1947, and who have experienced the labor market conditions of the 60s and 70s. The economic environment has considerably changed in the last three to four decades.

Welfare and Mother's Labor Supply and Teen Childbearing

This section concerns the impact of welfare on the mothers' labor supply and teen childbearing as well as the impact of the welfare reform of 1996 on those two outcomes.

Impact of Welfare on Mothers' Labor Supply and Teen Childbearing

The welfare cash assistance program previously known as Aid to Families with Dependent Children (AFDC) grants cash to mothers/families with children, and thus loosens the recipients' income constraints. Extended literature explores the effects of welfare programs on women's labor supply and reproduction. We present here some elements relevant to this research.

Moffitt (1992) reviews the incentives of the welfare program on the recipients' labor supply. He finds that among the female case heads, only a small percentage work and their earnings are low. This indicates not only that work and welfare tend to be substitutes but also that working women are paid at the minimum wage or below. Participation in the welfare program increases with age, lower education, poorer health,

greater disability, and greater numbers of children. Conversely, the exit rates from welfare are larger for mothers with higher wages, education, and nontransfer or non-wage income. Besides, most exits from the welfare rolls are related to changes in family structure rather than changes in hours of work or earnings.

The expansion of the welfare cash assistance programs over the last four decades coincides with an increase in out-of-wedlock childbearing prompting researchers to investigate a possible causality link. Akerlof, Yellen, and Katz (1996) review the literature on the effect of the welfare program on unmarried childbearing. Becker (1981) using the rational choice model affirms that the very existence of the welfare program reduces the cost of children to mothers and thus should increase out-of-wedlock childbearing. Murray (1984) credits the rise of out-of-wedlock childbearing to changes in welfare incentives, and Wilson (1986) attributes it to job availability.[4] For Akerlof, Yellen, and Katz (1996), none of the preceding theories completely explain the rise of out-of wedlock births across time and races. The authors instead offer an alternative explanation based on a theory of technological shock.[5]

Murray (1984) also reviews the literature of the impact of welfare on unmarried childbearing in the U.S.[6] Duncan and Hoffman (1990) using the PSID to study the effect of welfare on teen childbearing, find that the welfare program bears a modest but insignificant positive effect, while future economic opportunities have a larger and statistically significant negative effect. Plotnick (1990), Lundberg and Plotnick (1990),

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[4] We rely on Akerlof, Yellen, and Katz's (1996) review for the Murray (1984) and Wilson (1986) papers.
[5] The new technologies of contraception and abortion change the bargaining powers between men and women and penalize women who fail to master them. Premarital sex is expected more widely because women should know how to prevent unplanned pregnancies and save men from the parental responsibility for an unplanned child. Women who do not master the contraception or abortion process and those who want children lose out because they are unable to force the men to marry them when they are pregnant.
[6] We rely on his review and we did not assess the individual papers.

find that welfare has a significant and positive effect on the out-of-wedlock childbearing for white women but not for black women. For black women, neither the opportunity cost theory nor welfare dependency seems to fit the data. Ozawa (1989) claims that AFDC is significantly related to the ratio of out-of-wedlock births to all births for all women. When she disaggregates data by race, she finds that the welfare effect is positive and significant for white women but negative although insignificant for black women. As for Ellwood and Bane (1985) they find no relationship between welfare and out-of-wedlock childbearing. In his own analysis, Murray (1993) finds that the state size and the degree of urbanization increase unmarried childbearing, whereas the size of the minority population in the area where the women live bears a strong negative effect. He offers a supplemental hypothesis: the welfare package enables poor single women to afford children. This is different from the view that the welfare program induces poor single women to bear children by lessening the penalties of out-of-wedlock babies. For Murray (1993) the welfare program makes an intrinsically desirable event possible.

To sum up the above cited studies in this section, the welfare effect on unmarried childbearing is mixed and differs by race. These results are useful for this study because they offer also some explanatory variables that may explain teen mothers' welfare recipiency. Besides, if the welfare program positively influences teenage childbearing, we expect to find that teenage mothers rely more on welfare than non-teen mothers.

Impact of Welfare Reform on Mothers' Labor Supply, and Teenage Childbearing

In 1996, the federal government enacted a profound modification to the welfare program. The change of the welfare program's name from Aid for Families with

Dependent Children (AFDC) to Temporary Assistance for Needy Families (TANF) conveys the intent of the law. It aims to make public assistance temporary by moving welfare recipients into work. To achieve its goal, welfare reform has modified the funding rules for states and individuals. The states now receive a block grant instead of a matching grant and have more autonomy in setting the welfare rules at home. The recipients now face a federal lifetime limit of sixty months, and the obligation of work activity for beneficiaries who have been on welfare for two years.[7] The accepted work activities may be paid, unpaid or subsidized employment, up to 12 months of postsecondary or vocational training and six weeks of job search **(**Zidlewski 1999 **).** Welfare reform contains specific provisions concerning teenage mothers. They have to stay in school and live with an adult in order to be eligible for cash assistance.

In Georgia, welfare reform was implemented in January 1997, and the lifetime assistance is restricted to four years, a year less than the federal limit.[8] By state law, school attendance is only mandatory for children between their "sixth and the sixteenth birthday,"[9] but a teenage mother has to stay in school past her 16th birthday (until graduation from high school) while living with a relative if she is to receive cash assistance.[10] Assistance received as a minor does not count toward the lifetime limit of four years. Additionally, welfare recipients are subject to work requirements from the day they start welfare. The work activities requirements are similar to those of the federal

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[7] A provision allows states to provide help to some individuals after they have exhausted their 60-month limit. However, these persons should not represent more than 20% of the state's caseload.
[8] The Georgia reform took place in January, 1997, so that in January, 2001, those who reached the time limit were let out of the public cash assistance rolls.
[9] Code Ann. § 20-2-690.1
[10] The living condition requirement is waived if the Department of Human Resources (DHR) determines that it would be detrimental to the child or the young mother-parent to abide by this requirement. The school requirement is waived when the newborn is under the age of twelve weeks.

government, but the postsecondary education period is extended for more than twelve months (State Policy Documentation Project 2005). The work requirement is waived if the child is under the age of one year and is the first the mother bears while being on welfare. Nevertheless, by the time a welfare recipient has received two years of cash assistance, she must be working at least twenty hours a week. (See Table 1 for the institutional constraints for school and welfare.) Thus in the post-welfare reform era, work and welfare are not mutually exclusive.

Several years after the welfare reform of 1996, Blank (2002)reviews the literature on the reform's effect on women's labor force and welfare participation. She explains that multiple policy changes were implemented concomitantly with the reform of the AFDC. The most notable of the policy changes are the expansion of the Earned Income Tax Credit (EITC), the increase of the minimum wage in 1997, and the modification of child support rules. Moreover, the U.S. economy was then in expansion. This conjunction of events has a positive impact on women's labor supply and makes it difficult to pinpoint the specific effect of the welfare reform. Nonetheless, the research literature suggests that single mothers' labor force participation increased by 10% between 1994 and 1999. For single mothers with children under the age of six, this increase is about 5%. Moreover, the welfare caseload decreased considerably during the 1990s, and the economic expansion alone cannot be held responsible for such a decrease. The policy changes, among them the welfare reform, can be partly credited for the increase in labor force participation and the decrease in welfare caseloads.

While Blank's (2002) study concerns the entire United States, Smith (2002) focuses his research on Georgia. He investigates the effects of family structure, in

addition to individual and neighborhood characteristics, on full-time employment and welfare recidivism for women who have been receiving public cash. He uses administrative data and finds that child care availability increases the probability that a welfare mother works and welfare recidivism increases with the presence of young children and elderly parents. The neighborhood effect differs by race and geographic location.

This study uses the same wage and welfare data as Smith (2002) but supplements them with other administrative datasets. It contributes to the general knowledge of the effect of welfare on labor supply, and provides Georgia as a case study.

Theoretical Model

We use a theoretical basic labor-leisure framework to examine the work and earnings of mothers. In this model, a mother maximizes her utility under the constraints of institutional settings and income. This basic model is supplemented by a welfare stigma model for mothers who qualify for welfare (Moffitt 1983). In this theoretical framework, the choice variables are the hours of work and welfare participation for eligible mothers. Participation in the welfare program is endogenous to the model.

Utility Function and Constraints

When the mother is not eligible for welfare, she maximizes her utility

$$U(hw, Y) \qquad (1)$$

with $\{U, Y, hw\} \geq 0$. U is the utility function, h_w is the number of hours worked, and Y is private income. The derivative of U with respect to h_w, is assumed to be negative ($(\delta U/\delta h_w) < 0$), and the second derivative is expected to be positive ($(\delta^2 U/(\delta h_w)^2) > 0$). When the mother is eligible for welfare, she maximizes a utility function

$$U(h_w, Y+PB) - \Phi P \qquad (2)$$

where P is a binary indicator for welfare participation, and B is the benefit from welfare. The Φ indicates the stigma and other non-monetary costs borne by the mother on welfare. The private income constraint is the same whether the mother is on welfare or not.

$$Y = w\, h_w + N, \qquad (3)$$

where w is hourly wage, and N is non-wage income. The hourly wage is a given to the employee but represents a function of her human capital, education, and experience. The non-wage income of the young mothers can be their own parents' support, or the child support paid by the child's father. The public source of income constraint is valid only for the mothers who qualify for welfare:

$$B = G - t\, w\, h_w, \qquad (4)$$

where G is the guaranteed level net of marginal tax on non-earned income, and t is the marginal tax rate.

Solutions to the Utility Maximization

The solutions are derived with the unconstrained utility function. In the non-welfare case, substituting the constraints (3) into the utility function (1) yields:

$$U(h_w, w\, h_w + N) \qquad (5)$$

Taking the derivative with respect to h_w to maximize the utility yields:

$\delta U/\delta h_w = U_1 + w\ U_2 = 0$ or

$$- U_1/U_2 = w \qquad (6)$$

For mothers who qualify for welfare, substituting the constraints (3 and 4) into the utility function (2) yields:

$$U\ (h_{w,}\ w\ h_w + N + (G\text{-}t\ w\ h_w)\ P) - \Phi\ P \qquad (7)$$

Taking the derivative with respect to h_w to maximize the utility:

$$\delta U/\delta h_w = U_1 + w\ U_2 - (t\ w\ U_2)\ P = 0 \qquad (8)$$

and solving it gives the optimal h_{w*} with

$$- U_1\ /U_2 = w\ (1\text{-}tP) \qquad (9)$$

If the mother receives welfare, P=1 and the result (9) becomes

$$- U_1/U_2 = w\ (1\text{-}t) \qquad (10)$$

Otherwise, P=0 and the result (9) becomes

$$- U_1/U_2 = w \qquad (11)$$

The determination of P is best handled by the indirect utility function when the optimal amount of hours of work $h_{w*,}$ is plugged into the income and benefit constraints to get the optimal income Y* and benefit B*. Both Y* and B*are substituted into the utility function and this gives:

$$U\ (h_w\ (P),\ Y^*B^*P)\text{-}\Phi P = V\ (P,\ w\ (1\text{-}\ t\ P),\ N + GP) \qquad (12)$$

Replacing P by 1 and 0 and taking the difference of the indirect utility function gives P* and the mother participates in the welfare program only if P*> 0

$$P^* = V\ (1,\ w\ (1\text{-}t),\ N+G) – V\ (0,\ w,\ N) \qquad (13)$$

h_{w*} =0 corresponds to a corner solution and occurs for the mother when paid employment is not relevant.

The effect of teenage childbearing is indirectly accounted for in this model through its impact on the exogenous hourly wage, w. At the time of the first birth and during the following few years, teenage mothers are likely to be less educated than non-teen mothers and this low education level may reduce their hourly wage. On the other hand, teenage mothers may accumulate more labor market experience relative to non-teen mothers and this additional experience may increase their hourly wage. Thus, the final effect of teenage childbearing on hourly wage is ambiguous during the first few years following the birth of their first child.

III. DATA, EMPIRICAL METHODOLOGY AND ESTIMATION

This section describes the administrative datasets available as well as the samples used for this study and some data processing. Additional data processing information can be found in the appendixes.

Datasets

This study combines four Georgia administrative datasets housed in the Fiscal Research Center of Andrew Young School of Policy Studies, Georgia State University. The birth and welfare datasets were compiled by the Georgia Department of Human Resources, and the wage and employer datasets were compiled by the Department of Labor.

The birth dataset is the Georgia subset of the Vital Statistics collected by the Centers for Disease Control and Prevention for the U.S. The Vital Statistics data cover the period 1994-2002 and contain some demographic, medical, and behavioral information on the newborn and his/her parents. In particular, this dataset includes information on the child's sex and weight at birth, the parents' race, ethnicity, and educational attainment at the time of the child's birth, and the mother's previous fetal death and abortion events.

The welfare dataset contains individual and household level information on the recipients. Specifically, it contains self-reported demographic information (obtained from the application forms) and administrative updates added by the Department of Human

Resources.[11] The demographic variables of interest here are the mothers' date of birth and their family structure. The family structure helps identify siblings and the relationships between the head of household and the young mother. The administrative information concerns individual and case identifiers, eligibility status of each member of the household, and the benefits received. The welfare data cover the period 1990-2005 and contain quarterly information.

The wage dataset is compiled from the "employers' quarterly reports and tax payment" and provide the employee's identifier, her quarterly income, and an identifier of her employer. The employer dataset, known as ES202, includes an identifier of the employer and the industry of its activity. The wage and employer quarterly reports are merged through the employer identifier. These quarterly reports are mandated by the federal government for unemployment insurance purposes and in the U.S. they cover more than 96% of the total wage and non-military jobs. The uncovered workers are the self-employed, the informal sector workers, and the seasonal agricultural workers on small farms.[12] Agricultural employers are not subject to the unemployment insurance laws if they offer paid employment less than twenty weeks a year or if their quarterly payroll does not exceed $20,000. Since these data pertain only to Georgia, employees who work outside the state are not represented here. The wage data cover the years 1990-2003.

All four datasets (Vital Statistics, Welfare, Wage and Employer) represent administrative data of the population of Georgia and are linked by the social security

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[11] See http://domestic.gsu.edu/gadp/index.html (accessed on 5/1/2007) for more detail.

[12] See http://www.dol.state.ga.us and http://www.bls.gov/opub/hom/homch5_b.htm (accessed on 5/1/2007) for more information.

number of the mother. These combined datasets contain a very large number of observations, and are deemed highly accurate because they do not rely much on self-reported information. These administrative data, however, lack extensive background information on the individuals.

Three samples are extracted from the combination of datasets. Sample One is composed of sets of two or three sisters, at least one teenager, and one non-teen at the birth of their first child. Sample Two is constituted by teen mothers and older mothers who have had a miscarriage as a teen. Sample Three is selected from Sample Two, through a propensity score matching technique. Across the three samples, all women meet these three conditions: (1) Giving birth to a singleton first born, (2) being single at the time of the delivery, and (3) having a valid social security number. Ages of the teen mothers range from thirteen to seventeen years at the time of delivery and the non-teen mothers are eighteen years or older.

Sample One: Sisters' Sample

This sample is composed of eligible sisters raised in families on welfare because the welfare dataset is the only one that provides information on family relationships. First, we select welfare families with at least two eligible daughters and match the girls with the birth file. Then, we keep the sets where at least one sister gives birth by age seventeen and the other at age eighteen or older. Finally, we further restrict that selection to the sets of sisters where the younger sister turns eighteen in the year 1999 so that we can examine the labor market outcomes of adult women from the year 2000. The advantage of this selection process is threefold. First, the welfare dataset identifies sisters

and their date of birth. Second, merging the welfare and birth datasets allows us to identify sister pairs where one is a teen mother and the other a non-teen mother. Finally, the restriction on the year of the child birth and on the mother's age allows us to examine the labor market behavior of adult women. Thus, the sisters' sample is selected according to the following rule:

TABLE 1: Selection Rule for Sisters' Sample

Minimum Age in Year	**Year**								
	1994	1995	1996	1997	1998	1999	2000	2001	2002
Teens	13	14	15	16	17	-	-	-	-
Non-teens	18	18	18	18	18	18	19	20	21

Table 1 indicates the minimum age of the young mother each year if she is to be selected in the sisters' sample. For example, a teenager who gives birth in December 1994 at the age of thirteen turns eighteen in December 1999. When the labor market and welfare analysis starts in the first quarter of 2000, she is an adult.

Table 2 offers an example of two sister-pairs. In Family A, the older sister (A1) gives birth in the year 1994 at the age of eighteen. The next year, her younger sister (A2) becomes a mother at age fourteen. We cannot conduct any pertinent employment analysis from the year 1995 because both sisters are not adults yet. Although the older sister is an adult of nineteen years, the younger sister (A2) who in this case is also the teen mother, is then only fourteen. She cannot drop out of school and she faces strict restrictions on her labor supply. In Family B, the older sister (B1) becomes a teen mother at age sixteen in 1994, while the younger sister becomes a non-teen mother at the age twenty in 2001. We

analyze their labor market outcomes from the year 2000 when both sisters, B1 and B2, are eighteen and above, although the younger sister (B2) has not yet become a mother. For the sake of completeness, we also conduct an analysis for the year 2003 when all the sisters are mothers.

TABLE 2: Example of Sisters' Sample

Family ID	Mother ID	Year of child's birth	Age at time of first birth	Age in 2000
A	A1	1994	18	24
A	A2	1995	14	19
B	B1	1994	16	21
B	B2	2001	20	19

With the selection criteria explained above, we obtain a sisters' sample with eighty-two families, seventy-five with two sisters and seven with three sisters. In total, the sisters' sample is composed of 171 unique individuals, eighty-four teen mothers and eighty-seven non-teen mothers. Teenage childbearing in this sample is relatively a behavior of younger daughters: 73% of teenage mothers in this sample are the second or third daughter while 68% of the non-teen mothers are the older sisters. The sisters are born between 1974 and 1981 with 65% of them born between 1979 and 1981. This study examines the employment and the earnings of the young mothers from the year 2000 to 2003, when all women in the sample are at least eighteen years old. In 2000, teen mothers are eighteen to twenty-two years old and the non-teen mothers are nineteen to twenty-six years old.

This sisters' sample is not representative of all teenage mothers in Georgia. The conclusions are skewed toward larger families (those with at least two daughters) and the low-income population and may not be readily extended to other teenage mothers from wealthier families. This sample, however, avoids one of the criticisms formulated by Hoffman (1998) because these sisters are not selected for this sample based on their co-residing status. Therefore, these data do not represent solely the not-so-successful sisters who still live with their biological parents.

Sample Two: Miscarriage counterfactual group

The miscarriage sample comprises two groups of mothers: (1) teen mothers who first gave birth between the ages fifteen and seventeen, and (2) non-teen mothers who were pregnant as teens, have had a fetal death and later gave birth to their first child at age eighteen or nineteen.[13]

This selection is inspired by Hotz, McElroy, and Sanders (1996; 1999). These authors have used a counterfactual group of women who were pregnant as teens and delayed their motherhood on account of a miscarriage or abortion. Hotz et al. (1996; 1999) have shown that teenagers whose pregnancy ends either in birth or in miscarriage are similar "in observable characteristics," while teens who have had an abortion are different from those in the above two groups. Since the Vital Statistics do not provide any

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[13] A fetal death prior to 20 weeks is a miscarriage. When a fetal death occurs after 20 weeks of pregnancy, it is referred to as stillbirth. The Vital Statistics do not offer any information on the length of the pregnancy before the fetal death occurred. (http://search.marchofdimes.com/cgi-bin/MsmGo.exe?grab_id=0&page_id=918&query=stillbirth&hiword=STILLBIRTHS%20stillbirth%20) accessed on 5/13/2007

information on the young mothers' background, we exclude from the analysis teenagers whose earlier pregnancy ended in abortion. This study does not use miscarriage as an instrumental variable but rather those who have had a miscarriage constitute the control group. This Sample Two represents women who were willing to be teenage mothers under the assumptions that all miscarriages are random, and all fertility events are accurately reported. These may be strong assumptions: for instance, fetal deaths are correlated with prior smoking and alcohol consumption and consequently may not be completely random. Besides, some women would have had an abortion had they not miscarried. Although there is no way to be absolutely certain that the underlying assumptions are met, the Vital Statistics are deemed more accurate than survey data in the area of reproductive health.

Additional complications stem from the absence of the mothers' date of birth, the date of last fetal death event, and the length of the pregnancy that resulted in the fetal death. We assume women who have their first child at the age of eighteen or nineteen and also reported a fetal death prior to the birth of their first child became pregnant before their eighteenth birthday. On the one hand, in the NLSY data used by Hotz et al. (1996; 1999), a miscarriage delays the first birth by three to four years on average and the median age at first birth of women who have had a miscarriage is twenty. On the other hand, Hoffman (1998) claims that a miscarriage may delay the subsequent birth by barely a few months. Unfortunately, this dataset does not provide any information to decide one way or another since the last fetal death event is not dated. We adopt a conservative approach by limiting our counterfactual group to eighteen or nineteen years old. However, it is noteworthy that some mothers from the counterfactual group may have

been first pregnant after their eighteenth birthday. Moreover, we assume a fetal death does not have any independent effect on the outcomes examined. Table 3 recaps the minimum age of the mother at the time of birth and the year in which the birth occurred.

TABLE 3: Selection Rule for the Miscarriage Sample

Mother's age in years	**Year of first child's birth**								
	1994	1995	1996	1997	1998	1999	2000	2001	2002
Teens	15-17	15-17	15-17	15-17	15-17	15-17	15-17	15-17	15-17
Non-teens	18-19	18-19	18-19	18-19	18-19	18-19	18-19	18-19	18-19

This table indicates that teen mothers are aged fifteen to seventeen years at the time of their first child's birth and non-teen mothers are eighteen and nineteen years of age. This sample avoids one of the contamination problems encountered by Hotz et al. (1996; 1999): no mother in the counterfactual group gives birth before age eighteen. The analysis of employment, earnings, and welfare based on the miscarriage sample are performed by the age of the child and not by calendar year. Thus, the analyses conducted when the child's age varies from zero to three involve mothers that are minors. We will further discuss this point in the results section.

Sample Three: Propensity Score Matching Sample

The first two samples of this study are based on assumptions that would make the non-teen mothers as similar as possible to the non-teen mothers. These assumptions,

however, may be violated in reality for several reasons. For example, in the sisters' sample, the family effect may not be constant over time but may vary with the birth order, making younger sisters systematically different from the oldest. For the miscarriage sample, a fetal death may not be a random event but may be correlated with other unmeasured behaviors such as alcohol consumption. If the assumptions on which these samples rely do not hold, the estimates may be biased.

Therefore, we have selected a third sample using propensity score matching. The propensity score method matches a treated individual—a teen mother—with a control one—a non-teen mother—on the basis of pre-treatment observable variables (Rosenbaum and Rubin 1983); (Dehejia and Wahba 1999). The idea is that individuals as similar as possible on observable variables will also be similar on unobservable variables. This similarity will reduce the bias in the measured outcome. The matching process between a treated individual and non-treated observation may be complicated when the number of matching variables is large and many of them are continuous. The propensity score reduces the individual's pre-treatment variables into "a single-index variable" called the propensity score, which makes the matching feasible (Becker and Ichino 2002). Rosenbaum and Rubin (1983) show that individuals with similar propensity scores are assumed to have the same distribution of observables characteristics and this is independent of their treatment status. Next, a teen mother is matched with a non-teen mother on the basis of the propensity score. Since girls with similar propensity scores have the same distribution of observable characteristics, teen childbearing may be considered as a random event in this sample.

Practically using STATA, we first compute the probability that a girl becomes a teen mother (propensity score), then we divide the sample into equally spaced blocks and inside each block check if the average propensity score of the teen mothers differs from that of the non-teen mothers. If the propensity score average differs, the program divides the block into two and starts the process over until blocks with equal average propensity scores across the teen and the non-teen mothers are obtained. Next, we verify that within a block, the means of the observable variables are not significantly different across the treated and the untreated group (this is the balancing property). If the means are different, we add to the list of exogenous pre-treatment variables either higher order values for continuous variables or interaction terms of the dummy variables. Dehejia and Wahba (1999) show that analyses performed with propensity score matching are not sensitive to the higher order or interaction variables introduced in the matching equation to satisfy the balancing property.

However, the probability that two individuals have the same propensity score is zero because the propensity score is a continuous variable (Becker and Ichino 2002). We choose three widely used methods to deal with this problem: nearest neighbor matching, kernel matching, and radius matching. The nearest neighbor matching method matches a non-teen with a teen mother that has been assigned the nearest propensity score and then computes the difference in their dependent variables. The advantage of this matching method is that all teen mothers find a match. This match, however, may not be ideal because some non-teen mothers may be very different from their matches. Kernel matching is another method where all teen mothers are matched but with a weighted average of all non-teen mothers. The weights are obtained by computing the inverse of

the distance between the propensity scores of the teen and the non-teen mothers. The radius matching method matches each teen mother only with a non-teen mother whose propensity score falls within a predetermined radius of the propensity score of the teen mother. For each method of calculation of the average treatment effect, we computed bootstrapped standard errors to further correct any issues pertaining to the standard errors[14].

The propensity score matching sample is limited to girls who have been in a welfare family at the age fourteen or before, and who become mothers between the years 1994 and 1999. This is done for the following reasons: (1) The Vital Statistics do not provide enough pre-birth variables for the propensity score matching technique. The only pre-birth variables available are race, ethnicity, county of residence, and state of birth. These four variables cannot accurately predict teen childbearing. (2) We set the pre-birth characteristics at the age of fourteen because if a teenager gets pregnant at that age, she becomes a teen mother at the age of fifteen which is the minimum age for teen mothers in this sample. Consequently, we exclude young women who first appear in the welfare files at the age fifteen or beyond because we will then miss at least a year when the girl is exposed to a pregnancy risk. When the woman is not in a welfare family at the age of fourteen, we use the information at the nearest younger age available. (3) The birth years included in this sample range from 1994 to 1999, so that the youngest teen mother who is fifteen years old in December 1999 turns eighteen in December 2002. In the year 2003

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[14] for application, see Mocan, Naci and Erdal Tekin. 2006. Catholic schools and bad behavior: A propensity score matching analysis. *Contributions to Economic Analysis & Policy Berkeley Electronic Press* 5, no. 1: 1403-1403.

when we analyze the mothers' employment, earnings, and welfare, all the women are adults. Table 4 recaps the selection rules for the propensity score sample.

TABLE 4: Selection Rule for the Propensity Score Sample

Minimum age in the year	**Year of first child's birth**						**Year of the analysis**
	1994	1995	1996	1997	1998	1999	2003
Teens	15-17	15-17	15-17	15-17	15-17	15-17	19
Non-teens	18-19	18-19	18-19	18-19	18-19	18-19	21

The selection criteria yield a sample of mothers who share a relatively homogeneous poverty background. The observable variables used for the matching are race, ethnicity, relationship to the case-head at age fourteen or earlier if necessary (mother, grandmother, or other), the number of adults receiving welfare in the household, whether the young mother is born in Georgia, the area of residence, the number of quarters she has been on welfare before getting pregnant[15] and whether she has had a previous fetal death event. In total, 8,856 observations meet the selection criteria. When we apply the propensity score program on them, the sample is reduced to a smaller number of 896 observations, all of whom have had a pre-first birth fetal death, 316 teen observations and 580 non-teen observations. Note that these observations concern the outcomes for the four quarters of the year 2003.

[15] Practically, we counted the number of quarters she appeared in the welfare file till a year before the birth of her first child.

Empirical Methodology

The mother maximizes her utility subject to her different constraints. She chooses her labor supply and conditional on positive hours of work, her earnings. If she qualifies for cash assistance, she decides whether to apply or not.

Employment and Welfare

Assume a continuous latent random variable Y^*_i representing each mother's underlying labor supply function.

$$Y^*_i = Z_i \beta_i + \varepsilon_i \qquad (14)$$

where Z_i are exogenous variables of the individual i, β_i are the coefficients, and ε_i is a random component representing the unobserved characteristics of the mother i. Assume ε_i is independent of Z and ε_i ~Normal (0,1). We do not observe Y^*_i but Y_i.

When $Y^*_i > 0 \Rightarrow Y_i = 1$ and the observed outcome is that the mother is employed;

$Y^*_i < 0 \Rightarrow Y_i = 0$ and the observed outcome is that the mother is not employed.

For the distribution of Y_i given X_i, we have to consider the case when $Y_i = 1$ and $Y_i = 0$.

For $Y_i = 1$,

$$P(Y_i=1| X_i) = P(Y^*_i>0| X_i) = P(Z_i \beta_i+\varepsilon_i >0| X_i)$$

$$P(Y_i=1| X_i) = P(\varepsilon_i > -Z_i \beta_i | X_i) = 1- \Phi(-Z_i \beta_i)$$

$$P(Y_i=1| X_i) = \Phi(+Z_i \beta_i) \qquad (15)$$

where Φ is the standard normal cumulative distribution function.

Similarly for $Y_i = 0$,

$$P(Y_i=0|\ X_i) = P(Y^*_i<0|\ X_i)$$

$$P(Y_i=0|\ X_i) = P(\varepsilon_i < -Z_i\,\beta_i|\ X_i) = 1- \Phi(-Z_i\,\beta_i) \qquad (16)$$

The density function of Y_i given X_i, for each individual is

$$F(Y_i|\ X_i) = [\Phi(Z_i\,\beta_i)]^{\,y_i}\,[1- \Phi(-Z_i\,\beta_i)]^{\,1-y_i} \text{ with } y=[0,1] \qquad (17)$$

The likelihood function is represented by

$$L=\Pi_{i=1}^{n}\ [\Phi(Z_i\,\beta_i)]^{\,y_i}\,[1- \Phi(-Z_i\,\beta_i)]^{\,1-y_i} \qquad (18)$$

The log and the derivatives with respect to the relevant variables give the estimates of β_i. The estimation of the welfare participation equation can be derived in a manner similar to the employment decision.

Earnings

Earnings are analyzed with the following equation:

$$E_i = Z_i\,\alpha_i + \varepsilon_i\,, \qquad (19)$$

where E_i represents earnings, Z_i is a vector of exogenous variables affecting earnings, α_i represents the coefficients of the variables, and ε_i is the error. Assume that ε_i is independent of Z_i and ε_i ~Normal (0, 1). Earnings are observed only for employed women, and there is a potential unobserved heterogeneity between women who are employed and those who are not. To correct for sample selection into employment, estimation of earnings is based on a two-step Heckman procedure.

Potential Source of Bias

The employment, welfare and earning equations assume that $E(\varepsilon_i)=0$ and

$E(\varepsilon_{i,} Z_i)=0$, and that the variables Z_i are exogenous, measured without error, and include all the variables that affect the outcomes.

Assume the error term is composed of two elements, an unobserved random variable (it may be the family effect in a sisters' sample for example) and an unobserved disturbance with mean 0. The composite error term is $\varepsilon_i = F_i + \eta_i$, where F is the unobservable variable and η is the unobserved error. Thus, the employment, welfare, or earnings equations can be written as:

$$Y_i = \beta_0 + \beta_1 Z_i + \beta_4 F_i + \eta_{i,}, \qquad (20)$$

where the index $_i$ represents individual *i*, Y is the outcome examined, and Z are the exogenous variables. Assume further that F is an unobserved time-constant variable correlated with Z. Thus, $E(Z_i, F_i) \neq 0$, but $E(\eta_i | Z_{i,} F_i)=0$. Estimating this equation (20) without accounting for F (the unobservable effect) will lead to biased results because of the omitted variable. This omitted variable issue can be dealt with if repeated individual observations across time are available. Then, using a first-difference of equation (20) across individuals and across time will yield

$$\Delta Y_{it} = \beta_{0it} + \beta_{1it} \Delta Z_{it} + \Delta\eta_{it,} \qquad (21)$$

where the time-invariant characteristics (including the one in the error term) drop out. The estimates obtained are unbiased. This is also referred to as fixed-effects estimation. If we assume instead that the unobservable is uncorrelated with each of the parameters in the equation, then $E(\varepsilon_i \mid Z_{it}) = 0$ and we can use a random effects estimation technique to evaluate the effect of teen childbearing on the mother's outcomes while accounting for the repeated observations.

According to Wooldridge (2002) when $E(\varepsilon_i \mid Z_{it}) = 0$, pooled Ordinary Least Square (OLS) with time dummies may produce consistent estimates of the β but the model ignores the fact that the ε_{it} are serially and positively correlated across time. The correlation between the composite error terms across two different time periods t and s is $\text{Corr}(\varepsilon_{it}, \varepsilon_{is}) = \sigma^2_F/(\sigma^2_{F+}\sigma^2_\eta)$ where F is the unobserved heterogeneity and η is the unobserved error. Practically, the random effects model is computed using Generalized Least Square (GLS) on the data. The transformation factor is $\lambda = 1 - [\sigma^2_\eta / (\sigma^2_\eta + T\sigma^2_F]$, where T is the number of time periods and $0 > \lambda > 1$. The transformed equation becomes

$$Y_{it} - \lambda Y'_i = (Z_{it} - \lambda Z_i')\beta_i + \varepsilon_i, \qquad (21')$$

where Y'_i and Z_i' are the averages over the individuals. Note that for a pooled OLS, $\lambda = 0$ and for fixed effect models $\lambda = 1$. If λ is small in magnitude i.e. the unobserved effect is minor, the random effects estimates are close to the OLS ones. If on the contrary, λ is closer to 1, the random effects estimates are closer to the fixed effects estimates.

Since this dissertation studies the effect of teen childbearing, the variable of interest is the age at the first birth and is time-invariant. Therefore, we cannot use the individual fixed effects model because it will drop the time-invariant variables, among them our variable of interest. However, we can use pooled OLS with family fixed-effects and random effects models. We build on recent studies that used family fixed effects or a "natural experiment" as described in the literature review to deal with the endogeneity of teen childbearing. But we improve on these studies by using panel data analysis to control for the unobserved heterogeneity.

Empirical Estimation

This section discusses the empirical methodology for the different samples of this study.

Employment Estimation

The basic equation for employment is:

$$Y_{it} = \beta_0 + \beta_1 \text{Teen}_{it} + \beta_2 X_{it} + \beta_3 Z_{it} + \varepsilon_{it,} \quad (22)$$

where the dependent variable Y_{it} is a binary indicator of the mother's employment status at time t. We use linear probability model and a probit model for the analysis of employment.

Teen is a binary variable that indicates if the mother gives birth before the age of eighteen. X_i represents the characteristics of the mother and her partner at the time of the child's birth, and Z_i are the child's characteristics. The mother's characteristics are education, county of residence at the time of birth, race, ethnicity, current age, experience, and experience squared. The father's characteristics are age and education at the time of the child's birth. These characteristics serve as proxies for the mother's non-wage income. The child's characteristic is current age. Most of these variables enter the equation in a binary form with the exception of the current ages and experience. All the employment equations include calendar quarterly time dummies.

The wage-employer data provide the mother's quarterly earnings as well as her employer identifier and the industry of activity but lack information on hours of work or wages. Therefore, we use two income thresholds as proxies for employment. The first threshold is $0 implying that all those who earn a positive income during a quarter are

considered as workers. The second threshold depends on the minimum wage and equals the amount of the minimum wage earned for twenty hours a week and thirteen weeks per quarter. This is based on Smith (2002) who has used the same data and a similar assumption to analyze full-time employment. He assumes that a mother who earns the minimum wage of $5.15, works thirty hours a week, and thirteen weeks in a quarter is a full-time worker. He proceeds with a $2000 value as a cut-off income for full-time employment. We make a parallel assumption with twenty hours a week because it allows us to consider women who work part-time only as workers. This may be important since teen mothers may be engaged in unpaid activities such as the care of the child or further education.

Employment Estimation for the Sisters' Sample

We assume the existence of unobserved family effects, which are fixed within a family over time, but different across families. This assumption is based on the sisters' common genetic and social backgrounds. If the family effect is correlated with the teen variable, an ideal estimation technique is the panel data one with individual fixed effects which corrects for unobserved heterogeneity. This technique, however, is inappropriate here since it will also drop the variable of interest. If the family effect is uncorrelated with the teen variable, the random effects model is appropriate. We estimate some specifications that control for the family effect with dummies. We add a binary indicator for whether the woman is a mother during the quarter of the analysis. We use three

estimation techniques for the sisters' samples: pooled OLS, pooled data with probit, and random effects.

For the sisters' sample, the minimum wage threshold is $1339 because the minimum wage has been constant during the period of analysis, years 2000 to 2003. The minimum wage has been set at $5.15 in September 1997 and has not been changed since then.[16]

Employment Estimation for the Miscarriage Sample

The miscarriage sample is composed of all women in Georgia who have been pregnant as teens between the years 1994 and 2002. In this sample, the dollar value of the minimum wage threshold varies because the minimum wage has been increased four times between 1990 and 2003. The minimum wage was $3.35 in the first quarter of 1990, $3.80 from April 1st 1990 to March 31st 1991, $4.25 from April 1st 1991 to September 30th 1996, $4.75 from October 1st 1996 to August 1st 1997, and $5.15 since September 1st 1997. Note that some mothers in this sample have been raised in families on welfare so we add to the explanatory variables a measure of the intensity of welfare (i.e., the number of quarters a woman was in the welfare file before getting pregnant with her first child, if any).

The analysis is based on the child's age. We first conduct the analysis for each age of the child. Second, we group the mothers in three categories according to their children's school age group. The variable school indicates mothers whose children are

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[16] A bill has been introduced in Congress in January 2007 but is not yet a law.

old enough to go to elementary school (age six and above on September first), preschool represents the mothers whose children can attend public pre-kindergarten and kindergarten (age four and five on September first) and toddler indicates the mothers of children not old enough for pre-kindergarten (from birth to the age three). We also generate three dummy variables to indicate whether the birth occurred before the welfare reform (years 1994 and 1995), during the reform implementation period (years 1996 and 1997) and after the reform (years 1998 and beyond). These dummy variables control for cohort effects. These cohort effects may exist if women who gave birth in each of these different periods are intrinsically different. Moreover, the employment regressions contain the father of the child's characteristics and a variable of welfare intensity—i.e., the number of quarters during which the mother has lived in a family on welfare before getting pregnant. These two variables serve as proxy for non-wage income and socioeconomic status.

Employment Estimation for the Propensity Score Matching Sample

The propensity score sample is restricted to women raised in families on welfare who gave birth between the years 1994 and 1999. We analyze their employment in the year 2003. The dollar value of the minimum wage threshold is $1339. For the radius matching, we set the value of the propensity score at 0.1 (which is also the default value in STATA).

Earnings Estimation

The general earnings equation is:

$$E_{it} = \beta_0 + \beta_1 \, Teen_{it} + \beta_2 \, X_i + \beta_3 Z_{it} + \varepsilon_{it}, \qquad (23)$$

where E_{it} represents the mother's log of earnings at the time t. The earnings values were deflated using the Consumer Price Index provided by the Bureau of Labor Statistics (base year=1982-84). The independent variables are similar to those described in the employment estimation section (4.2.1). For both the sisters' sample and the miscarriage sample, we use a pooled OLS and panel data estimations. We control for sample selection by using a two-step Heckman procedure.

Welfare Estimation

A mother who appears in the welfare file as a recipient of cash assistance during a quarter, or a mother whose child receives additional social security income is considered as being on welfare during that quarter regardless of the amount received. The rationale behind using the $0 cutoff is that the mother does not decide directly on the amount of cash assistance she receives. A mother, however, who appears in the welfare dataset as ineligible or non-member is not considered as welfare recipient. Her information is collected essentially for completeness purposes by the Department of Human Resources. For instance, consider two sisters, S_1 and S_2, who reside in the same household. One sister receives AFDC/TANF while the other sister, S_2, does not. Both sisters may appear in the welfare file, S_1 as a recipient and S_2 as an ineligible member of the household.

The welfare model is based on the following equation:

$$Y_{it} = \beta_0 + \beta_1 \, Teen_{it} + \beta_2 \, X_{it} + \beta_3 Z_i + \varepsilon_{it}, \qquad (24)$$

where Y_i indicates if the mother has received welfare cash assistance during that quarter. All the other variables are defined as before.

IV. RESULTS AND DISCUSSIONS

This chapter describes the results for each of the outcomes studied – employment, earnings, and welfare – by sample. The coefficients on the teen variables, their standard errors, and the number of observations are in the text but the full tables are in the appendixes.

Sample Statistics

This section provides descriptive statistics for the sisters' sample (Table A1), the miscarriage sample (Table A2), and the propensity score matching sample (Table A3). Most of the time-invariant exogenous variables are collected at the time of the first birth. The dependent variables—employment, earnings and welfare participation—are collected later in the woman's life. The time-variant exogenous variables, such as the mother's current age, and work experience are updated each quarter.

Sisters' Sample

Table A1 shows that the sisters raised in families on welfare in Georgia are more likely to be black (76%) and non-Hispanic (99%). By construction, at the time of their first birth, the non-teen mothers are significantly older than the teen mothers (3.4 years more). Expectedly, the non-teen mothers are more educated than their sister teen mothers: 86% of the non-teens have a high school education level compared to 73% of the teens. More importantly, however, only 3% of the non-teens have an education level lower than

ninth grade while 23% of the teens were still in junior high at the birth of their first child. This association between age and education is due to the correlation between the age of the youth and their education level. In addition, the fathers of the teenage mothers' children also are younger and less educated than the fathers of the counterfactual group. Note that this disparity in the fathers' characteristics may be biased because this information is missing for about 60% of teenage mothers and 40% for their non-teen sisters.

The number of observations for the work and welfare variables for the panel data sample for the years 2000 to 2004 is 2736. This number decreases to 983 for the analysis of earnings (threshold minimum wage) since not all of the sisters are employed in each quarter. After the birth of their first child, on average the non-teen mothers are more likely than the teen mothers to work part-time (42% vs. 36%) and the non-teen mothers earn $546 more than the teen mothers in real income. We create nineteen dummy variables to indicate the industry of activity.[17] About 60% of the sisters who are employed are concentrated in three sectors. One-third of the sisters are employed in the "Accommodation and Food" industry (36% of teen mothers, versus 33% of non-teen mothers). This sector is the highest employer of part-time workers and young workers (16-24 years old) in the U.S. and 60% of its employees have an education level of high school or less (Bureau of Labor Statistics, 2006). One quarter of the sisters work in either "Health Care and Social Assistance" (15% of non-teen versus 11% of teen) or

[17] Note that this description of industry of activity is based on any positive income whether it meets the minimum wage requirement or not. Besides for those who earn income from more than one job, we ascribe to them the sector where the highest income has been earned. See appendix for detail

"Administrative and Support, Waste management and Remediation Services" (11% versus 15%).[18]

Miscarriage Sample

The descriptive statistics of the miscarriage sample (Table A2) concern all the mothers who gave birth between the years 1994 and 2002. This sample comprises 42,222 unique individuals, 38,836 (92%) teen mothers and 3,386 (8%) non-teen mothers. By construction, the non-teen mothers are older than the teen mothers at the time of their first birth (18.6 years versus 16.3 years). Consequently, the non-teen mothers are more educated than the teen mothers at the birth of their first child. The majority of the mothers have a high school level education at the time of birth (87%) although there are more non-teen mothers at this level and beyond than teen mothers. The information on the fathers' age and education is missing for more than half of this sample as well. Teen mothers are less likely than the non-teens to provide information on their partners, and this variation in reporting tends to increase the difference between the father's age and education across the teen and non-teen groups. When the information is available, the fathers of non-teen mothers' children are also older and more educated than their counterparts at the time of the child birth: 46% of the fathers of the non-teen mothers' babies are twenty years and older while this proportion is only 19% for the teen mothers. Conversely, 10% of the fathers of the teen children are themselves younger than eighteen and this percentage is only 2% for the fathers of non-teen mothers' children. Note that 4% of teen mothers have had a fetal death in the past.

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[18] http://www.bls.gov/oco/cg/indchar.htm accessed on 5/1/2007.

Over one-fifth (23%) of this sample is raised in a family that has received public assistance. Among those who have been on welfare, teen mothers spend two quarters more than their counterparts on welfare before the age of fourteen and this difference is significant. Teenage mothers appear in the welfare file on average fifteen quarters before their fourteenth birthday, while the non-teens appear 12.7 quarters.

After the birth of their first child, on average teen mothers are less likely than the non-teens to be employed part-time (29% vs. 36%). Teen mothers earn about $251 less than the non-teen mothers in terms of real income. We create twenty-one dummy variables to indicate the sector in which the mother works. The "Accommodation and Food Services" industry is the biggest employer of the women in this sample: 29% (29 teen mothers vs. 22% non-teen mothers) of them work for this industry. The second biggest industry of employment is "Retail Trade" that employs 19% (19% of teen vs. 18% of non-teen) of the women in this sample. The "Administrative and Support" industry employs 11% of the young mothers (teen and non-teen together).

Propensity Score Sample

The propensity score matching yields a sample of 896 observations, 316 teen mothers and 580 non-teen mothers. All mothers in this sample have had a fetal death prior to their first birth. The descriptive statistics (Table A3) reveal no statistical difference across the observable variables used to match the teen mothers to their non-teen mother counterparts. The majority of the women in the sample (88%) were raised by their own mothers. Teen and non-teen mothers' ages at first birth are different (average 16.5 and 18.6), as are their levels of education, in addition to the ages and education

levels of their partners. Surprisingly, most of the young mothers' education is unknown (although we did not use education to match them). The fathers' education is captured more sufficiently than the mothers': non-teen mothers are more likely to have older partners than their counterpart teens. The father's education is significantly different only at the highest level of education. Although work experience before birth was not one of the matching observables, this variable does not indicate any difference among the teen mothers and the non-teen mothers. Respondents in both categories have acquired about 1 quarter of working experience before the age fourteen. On average, non-teen mothers have spent about twelve quarters in families on welfare before getting pregnant, while the teen mothers have spent about 11.5 quarters.

The outcome variables, employment, earnings, and welfare, concern only the year 2003 and the descriptive statistics indicate that teen mothers work less than the non-teen mothers (35% versus 41% for the $1339 threshold). Consequently, non-teen mothers earn more than the teen mothers ($2133 per quarter vs. $1705) per quarter. This difference is significant at 1%. We create seven dummies to account for the industry in which the mothers work. There exists no statistically significant difference between teen mothers and non-teen mothers based on the industry in which they work. For this sample also, the biggest employer is "Accommodation and Food" industry that occupies 22% of the sample with a higher proportion of teen mothers (41% vs. 20%). The second biggest employer is the "Retail Trade" industry which occupies 15% of the sample (36% teen mothers vs. 16% of the non-teen mothers). Although the difference in magnitude seems large, it is not statistically significant. The third biggest employer is "Administrative

Support, Waste management and Remediation" which occupies 12% of the sample (32% of the teen mothers vs. 12% of the non-teen mothers).

Employment

We use several estimation models for the employment analysis: linear probability model, probit, and random effects (linear and probit). Although we consider two quarterly income thresholds, we will discuss only the minimum wage equivalent to part-time earnings. The results for the $0 threshold are generally similar to the minimum wage ones but are measured with less precision.

Sisters' Sample

The results for the sisters' sample are based on data analysis for the years 2000 to 2004 when all the sisters are eighteen and older. Table 5 indicates that teenage childbearing does not seem to influence significantly the labor market participation of the sisters. The magnitude of the marginal effect is small (between 3% and 5%) and none of the coefficients are statistically significant. Note that the random effects estimates indicate that Rho, the proportion of the variance contributed by the panel level component, is different from zero and the likelihood ratio test fails to reject the null. Thus, panel data analysis is better suited for this sample than a pooled model. The quadrature checks indicate stable results.[19] We conduct complementary analysis for the

[19] For integration points of 16 instead of the 12 that STATA uses as default.

year 2003 when all of the sisters are mothers and all the children are old enough to attend preschool. Although the magnitude of the effect seems to increase, none of the results are statistically significant.

TABLE 5: Sisters Sample: Effect of Teen Childbearing on the Mothers' Employment

Variables	Pooled linear probability model with family dummies	Pooled probit without family dummies	Pooled probit with family dummies	Panel probit random with family dummies
	Sisters 2000 - 2003			
Marginal effects Effect	-0.046	-0.031	-0.04	-0.038
Robust Standard Errors	(0.029)	(0.031)	(0.041)	(2.697)
Number of observations	2736	2736	2512	2736
	Sisters 2003			
Marginal effects Effect	-0.0081	-0.100	-0. 108	-0.049
Robust Standard Errors	(0.057)	(0.067)	(0.044)	(13.15)
Number of observations	684	684	504	684

*, **, *** result statistically significant at 10%, 5% and 1%.

Miscarriage Sample

The miscarriage sample offers the largest sample size of this study and covers the years 1994 to 2003. The analysis of this sample is based on the children's age and not on calendar years. We first conduct the analysis of the mothers' employment at each age of

the child (0-9 years) and then we regroup the mothers by race and age group of their child.

Table 6 indicates that teen mothers are generally more likely than the non-teen mothers to be employed from the time their first born reaches his/her first birthday. The magnitude of this effect lies mostly between 3% and 6%.

TABLE 6: Miscarriage Sample: Effect of Teen Childbearing on the Mothers' Employment

Children's Age	Marginal Effect	Robust Std. Errors	Number of observations
0	0.001	-0.005	168888
1	0.05***	-0.007	158550
2	0.044***	-0.009	141906
3	0.045***	-0.011	124783
4	0.033***	-0.012	105127
5	0.03***	-0.014	86053
6	0.019	-0.017	67432
7	0.025	-0.02	47947
8	0.065***	-0.024	28640
9	-0.019	-0.051	8151

*, **, *** result statistically significant at 10%, 5% and 1%.

The analysis by race shows that the impact of teen childbearing on employment is different for white and black mothers. For the pooled probit model, the marginal effects show that a teenage childbearing increases white teen mothers' employment by 2% when the child is a toddler to 6% when he reaches school age (Table 7, second panel). For Blacks, the marginal effects are positive but remain inferior to 2% (Table 7, first panel).

We conduct panel data analysis with linear probability model and probit. For the probit, we run quadrature tests that indicate stable results. A testing of Rho indicates that it is statistically different from zero—i.e. that panel models are superior to pooled ones in

this analysis. The panel data analyses reveal more contrasted results. For the Whites, the linear probability model also suggests positive effects with much smaller magnitudes while the random effects probit reveals no significant effect on employment. As for black teen mothers, the panel analyses show a negative and significant effect when the child is preschool age or older. The magnitudes with the probit models are about 11% and statistically significant while the coefficients obtained with the linear regressions are much smaller in magnitude (about 4%).

TABLE 7: Miscarriage Sample: Effect of Teen Childbearing on the Mothers' Employment

	Pooled Probit			Random effect (probit)			Random effect (linear model)		
Variable	Toddler	Pre-school	School	toddler	Pre-school	School	Toddler	Pre-school	School
				Black					
Marginal Effects	0.015***	0.016*	0.018*	-0.008	-0.106***	-0.114***	0.021***	-0.035***	-0.037***
Robust Standard Errors	(0.003)	(0.009)	(0.01)	(0.006)	(0.022)	(0.076)	(0.006)	(0.011)	(0.013)
Number of observations	379177	109645	81671	379177	109645	81671	379177	109645	81671
				White					
Marginal Effect	0.023***	0.044***	0.064***	0.003	-0.021	0.026	0.019**	0.007	0.028*
Robust Standard Errors	(0.004)	(0.01)	(0.01)	(0.007)	(0.020)	(0.020)	(0.007)	(0.012)	(0.015)
Number of observations	244520	67764	48138	244520	67764	48138	244520	67764	48138

, **, *** result statistically significant at 10%, 5% and 1%.

Propensity Score Matching Sample

The average treatment effect on the teen mothers' employment is computed controlling for a shorter list of independent variables because the program does not converge otherwise. The exogenous variables here are the mother's characteristics (race, ethnicity), the area of residence, her age and that of the baby, and her experience and its square. The standard errors are bootstrapped. The estimation uses a linear probability model. Table 8 shows that all three matching methods indicate a negative effect of teenage childbearing on the mothers' employment using the minimum wage threshold. However, the only significant estimate is obtained by the radius matching. The magnitude of the effect is 7% and is significant at the 1% level.

TABLE 8: Propensity Score Sample: Effect of Teen Childbearing on the Mothers' Employment

Variables	Nearest neighbor matching	Kernel matching	Radius matching
Teen Effect	-0.062	-0.047	-0.071***
Bootstrapped Standard Errors	(0.047)	(0.032)	(0.035)
Number of observations	540	896	896

*, **, *** result statistically significant at 10%, 5% and 1%.

Discussion on the Employment Results

The sisters' sample shows that teen childbearing does not make a difference in the employment of the teen mothers vs. the non-teen mothers. In the miscarriage sample, the race of the mothers seems to be an important determinant of their employment. Black

teen mothers are slightly less likely to be employed than non-teen mothers and the effect on white teen mothers is not significant. As for the propensity score sample, teen mothers are less likely than non-teen mothers to be employed. These mixed results are most probably due the heterogeneity of the samples, the distribution of races, and the correlation between race and socioeconomic outcomes of the mothers. Note that the small sample sizes of the sisters and the propensity score samples prevent further analysis by race.

The teen coefficients are generally in line with the ones found in this literature. Geronimus and Korenman (1992) found a wide range - 28% to 61% according to the survey datasets they used (NLSY, NLSW) - for the effect of teen childbearing on the employment using sisters sample. But women in their samples are about a decade older than the mothers in this study. Besides, the miscarriage study cited in the literature does not look at employment. Other control variables have the expected signs and magnitude. For instance, higher education and experience increase the likelihood of employment while the intensity of welfare (the number of quarter the mothers have spent on welfare) decreases it. The results are not sensitive to the form in which the intensity of welfare is accounted for (either as a continuous variable or as a dummy).

Earnings

The analysis of the earnings concerns only mothers who have a positive income. We use the log of earnings as the dependent variable. The reported results control for the industry of activity and for self-selection in the labor market by a two-step Heckman procedure. We present the results with the pooled and the panel data analyses.

Sisters' Sample

The results of the earnings analysis show that generally teen mothers earn less than their non-teen counterparts but these results are not always measured with precision. We prefer the regressions that control for family effects and the one that is statistically significant suggest that teen mothers earn 15% less than the non-teen sisters. The panel analysis indicates an effect of similar magnitude 12% but the significance level is only 12% (Table 9). This difference corresponds to $322.2 per quarter in real income or $649.5 per quarter in 2006 dollars.[20]

This negative impact of teen childbearing on earnings may well be a temporary situation. In the year 2003, when all sisters are mothers and the teen mothers are 23.14 years old on average, none of the specifications with family fixed effects suggest a significant impact of teen birth. Note that the Geronimus and Korenman (1992) paper that

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[20] ftp://ftp.bls.gov/pub/special.requests/cpi/cpiai.txt accessed on 5/14/07

uses sisters to evaluate the consequences of their childbearing does not evaluate the effect on the women's own earnings so we do not have any other benchmark here.

TABLE 9: Sisters Sample: Effect of Teen Childbearing on the Mothers' Earnings

	Year 2000-2003			
	Linear (with family dummies) a	Without family dummies b	With family dummies c	Random effects d
Marginal Effects	-0.247***	-0.202***	-0.144**	-0.117
Robust Std Errors	(0.088)	(0.065)	(0. 068)	(0.077)
Number of Observations	*983*	*983*	*951*	983
	Year 2003			
Marginal Effects	-0.020	-0.304***	-0. 155	0.040
Robust Std Errors	(0.194)	(0.093)	(0. 224)	(0.200)
Number of Observations	258	258	226	258

*, **, *** result statistically significant at 10%, 5% and 1%.
All the estimations include an inverse mills Ratio obtained with the method list in a, b, c, or d
a: the first step analysis on employment is run with linear regression
b: the first step analysis on employment is run with probit without family dummies
c: the first step analysis on employment is run with probit with family dummies regression
d: the first step analysis on employment is run with xtprobit

Miscarriage Sample

In this sample, teenage mothers earn more income than the non-teen mothers when the child is younger and this difference decreases with time. For instance, teen mothers earn around 4% more than the non-teen mothers until the child turns five. Then, the difference decreases down almost completely both in magnitude and in statistical significance (Table 10). This decline in magnitude is mostly due to the differential impact of teen childbearing by race.

TABLE 10: Miscarriage Sample: Effect of Teen Childbearing on the Mothers' Earnings, by Age of the Child

Child's Age	Coefficient		Robust std errors	Number of observations
0	-0.008		-0.017	*25034*
1	0.043	***	-0.017	*38172*
2	0.038	**	-0.017	*42823*
3	0.017		-0.017	*42506*
4	0.041	***	-0.020	*37861*
5	-0.001		-0.021	*32405*
6	0.003		-0.023	*25922*
7	0.049	*	-0.029	*18712*
8	0.013	*	-0.040	*11326*
9	0.082		-0.075	*3278*

*, **, *** result statistically significant at 10%, 5% and 1%

The decomposition by race and age group indicates a differential effect by race. Black teen mothers earn more than the black non-teen mothers when the child is young. (Table 11, panel 1). Both the OLS and the random effects models indicate that the black teen mothers earn about 5% more than the non-teen mothers when the child is a toddler (less than four years old). But once the child is four and older, the black teen mothers earn less than the black non-teen mothers. By the time the child is in grade school (age six and above), black teen mothers earn significantly less than the black non-teen mothers, 2.5% for the OLS sample and 9% for the panel analysis. In real terms, these percentages correspond to a gap of $59 to $211 per quarter i.e. $119 to $425 in 2006 income.

As for the white teen mothers, they consistently earn more than white non-teen mothers (Table 11, panel 2). The magnitude of the estimates differs by the method of estimation. The OLS estimates vary from 5% to 10% while the panel analysis estimates

vary from 3% to 6%. In real income, the difference in earnings is $75.5 (for the 3%) to $151 (for the 6%) a quarter—i.e. $152 to $304 in 2006 income.

Hoffman (forthcoming), using a NLSY sample and a miscarriage sample, finds that teen mothers earn $3915 *more* than non-teen mothers a year (or $978 a quarter) between the age eighteen and thirty-five. The difference in his value and the one obtained for this study may be due to the sample composition and the fact that Hoffman's results are not measured with precision.

TABLE 11: Miscarriage Sample: Effect of Teen Childbearing on the Mothers' Earnings by Race and Age Group of the Child

	Pooled OLS			Panel Effects		
Variables	Toddler	Preschool	School	Toddler	Preschool	School
			Black			
Coefficients	0.045***	-0.014	-0.025**	0.040***	-0.033**	-0.085***
Robust Standard Errors	(0.005)	(0.011)	(0.012)	(0.008)	(0.016)	(0.003)
Number of Observations	*93024*	*42420*	*33742*	*93024*	*42420*	*33742*
			White			
Coefficients	0.061***	0.05***	0.10***	0.059***	0.032	0.054**
Robust Standard Errors	(0.006)	(0.015)	(0.018)	(0.010)	(0.021)	(0.028)
Number of Observations	*66598*	*23570*	*16854*	*66598*	*23570*	*16854*

*, **, *** result statistically significant at 10%, 5% and 1%.

Propensity Score Matching Sample

Generally, the propensity score sample shows that in the year 2003, teenage mothers earn 12% to 21% less than non-teen mothers and these percentages are

significant at the 10% and 1% levels. These reductions in earnings correspond to real incomes of $255 to $447.9 per quarter in 82-84 dollars or $435 to $765 in 2003 dollars (Table 12).

TABLE 12: Propensity Score Matching Sample: Effect of Teen Childbearing on the Mothers' Earnings

Variables	Nearest Neighbor	Kernel	Radius
Teen Effect	0.029	-0.194***	-0.116*
Bootstrapped Standard Errors	(0.101)	(0.056)	(0.072)
Number of observations	228	441	319

*, **, *** result statistically significant at 10%, 5% and 1%.

Discussion of the Earnings Results

The earnings analysis suggests that teen mothers in the sisters' sample, teen mothers in the propensity score sample, and black mothers in the miscarriage sample fare worse than the non-teen mothers. However, white teen mothers in the miscarriage sample seem to do better or at least no worse than the non-teen mothers. These mixed results are probably due to the sample composition - i.e., the distribution of race, age, and socioeconomic categories of the teen mothers and their counterparts in each of these samples. In the sisters' sample, all the mothers were raised in families on welfare, and they are mostly Black (76%). Similarly in the propensity score, all the mothers have also been raised in families on welfare and 60% of them are black. In contrast, only 23% of mothers in the miscarriage sample are raised in families on welfare. So it comes as no surprise that the results for the sisters sample, years 2000 to 2003, are generally similar to

the ones obtained by the propensity score sample. It is noteworthy that the propensity score results are somehow different from the results for the sisters' sample for the year 2003. This might be due to the smaller sample size of the 2003 sisters' sample or the younger average of the teen mothers in the propensity score sample in 2003. These results invite more scrutiny.

In the miscarriage sample, when the child is a toddler many teen mothers are not yet eighteen years old so we will not focus on these results. The effect of teen childbearing on the adult mothers' earnings is negative in the black sub-group of the miscarriage sample for children age four and above. But the magnitude of this effect is smaller than the magnitude found for the sisters and propensity score sample. This comparison suggests that being raised in poverty exacerbates a negative influence of teen childbearing on earnings while a non-welfare upbringing may mitigate such a negative effect.

Many other possible reasons may explain the contrasting results obtained for earnings outcomes. For instance, the mothers' subsequent education may be of importance. If white non-teen mothers finish high school and acquire some college education, they may be less likely than white teen mothers to work in the few years following the birth of their first child. In such cases, the difference in the earnings between white teen mothers and non-teen mothers will decrease with time as the non-teen mothers complete their education and enter the labor market. This does not seem to be the case in this sample since the difference in earnings in the white sub-sample does not decrease as the child grows regardless of the model used.

Another possible explanation is the subsequent marital status. Note that at the time of the birth all the mothers declared being single. If white non-teen mothers subsequently get married and then have a parenting partner, there is less need for them to earn money. They will work less than the white teen mothers and this may justify the result. This subsequent marital status explanation may find empirical support because the marriage rate in the white population is higher than in the black population. Moreover, if the non-teen mothers receive more child support from the child's fathers, they are less likely to work.

A third possible explanation pertains to the teen mothers' subsequent fertility. If teen mothers raised in welfare families are more likely to bear a second or third child by the time the first one is four or six years old, they might not be available to work more than the minimum amount of time. The National Campaign to Prevent Teen childbearing points out that Georgia has the highest ranking in terms "the proportion of teen births that are subsequent births, by Race/Ethnicity" for girls 15-19 in 2003.[21] Further analysis of subsequent fertility of the teen mothers vs. non-teen mothers may help determine the importance of the subsequent fertility in explaining teen mothers' earnings.

These data do not allow us to test the validity of all the possible explanations: none of the education and marital status information is updated unless the mother gives a subsequent live birth. However, it is possible to test the validity of the subsequent fertility explanation. This will be the objective of future research.

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[21] http://www.teenpregnancy.org/america/statisticsDisplay.asp?ID=4&sID=35&sort=rank accessed on 5/14/2007

Welfare

This section is devoted to the welfare receipt of teen mothers relative to the non-teen mothers after the birth of their first child.

Sisters' Sample

Very few young mothers appear in the welfare file in the years 2000-2004. Only 3% of them are in the file regardless of their status and less than 1% of the sample is a welfare recipient during the period of analysis. This small proportion does not allow us to conduct the analysis of welfare participation after the eighteenth birthday for this sisters' sample.

Miscarriage Sample

In the miscarriage sample, 16% of mothers appear in the welfare dataset after the birth of their first born child regardless of their status in the case and 13% are recipients of AFDC/TANF. The regressions indicate that teenage mothers are slightly more likely to receive direct cash assistance when their first born child is one or two years old (Table 13). This effect is small in magnitude (less than 3%) and is generally measured with precision. But once the child turns four, teen mothers are less likely than non-teen mothers to benefit from AFDC/TANF. Here also, the difference is small in magnitude (about 1%) and statistically significant.

TABLE 13: Miscarriage Sample: Effect of Teen Childbearing on the Mothers' Welfare Receipt, by Age Group of the Child

Children's Age	Coefficient		Robust Std Err	Number of Observations
0	-0.013	***	-0.004	*168888*
1	0.029	***	-0.003	*168888*
2	0.019	***	-0.004	*162667*
3	0		-0.004	*146125*
4	-0.008	*	-0.005	*125888*
5	-0.01	**	-0.005	*109703*
6	-0.011	**	-0.005	*92050*
7	-0.01	*	-0.006	*72828*
8	0		-0.006	*54309*
9	0.003		-0.006	*33795*

*, **, *** result statistically significant at 10%, 5% and 1%.

The analysis by race and age group shows a difference by race and age of the child. Black teen mothers are more likely to receive cash assistance (less than 2%) than black non-teen mothers when their child is a toddler. Later, when the child is of school age, panel data analysis suggests that black teen mothers are less likely than black non-teen mothers to be on welfare (Table 14, panel 1). In the white sub-sample, teen mothers are less likely to receive welfare than non-teen mothers throughout the years covered by this analysis. Whether the effects are measured with pooled probit or panel analysis, the magnitude is 2% or less, and generally measured with precision (Table 14, panel 2). Note that Hoffman (forthcoming) found an average effect of -6% over the two decades after the teen mothers turn eighteen. Our results show a much lower value but they concern only the first decade and in that regard are not inconsistent with prior results.

TABLE 14: Miscarriage Sample: Effect of Teen Childbearing on the Mothers' Welfare Receipt, by Age Group of the Child

	Probit			Panel Linear probability Model			Panel Probit		
Variables	Toddler	Pre-school	Toddler	Toddler	Pre-School	School	Toddler	Pre-school	School
					BLACK				
Marginal Effects	0.019***	0.002	0.003	0.014**	0.0004	-0.027***	0.010***	0.001	-0.005*
Robust Standard Errors	(0.003)	(0.005)	(0.004)	(0.006)	(0.009)	(0.008)	(0.004)	(0.003)	(0.003)
Number of Observations	*413679*	*136331*	*147301*	*413679*	*136331*	*147301*	*413679*	*136331*	*147301*
					WHITE				
Marginal Effects	-0.004***	-0.013***	-0.01***	-0.018***	-0.012***	-0.024 ***	-0.001***	-0.0006**	-0.002
Robust Standard Errors	(0.002)	(0.003)	(0.003)	(0.004)	(0.005)	(.005)	(0.000)	(0.000)	(0.002)
Number of observations	*268763*	*86318*	*88260*	268763	86318	88260	268763	86318	88260

*, **, *** result statistically significant at 10%, 5% and 1%.

Propensity Score Matching Sample

No mother in the propensity score matching sample receives cash welfare assistance in the year 2003.

Discussion of the Welfare Results

Only a small percentage of sisters and nobody in the propensity score sample receives welfare. One might expect a higher probability of welfare receipt in these two samples since these mothers were raised in families on welfare, and their upbringing may make them less sensitive to the welfare stigma. The miscarriage sample reveals that teen mothers are less likely than the non-teen mothers to receive welfare once their child reaches preschool age.

These results may be heavily influenced by welfare reform. The children are born between 1994 and 2002 so that many were toddlers in the pre-welfare years (1994 to 1996). However, all the children were in preschool and school in the post-welfare period. The welfare reform implemented in January 1997 in Georgia has tightened the eligibility conditions for welfare receipt, especially for teen mothers. As described in the literature section, there exists a lifetime four-year limit, a work obligation for the beneficiaries, and additional school and living arrangement requirements for teen mothers. Although welfare received before the age eighteen does not count toward the lifetime requirement, assistance received after the eighteenth birthday does. This substantial policy change may explain the steep decline in welfare receipt among blacks.

V. CONCLUSION AND POLICY IMPLICATIONS

This dissertation examines the impact of teen childbearing on the mothers' subsequent employment, earnings and welfare participation. We combine four administrative datasets—Birth, Wage, Employer and Welfare—and select three samples for the empirical analysis. These samples consist of a sisters' sample, a miscarriage sample, and a propensity score matching sample. We use pooled and panel data analyses with different models to assess the robustness of the empirical findings.

Overall, this study suggests that teen childbearing has a negative effect on the employment and earnings of Blacks in the miscarriage sample and in the propensity score sample. However, white teen mothers are more likely to be employed and to earn more than the white non-teen mothers. In contrast, the sisters' sample does not show any statistical significant effect of teen childbearing on employment or earnings. This racial difference in the impact of teen childbearing has been also found by Grogger and Bronars (1993). Other studies based on miscarriage samples find a null or a positive effect of teenage childbearing on the mother's earnings (Hoffman, forthcoming; Hotz et al., 1996, 1999). These latter studies use survey data with a smaller sample size that cannot be subdivided by race or socioeconomic status of the mothers. Our dissertation improves on this. Finally, for the welfare participation, few mothers in the sisters' sample and no mothers in the propensity score sample receive welfare during the years of study. For the miscarriage sample, white teen mothers are less likely than the white non-teen mothers to receive welfare at any time. Black teen mothers with toddlers are more likely to receive welfare than black non-teen mothers with a toddler. But as the child turns four, black teen

mothers become less likely than non-teen mothers to receive welfare. Since the study period straddles the welfare reform date, the change in the welfare policy may partly explain the shift in welfare receipt especially for the low-income population. Note that these results are aligned with previous ones that found no effect or a small negative effect of teenage childbearing on the adult mothers' welfare receipt. See (Geronimus and Korenman 1992); (Hotz 1996), (Hotz, Seth G Sanders, and Williams 1999); (Hoffman forthcoming).

Among the three samples used for this study, the miscarriage sample is the preferred one because it is representative of the population of Georgia, and is large enough to allow for an analysis by race and covers the longer period of time in this study (up to nine years after the birth of the child). Besides, the miscarriage sample is the only one that offers the possibility to analyze welfare participation. In addition, it presents rather conservative results because (1) the difference in age between the teen mothers and the non-teen mothers at the time of the first birth is small, and (2) the children born to teen mothers and the non-teen mothers have the same age in this sample. Although the miscarriage sample does not offer any family background information on the mothers, we assume that by virtue of their teen pregnancy and random miscarriage, the counterfactual mothers are as similar as possible to the teen mothers. In contrast, the sisters' sample is smaller, composed with mothers raised in large families on welfare. The outcome data spans only four calendar years and the age of the mothers and the children covers a larger range than in the miscarriage sample. The propensity score matching sample is the smallest of the three samples, and it covers only one calendar year. The fact that in this

sample, the teen mothers and the non-teen mothers are very much alike in terms of previous fetal death and education at the time of birth, suggests a path for future research. The preferred estimation technique is the panel one since all the likelihood ratio tests indicate that the panel component of the variance is statistically not null. Thus, we prefer the result obtained with probit on the binary outcomes (employment and welfare). Tables 15 and 16 summarize the preferred results across the three samples.

This study presents some limitations, the most important being that many key variables are either missing or not updated. For instance, the date of the fetal death event before the first birth is not reported, and neither education nor marital status are updated in these datasets. Moreover, there is no information on the mother's socioeconomic status unless she has been raised in a family on welfare. These limitations restrict the range of outcomes that we can investigate and make it impossible to offer definitive explanations for the results. Besides, this dissertation concerns only a couple of labor market outcomes and welfare participation. It does not investigate other outcomes that are relevant to the well-being of teen mothers and their families, such as family income and the probability of living in poverty. Nonetheless, we can suggest some policy implications based on the empirical findings.

This research implies that as far as employment and earnings are concerned, policy dollars aimed at preventing teenage childbearing would be more efficiently used for the Blacks and low-income populations. However, the small magnitude of the teen coefficients in the employment and earnings analyses suggests that teen pregnancy prevention only will not have a very dramatic influence on the adult mothers' standards of living. Besides, the fact that the white teen mothers are more likely to work and earn

more income than white non-teen mothers may conceal important difference in their standard of living and the care offered to the child. Therefore, policy dollars should also be directed to issues correlated with teen childbearing such as poverty or low education attainment. As for welfare participation, teen mothers are no more likely to rely on public assistance than non-teen mothers so their welfare dependence should not be a concern.

TABLE 15: Summary of the Main Results with Each Sample

	Sisters Sample (Years 2000-2004)	**Miscarriage Sample**				**Propensity Score Matching Sample (Year 2003)**
		Pre-School		**School**		
		Black	White	Black	White	Radius Matching
Effects of teen childbearing on Employment (Random Probit)	-0.038	-0.035***	0.007	-0.037***	0.028*	-0.071***
Effects of teen childbearing on Earnings	-0.117	-0.033**	0.032	-0.085***	0.054**	-0.116*
Effects of teen childbearing on Welfare (Random Probit)	NA	0.001	-0.0006**	-0.005*	-0.002	NA

*, **, *** result statistically significant at 10%, 5% and 1%.

TABLE 16: Brief Summary of the Main Characteristics of Each Sample

	Sisters Sample		**Miscarriage Sample**				**Propensity Score Matching Sample**	
	(Years 2000-2004)		Pre-School♣		School ♣		(Year 2003)	
	Teen	Non-teen	Teen	Non-Teen	Teen	Non-Teen	Teen	Non-teen
Mean Age of Mothers	21.6	22.9	21.1	23.3	23.3	25.5	23.1	24.7
Mean Age of Children	5.1	3.1	4.7	4.71	7.0	6.9	6.0	5.9
Percentage Black	70	70	61	56	63	57	53	58
Percentage raised in Welfare	100	100	20	9.5	16	5	100	100
Number of Observations	1344	1392	165,296	13,104	134,754	10,272	316	580

♣ (Age 4 on September 1st , 5 and 6 after September 1st)
♣ (Age 6 on September 1st , and above)

APPENDIX A: DESCRIPTIVE STATISTICS

TABLE A 1: Descriptive Statistics for the Sisters Sample

Variables at the time of first delivery	Definition	Full Sample		Teenage mothers			Non-teen Mothers	
		Mean	Std. Dev.	Mean	Std. Dev.		Mean	Std. Dev.
	Mother's characteristic's							
Mageyear	Mothers age in years	17.807	2.16	16.059	0.918	***	19.494	1.604
Teen	=1 if teenage mother less than 18, =0 otherwise	0.491	0.500	1.000	0.000		0.000	0.000
Evenyear	Year of the child's birth	1996.977	1.904	1995.869	0.974	***	1998.046	1.971
Evenmont	Month of the child's birth	6.971	3.269	6.964	3.191		6.977	3.344
Mother's race								
Black	=1 if mother's race is black, =0 otherwise	0.760	0.427	0.76	0.426		0.76	0.428
White	=1 if mother's race is Caucasian, =0 otherwise	0.240	0.490	0.238	0.426		0.241	0.428
Mrace_other	=1 if mother's race is other, =0 otherwise	0	0	0	0		0	0
Mother's ethnicity								
Latina	=1 if mother is Latina, =0 otherwise	0.012	0.108	0.012	0.108		0.011	0.107
Nonlatina	=1 if mother is not a Latina, =0 otherwise	0.988	0.108	0.988	0.108	***	0.988	0.108
Mother's education								
Meduc_unknown	=1 if mother's education is unknown, =0 otherwise	0.018	0.131	0.024	0.153	**	0.011	0.107
Meduc1	=1 if mother's education up to 8th grade, =0 otherwise	0.135	0.341	0.238	0.426	***	0.034	0.183
Meduc2	=1 if mother's education up to 9th to 12th grade, =0 otherwise	0.801	0.399	0.738	0.440	***	0.862	0.345
Meduc3	=1 if mother's education more than HS, =0 otherwise	0.0047	0.211	0.0	0.00	***	0.092	0.289

Table A1: Descriptive Statistics for the Sisters Sample (continued)

Variables	Definition	Full Sample		Teenage mothers			Non-teen Mothers	
		Mean	Std. Dev.	Mean	Std. Dev.		Mean	Std. Dev.
Residence county								
Merescoun	=1 if mothers' residence county is in metro area, =0 otherwise	0.275	0.447	0.298	0.457	***	0.253	0.435
Urrescoun	=1 if mothers' residence county is in urban area, =0 otherwise	0.678	0.467	0.655	0.476	***	0.701	0.458
Rurescoun	=1 if mothers' residence county is in rural area, =0 otherwise	0.047	0.211	0.048	0.213		0.046	0.210
	Child's characteristics							
Weight	Weight in grams	3093.193	533.511	3072.202	569.867	**	3113.460	495.249
Weight1500	=1 if the baby weight less than 1500 grams, =0 otherwise	0.006	0.076	0.012	0.108	***	0	0
Weight2500	=1 if the baby weight between 1500 and 2500 grams, =0 otherwise	0.117	0.321	0.119	0.115		0.115	0.319
Weight2500p	=1 if the baby weight more than 2500 grams, =0 otherwise	0.877	0.328	0.869	0.337		0.885	0.319
Sex	=1 if the child is a male, =0 otherwise	0.503	0.500	0.512	0.500		0.494	0.500
Father's characteristics								
Fathers' age								
Fage_unknown	=1 if father's age unknown, =0 otherwise	0.503	0.500	0.607	0.489	***	0.402	0.491
Fagelt18	=1 if father's age less than 18, =0 otherwise	0.053	0.223	0.095	0.294		0.011	0.107
Fage1819	=1 if father's age 18 and 19, =0 otherwise	0.146	0.358	0.155	0.362	***	0.138	0.345
Fage20plus	=1 if father's age 20 and more, =0 otherwise	0.298	0.458	0.143	0.35	***	0.448	0.422
Fathers' education								
Feduc_unknown	=1 if father's education unknown, =0 otherwise	0.538	0.499	0.643	0.479	***	0.437	0.496
Feduc1	=1 if father's education up to 8th grade, =0 otherwise	0.041	0.198	0.048	0.213	*	0.034	0.183
Feduc2	=1 if father's education up to 9th to 12th grade, =0 otherwise	0.404	0.491	0.298	0.457	***	0.506	0.500
Feduc3	=1 if father's education more than HS, =0 otherwise	0.018	0.131	0.012	0.108	***	0.023	0.150
Number of Observations		2736		1344			1392	

Table A1: Descriptive Statistics for the Sisters Sample (end)

		Full Sample		Teenage mothers			Non-teen Mothers	
Variables	**Definition**	Mean	Std. Dev.	Mean	Std. Dev.		Mean	Std. Dev.
Updated Variables at the time of employment (years 2000 to 2004)								
Emp1	=1 if woman's income>0 during the quarter, =0 otherwise	0.564	0.496	0.532	0.499	***	0595	0.569
Emp2	=1 if woman's income>=$1339 during the quarter, =0 otherwise	0.359	0.480	0.291	0.454	***	0.425	0.495
Cur_ageyy	Mother's current age in years	22.922	2.395	22.296	2.208	***	23.527	2.415
Non-Mother	=1 if woman's is not a mother during quarter, =0 otherwise	0.039	0.193	0	0	***	0.0761	0.265
B_curage	Baby' current age	4.850	3.965	5.946	3.654	***	3.791	3.967
Experience	Experience	14.512	9.463	11.108	7.55	***	16.940	10.43
Experience square	Experience Square	300.104	361.740	200.955	222.743	***	395.835	436.712
Def_inc	Deflated Income earned, (conditional on positive income)	1375.035	1268.478	1082.018	966.352	***	1628.062	1433.733
Number of Observations		1543		828			715	

*, **, *** result statistically significant at 10%, 5% and 1%.

TABLE A 2: Descriptive Statistics for the Miscarriage Sample

Variables	Definition	Full Sample		Teenage mothers			Non-teen Mothers	
		Mean	Std. Dev.	Mean	Std. Dev.		Mean	Std. Dev.
	Mother's characteristic's							
Mageyear	Mothers age in years	16.501	0.953	16.321	0.752	***	18.557	0.497
Teen	=1 if teenage mother less than 18, =0 otherwise	0.920	0.500	1.000	0.000		0.000	0.000
Evenyear	Year of the child's birth	1997.819	2.545	1997.797	2.545	***	1998.072	2.535
Evenmont	Month of the child's birth	6.535	3.478	6.535	3.481	***	6.568	3.446
Dfetal	=1 if mother has had a miscarriage.	0.114	0.318	0.041	0.197	***	1	0
Mother's race								
Black	=1 if mother's race is black, =0 otherwise	0.599	0.490	0.604	0.489		0.548	0.498
White	=1 if mother's race is Caucasian, =0 otherwise	0.392	0.487	0.379	0.487		0.442	0.497
Mrace_other	=1 if mother's race is other, =0 otherwise	0.008	0.091	0.008	0.091		0.010	0.10
Mother's ethnicity								
Latina	=1 if mother is Latina, =0 otherwise	0.023	0.151	0.024	0.152	***	0.019	0.131
Nonlatina	=1 if mother is not a Latina, =0 otherwise	0.972	0.1666	0.972	0.167	***	0.975	0.155
Mother's Ethnicity unknown	=1 if mother's ethnicity is unknown, =0 otherwise, =0 otherwise	0.005	0.684	0.005	0.068	***	0.006	0.077
Mother's education								
Meduc_unknown	=1 if mother's education is unknown, =0 otherwise	0.011	0.103	0.011	0.105	***	0.006	0.077
Meduc1	=1 if mother's education up to 8th grade, =0 otherwise	0.111	0.314	0.118	0.322	***	0.033	0.180
Meduc2	=1 if mother's education up to 9th to 12th grade, =0 otherwise	0.873	0.333	0.870	0.336	***	0.907	0.290
Meduc3	=1 if mother's education more than HS, =0 otherwise	0.005	0.027	0.001	0.027	***	0.054	0.226
Residence county								
Merescoun	=1 if mothers' residence county is in metro area in	0.272	0.445	0.274	0.446	***	0.245	0430

	2000 census, =0 otherwise							
Urrescoun	=1 if mothers' residence county is in urban area in 2000 census	0.697	0.459	0.697	0.460	***	0.728	0.445
Rurescoun	=1 if mothers' residence county is in rural area in 2000 census, =0 otherwise	0.029	0.168	0.029	0.168	***	0.027	0.161
Weight	Weight in grams	31110	592.151	3109.94	586.725	***	3114.421	651.141
Weight1500	=1 if the baby weight less than 1500 grams, =0 otherwise	0.021	0.144	0.021	0.141	***	0.032	0.175
Weight2500	=1 if 1500 grams < baby weight>2500 grams, =0 otherwise	0.091	0.288	0.091	0.288	***	0.091	0.288
Weight2500p	=1 if the baby weight more than 2500 grams, =0 otherwise	0.888	0.315	0.889	0.315	***	0.878	0.327
Sex	=1 if the child is a male	0.511	0.500	0.512	0.500	***	0.503	0.500
Father's characteristics								
Fathers' age								
Fage_unknown	=1 if father's age unknown, =0 otherwise	0.521	0.500	0.533	0.500	***	0.393	0.500
Fagelt18	=1 if father's age less than 18, =0 otherwise	0.094	0.291	0.010	0.300	***	0.023	0.153
Fage1819	=1 if father's age 18 and 19, =0 otherwise	0.180	0.384	0.175	0.380	***	0.125	0.331
Fage20plus	=1 if father's age 20 and more, =0 otherwise	0.210	0.410	0.188	0.391	***	0.458	0.498
Fathers' education								
Feduc_unknown	=1 if father's education unknown, =0 otherwise	0.551	0.497	0.561	0.496	***	0.430	0.495
Feduc1	=1 if father's education up to 8th grade, =0 otherwise	0.021	0.143	0.021	0.144	***	0.019	0.137
Feduc2	=1 if father's education up to 9th to 12th grade, =0 otherwise	0.405	0.491	0.398	0.489	***	0.488	0.500
Feduc3	=1 if father's education more than HS, =0 otherwise	0.023	0.150	0.019	0.138	***	0.062	0.242
Number of Observations	(unique undividuals)	42,222		38,826			3,386	

	Labor Market Variables							
emp1	=1 if the mother has a positive quarterly income, =0 otherwise	0.493	0.500	0.489	0.500	***	0.543	0.498
emp2	=1 if the mother has a quarterly income>= equivalent minimum wage, =0 otherwise	0.293	0.455	0.287	0.452	***	0.363	0.481
mother's age	mother's age,	19.367	2.502	19.204	2.444	***	21.340	2.349
mother's age square	mother's age square	381.348	100.050	374.757	96.869	***	460.897	103.528
Experience	Experience	9.097	8.522	8.748	8.331	***	13.317	9.604
def_inc	Deflated income	1324.976	1987.045	1303.774	2019.974	***	1555.663	1566.726

*, **, *** result statistically significant at 10%, 5% and 1%.

TABLE A 3: Descriptive Statistics for the Propensity Score Matching Sample

Variables	Definition	Full Sample		Teenage mothers			Non-teen Mothers	
		Mean	Std. Dev.	Mean	Std. Dev.		Mean	Std. Dev.
Mother's characteristic's								
mageyear	Mothers age in years	17.862	1.116	16.557		***	18.572	0.495
teen	=1 if teenage mother less than 18, =0 otherwise	0.353	0.478	1.000	0.000		0.000	0.000
Evenyear	Year of the child's birth	1997.013	1.600	1996.899	1.566		1997.076	1.616
evenmont	Month of the child's birth	6.969	3.352	7.013	3.375		6.945	3.343
Mother's race								
Black	=1 if mother's race is black, =0 otherwise	0.563	0.496	0.532	0.500		0.579	0.494
White	=1 if mother's race is Caucasian, =0 otherwise	0.429	0.495	0.456	0.499		0.414	0.493
mother other race	=1 if mother's race is other, =0 otherwise	0.009	0.094	0.013	0.112		0.007	0.083
Mother's ethnicity								
Latina	=1 if mother is Latina, =0 otherwise	0.013	0.115	0.025	0.157	**	0.007	0.083
Non-latina	=1 if mother is not a Latina, =0 otherwise	0.978	0.148	0.962	0.191	**	0.986	0.117
Methn unknown	=1 if mother's ethnicity is unknown, =0 otherwise	0.009	0.094	0.013	0.112	***	0.007	0.083
Mother's education								
Meduc unknown	=1 if mother's education is unknown, =0 otherwise	0.978	0.148	0.937	0.244	***	1.000	0.000
Meduc1	=1 if mother's education up to 8th grade, =0 otherwise	0.022	0.148	0.063	0.244	***	0.000	0.000
meduc2	=1 if mother's education up to 9th to 12th grade, =0 otherwise	0.000	0.000	0.000		***	0.000	0.000
meduc3	=1 if mother's education more than HS, =0 otherwise	1.000						
Weight	Weight in grams	3048.884	652.502	2966.595	668.092	***	3093.717	639.988
Mother's residence county								
rurescoun	=1 if mothers' residence county is in metro area, =0 otherwise	0.018	0.133	0.038	0.191	***	0.007	0.083
Urescoun	=1 if mothers' residence county is in urban area, =0 otherwise	0.781	0.414	0.772	0.420		0.786	0.410
merescoun	=1 if mothers' residence county is in rural area , =0 otherwise	0.201	0.401	0.190	0.393		0.207	0.405

Table A3: Descriptive Statistics for the Propensity Score Matching Sample (continued)

Variables	Definition	Full Sample		Teenage mothers			Non-teen Mothers	
		Mean	Std. Dev.	Mean	Std. Dev.		Mean	Std. Dev.
dfetal	=1 if mothers' have had a fetal death prior to the birth of the first child, =0 otherwise.	1.000	0.000	1.000	0.000		1.000	0.000
expebefore birth	Number of quarters the mothers have worked before the birth of the first child	1.111	0.319	1.143	0.356		1.000	0.000
relatc child	=1 if child of the head of household at the age 14 in welfare, =0 otherwise	0.884	0.320	0.873	0.333		0.890	0.314
relatc grand child	=1 if grand Child of the head of household at the age 14 in welfare, =0 otherwise	0.067	0.250	0.063	0.244		0.069	0.254
relatc other	=1 if Other relationship with the head of household at the age 14 in welfare, =0 otherwise	0.049	0.216	0.063	0.244		0.041	0.199
eligi	Mother eligible at the age 14 in welfare	0.625	0.484	0.646	0.479		0.614	0.487
Mm	Month of birth	6.946	3.307	7.190	3.156		6.814	3.382
Adult	Number of adults on welfare	0.848	0.538	0.848	0.480		0.848	0.568
Child	Number of child on welfare	2.254	1.345	2.253	1.347		2.255	1.344
Intensity of welfare	Number of quarters on welfare	11.862	7.894	11.494	7.901		12.062	7.890
Child's characteristics								
weight1500	=1 if the baby weight less than 1500 grams, =0 otherwise	0.049	0.216	0.063	0.244		0.041	0.199
weight2500	=1 if the baby weight between 1500 and 2500 grams, =0 otherwise	0.080	0.272	0.089	0.285		0.076	0.265
weight2500 plus	=1 if the baby weight more than 2500 grams, =0 otherwise	0.871	0.336	0.848	0.359		0.883	0.322
sex	=1 if the child is a male, =0 otherwise	0.504	0.500	0.430	0.496	***	0.545	0.498

Table A3: Descriptive Statistics for the Propensity Score Matching Sample (end)

Variables	Definition	Full Sample		Teenage mothers			Non-teen Mothers	
		Mean	Std. Dev.	Mean	Std. Dev.		Mean	Std. Dev.
	Father's characteristics							
fageyear unkown	=1 if father's age unknown, =0 otherwise	0.335	0.472	0.367	0.483		0.317	0.466
fageless than 18	=1 if father's age less than 18, =0 otherwise		0.196	0.063	0.244	***	0.028	0.164
fage 1819	=1 if father's age 18 and 19, =0 otherwise	0.147	0.355	0.190	0.393	***	0.124	0.330
fage 20 plus	=1 if father's age 20 and more, =0 otherwise	0.478	0.500	0.380	0.486	***	0.531	0.499
feduc unknown	=1 if father's education unknown, =0 otherwise	0.371	0.483	0.392	0.489		0.359	0.480
feduc1	=1 if father's education up to 8th grade, =0 otherwise	0.027	0.162	0.038	0.191		0.021	0.142
feduc2	=1 if father's education up to 9th to 12th grade, =0 otherwise	0.540	0.499	0.557	0.498		0.531	0.499
feduc3	=1 if father's education more than HS, =0 otherwise	0.063	0.242	0.013	0.112	***	0.090	0.286
Number of observations		896		580			316	
	Employment characteristics							
Employment 1	Employment threshold 1	0.482	0.500	0.434	0.496	**	0.509	0.500
Employment 2	Employment threshold 2	0.390	0.488	0.351	0.478	*	0.410	0.492
Deflated income	Deflated income	1997.854	1428.837	1705.574	1068.794	***	2133.591	1551.194

*, **, *** result statistically significant at 10%, 5% and 1%.

TABLE A 4 : Summary of Institutional Framework for Young Mothers in GA after the Welfare Reform

	Age				
	15	16	17	18	19
	School related constraints				
School attendance	Compulsory (High School)	Compulsory until the 16th birthday (High School)	Not Compulsory (High School: 11th or 12th grade)	Not Compulsory (High School: 12th grade; or college)	Not Compulsory (college)
Hours of work	Employment certificate required Work hour restrictions apply No restriction for child working for parent/guardian business Hazardous/prohibited occupation restrictions for all	Employment certificate required No work hour restrictions even if in school No restriction for child working for parent/guardian business Hazardous/prohibited occupation restrictions for all	Employment certificate required No work hour restriction Hazardous/prohibited occupation restrictions for all	No restriction	No restriction
	Welfare related requirements				
Welfare access	Generally, may not be case head. May be client after the welfare reform; Has to be in school	Generally, may not be case head. May be client after the welfare reform; Has to be in school	Generally, may not be case head. May be client after the welfare reform; Has to be in school	May be case head;	May be case head
Living arrangements	Generally, has to live with an adult	Generally, has to live with an adult	Generally, has to live with an adult	No requirement	No requirement

Work requirement under welfare	Not applicable; has to be in school. School requirement may be waived during the first12 weeks of the newborn	Not applicable if she is in school	Not applicable if she is in school	Waived if the child is less than a year old Otherwise has to work at least 20 hours a week	Waived if the child is less than a year old Otherwise has to work at least 20 hours a week
Lifetime assistance	Does not count toward lifetime assistance	Does not count toward lifetime assistance	Does not count toward lifetime assistance	Generally, count from the 18th birthday	Generally, count from the 18th birthday

TABLE B 1 Sister Sample: Effects of Teenage Childbearing on the Mother's Subsequent Employment, Years 2000 -2003

	LPM with family dummies			Probit with family dummies			Probit without family dummies			Random Effects (Probit)	
Variables	Coef-Ficient	Rob Std. Err.		Marginal Effect	Rob Std. Err.		Marginal Effect	Rob Std. Err.		Coef-ficient	Std. Err.
Teen	0.001	0.020		-0.040	0.041		-0.031	0.031		-0.039	2.697
Mother's current age	-0.013	0.009		-0.042	0.014	***	-0.032	0.010	***	-0.061	4.227
Unemployment rate	-0.116	0.041	***	-0.173	0.061	***	-0.089	0.050		-0.032	2.240
Non Mother*	-0.119	0.040	***	-0.123	0.049	**	-0.144	0.040	***	-0.075	6.047
Mother's education unknown	-0.323	0.116	***	-0.361	0.012	***	-0.181	0.054		-0.197	21.039
Mother's education 8th grade or less	-0.238	0.068	***	-0.276	0.055	***	-0.300	0.033		-0.185	16.589
Mother's education up to high school	-0.182	0.055	***	-0.264	0.085	***	-0.272	0.054	***	-0.252	12.323
Experience	0.041	0.003	***	0.060	0.004	***	0.036	0.003	***	0.062	4.366
Experience square	0.000	0.000	***	-0.001	0.000	***	0.000	0.000	***	-0.001	-0.056
Child's age	0.000	0.000		-0.015	0.013		0.005	0.009	***	0.004	0.270
Black				0.778	0.037		0.013	0.024		0.723	207.68
Latina				-0.186	0.066		0.014	0.088		-0.073	5.969
Time control	Yes			Yes			Yes			Yes	
Number of observations	2736			2512			2736			2736	

*, **, and *** indicate that estimated coefficients are statistically significant at 10%, 5% and 1% levels respectively

TABLE B 2 Sister Sample: Effects of Teenage Childbearing on the Mother's Subsequent Employment Year 2003

	LPM with family dummies			Probit with family dummies			Probit without family dummies			Random Effects (Probit)	
Variables	Coef-ficient	Rob Std. Err.		Marginal Effect	Rob Std. Err.		Marginal Effect	Rob Std. Err.		Coef-ficient	Std. Err.
Teen	-0.008	0.057		-0.116	0.109		0.101	0.067		-0.049	13.146
Mother's current age	-0.016	0.020		-0.002	0.039		-0.009	0.020		-0.010	2.789
Mother's education unknown	-0.021	0.135	*				0.047	0.049	*	-0.106	1199.2
Mother's education 8th grade or less	-0.008	0.149	**	0.105	0.268		0.297	0.151	**	-0.097	21.66
Mother's education up to high school	-0.008	0.116	***	0.184	0.190		-0.288	0.114	***	-0.055	16.344
Experience	0.039	0.007	***	0.082	0.014	***	0.023	0.007	***	0.027	7.566
Experience Square	0.000	0.000		-0.001	0.000	***	0.000	0.000		0.000	0.080
Child's current age	0.016	0.015		0.047	0.030		-0.023	0.017		-0.013	3.556
Father is 20	-0.067	0.051	*	-0.269	0.086	***	-0.082	0.049	*	-0.070	20.028
Father is 18 or 19	-0.263	0.058		-0.539	0.041	***	0.003	0.060		-0.111	30.71
Black				-0.719	0.096	***	-0.466	0.049		-0.144	1078
Latina							-0.297	0.151	*	-0.014	4.069
Rho											
Number of observations	684			684			684			684	

*, **, and *** indicate that estimated coefficients are statistically significant at 10%, 5% and 1% levels respectively

TABLE B 3 Sister Sample: Effect of Teenage Childbearing on the Mother's Subsequent Earnings, Years 2000-2003

	Linear (with family dummies) *a*			*Without family dummies* *b*			*With family dummies* *c*			*Random effects* *d*		
Variables	Coef-ficient	Rob Std. Err.		Margi nal Effect	Rob Std. Err.		Margi nal Effect	Rob Std. Err.		Coef-ficient	Std. Err.	
Teen	-0.130	0.063	**	-0.128	0.065	**	-0210	0.047	***	-0.329	0.146	**
Mother's current age	0.042	0.029		0.060	0.021	***	-0.057	0.026	**	-0.081	0.035	**
Mother's education unknown									**	-0.545	0.352	
Mother's education unknown	-1.098	0.378	***	-0.486	0.188	***	-0.932	0.286	**	-1.118	0.291	***
Mother's education 8th grade or less	-0.805	0.274	***	-0.322	0.135	**	-0.587	0.174	***	-0.779	0.239	
Experience	0.094	0.070		-.0002	0.0181		0.050	0.038		0.008	0.032	
Experience Square	-0.001	0.001		0.000	0.000		-0.000	.000		0.000	0.000	
Child's age	0.065	0.017	***	0.060	0.017	***	0.062	0.015	***	0.123	0.032	***
Control for sample selection	5.337	3.116	*	0.245	0.186		0.753	0.478		0.323	0.516	
Time control	Yes			Yes			Yes					
Industry Control	Yes			Yes			Yes			Yes		
Rho										0.451		
Number of observations	983			951			983			983		

*, **, and *** indicate that estimated coefficients are statistically significant at 10%, 5% and 1% levels respectively
*, **, and *** indicate that estimated coefficients are statistically significant at 10%, 5% and 1% levels respectively
All the estimations include an inverse mills Ratio obtained with the method list in a, b, c, or d
a: the first step analysis on employment is run with linear regression
b: the first step analysis on employment is run with probit without family dummies
c: the first step analysis on employment is run with probit without family dummies
d: the first step analysis on employment is run with xtprobit

TABLE B 4 Sister Sample: Effect of Teenage Childbearing on the Mother's Subsequent Earnings, Years 2003 Only

	Linear (with family dummies) a			*Without family dummies b*			*With family dummies c*			*Random effects d*		
Variables	Coef-ficient	Rob Std. Err.		Margi nal Effect	Rob Std. Err.		Margi nal Effect	Rob Std. Err.		Coef-ficient	Std. Err.	
Teen	-0.020	0.194		-0.304	0.094	***	-0.155	0.224		0.040	0.200	
Mother's current age	0.079	0.048	*	-0.109	0.028	***	0.058	0.056		0.081	0.050	
Mother's education unknown				-0.455	0.216	**	-0.646	0.638		-1.535	0.590	***
Mother's education 8th grade or less	-0.950	0.322	***	-1.164	0.188	***	-0.973	0.432	**	-0.839	0.350	**
Mother's education up to High School	-1.059	0.283	***	-0.804	0.150	***	-1.251	0.354	***	-0.779	0.239	***
Experience	-0.020	0.028		-0.001	0.025		-0.020	0.035		0.019	0.025	
Experience Square	0.000	0.000		0.000	0.001	**	0.000	0.000		0.000	0.000	
Child's age	0.105	0.052		0.121	0.021	***	0.133	0.064	**	0.100	0.053	*
Control for sample selection	-2.255	0.635	***	0.371	0.332		-0.218	0.184		0.131	0.125	
Time control	Yes			Yes								
Industry Control	Yes			Yes						Yes		
Number of observations	258			258				226		258		

*, **, and *** indicate that estimated coefficients are statistically significant at 10%, 5% and 1% levels respectively
*, **, and *** indicate that estimated coefficients are statistically significant at 10%, 5% and 1% levels respectively
All the estimations include an inverse mills Ratio obtained with the method list in a, b, c, or d
a: the first step analysis on employment is run with linear regression
b: the first step analysis on employment is run with probit without family dummies
c: the first step analysis on employment is run with probit without family dummies
d: the first step analysis on employment is run with xtprobit

TABLE C 1 Miscarriage Sample: Effects of Teenage Childbearing on the Mother's Subsequent Employment

Variables	Marginal Effects	Robust Std. Err.		Marginal Effects	Robust Std. Err.		Marginal Effects	Robust Std. Err.		Marginal Effects	Robust Std. Err.	
Child's current age	0	0		1	1		2	2		3	3	
Teen*	0.001	0.005		0.050	0.007	***	0.044	0.009	***	0.045	0.011	***
Mother's education <= 9 grade	0.026	0.002	***	0.039	0.003	***	0.052	0.004	***	0.042	0.004	***
Mother's education High School	0.071	0.013	***	0.058	0.017	***	0.106	0.022	***	0.142	0.025	***
black*	-0.009	0.002	***	-0.004	0.002		0.012	0.003	***	0.037	0.003	***
Latina*	0.052	0.006	***	0.082	0.009	***	0.094	0.010	***	0.121	0.012	***
Mother's ethnicity unknown	0.001	0.010		0.013	0.015		0.059	0.019	***	0.039	0.022	*
Metro residence county	0.019	0.005	***	0.004	0.007		-0.024	0.008	***	-0.030	0.009	***
Urban residence county	0.010	0.005		-0.015	0.007		-0.055	0.008	***	-0.063	0.009	***
Experience	0.046	0.000	***	0.065	0.000	***	0.068	0.001	***	0.066	0.001	***
Experience Square	-0.001	0.000	***	-0.001	0.000	***	-0.001	0.000	***	-0.001	0.000	***
Mother's current age in year	0.224	0.029	***	0.106	0.045	**	0.013	0.058		-0.120	0.069	*
Mother's current age in year square	-0.007	0.001	***	-0.003	0.001	***	-0.001	0.002		0.002	0.002	
Intensity of welfare	-0.001	0.000	***	-0.001	0.000	***	-0.001	0.000	***	-0.001	0.000	***
Father's education <=9th grade	0.001	0.002		0.018	0.003	***	0.019	0.004	***	0.023	0.004	***
Father's education High School	-0.015	0.004		0.024	0.008	***	0.030	0.009	***	0.043	0.011	***
Father age 18 or 19	0.004	0.003		0.003	0.004		0.007	0.004		0.013	0.005	***
Father age 20	-0.001	0.003		-0.010	0.004	***	-0.011	0.004	***	-0.010	0.005	**
Time control dummies	Yes			Yes			Yes			Yes		
Number of observations		168888			1585501			141906			124783	

*, **, and *** indicate that estimated coefficients are statistically significant at 10%, 5% and 1% levels respectively.

Table C.1. Miscarriage Sample: Effects of Teenage Childbearing on the Mother's Subsequent Employment (continued)

Variables	Marginal Effects	Robust Std. Err.		Marginal Effects	Robust Std. Err.		Marginal Effects	Robust Std. Err.		Marginal Effects	Robust Std. Err.	
Child's current age	4	4		5	5		6	6		7	7	
Teen*	0.033	0.012	***	0.036	0.014	***	0.019	0.017		0.025	0.020	
Mother's education <= 9 grade	0.038	0.005	***	0.031	0.006	***	0.025	0.006	***	0.025	0.007	***
Mother's education High School	0.100	0.027	***	0.065	0.029	**	0.036	0.033		-0.017	0.040	
black*	0.049	0.003	***	0.056	0.004	***	0.064	0.004	***	0.064	0.005	***
Latina*	0.117	0.014	***	0.134	0.016	***	0.139	0.019	***	0.132	0.024	***
Mother's ethnicity unknown	0.009	0.026		-0.071	0.027	***	0.031	0.036		0.163	0.053	***
Metro residence county	-0.014	0.010		-0.035	0.011	***	-0.045	0.012	***	-0.009	0.015	
Urban residence county	-0.062	0.010	***	-0.085	0.011	***	-0.096	0.013	***	-0.059	0.015	***
Experience	0.060	0.001	***	0.057	0.001	***	0.053	0.001	***	0.048	0.001	***
Experience Square	-0.001	0.000	***	-0.001	0.000	***	-0.001	0.000	***	0.000	0.000	***
Mother's current age in year	-0.120	0.082		-0.275	0.098	***	-0.115	0.118		0.035	0.148	
Mother's current age in year square	0.002	0.002		0.005	0.002	***	0.002	0.003		-0.001	0.003	
Intensity of welfare	-0.001	0.000	**	-0.001	0.000	**	-0.001	0.000	***	0.000	0.001	
Father's education <=9th grade	0.023	0.005	***	0.025	0.005	***	0.023	0.006	***	0.022	0.007	***
Father's education High School	0.038	0.012	***	-0.002	0.013		-0.022	0.015		0.011	0.018	
Father age 18 or 19	0.001	0.006		-0.007	0.006		0.003	0.007		0.009	0.008	
Father age 20	-0.011	0.005	**	-0.018	0.006	***	-0.005	0.007		-0.010	0.008	
Time control dummies	Yes			Yes			Yes			Yes		
Number of observations		105127			86053			67432			47947	

*, **, and *** indicate that estimated coefficients are statistically significant at 10%, 5% and 1% levels respectively.

Table C.1. Miscarriage Sample: Effects of Teenage Childbearing on the Mother's Subsequent Employment (end)

Variables	Marginal Effects	Robust Std. Err.		Marginal Effects	Robust Std. Err.	
Child's current age	7	7		8	8	
Teen	0.065	0.024	***	-0.019	0.051	
Mother's education <= 9 grade	0.039	0.009	***	0.017	0.018	
Mother's education High School	-0.029	0.060		-0.283	0.053	***
Black	0.062	0.007	***	0.071	0.012	***
Latina	0.064	0.032	**	0.053	0.059	
Mother's ethnicity unknown	0.293	0.086	***	0.462	0.187	**
Metro residence county	0.023	0.021		0.005	0.039	
Urban residence county	-0.018	0.021		-0.048	0.038	
Experience	0.044	0.001	***	0.040	0.002	***
Experience Square	0.000	0.000	***	0.000	0.000	***
Mother's current age in year	-0.330	0.202	***	0.283	0.403	
Mother's current age in year square	0.006	0.004		-0.006	0.008	
Intensity of welfare	0.001	0.001		0.003	0.003	
Father's education <=9th grade	0.032	0.009	***	0.020	0.018	
Father's education High School	0.080	0.026	***	0.082	0.048	*
Father age 18 or 19	0.007	0.011		0.005	0.021	
Father age 20	-0.013	0.010		-0.016	0.020	
Time control dummies	Yes			Yes		
Number of observations		28640			8151	

*, **, and *** indicate that estimated coefficients are statistically significant at 10%, 5% and 1% levels respectively.

TABLE C 2 Miscarriage Sample: Effects of Teenage Childbearing on the Black Mother's Subsequent Employment, by the child age group (Pooled Probit)

	Black and Toddler			Black and Preschool			Black and School		
Variables	Marginal Effect	Robust Std. Err.		Marginal Effect	Robust Std. Err.		Marginal Effect	Robust Std. Err.	
Teen	0.015	0.003	***	0.016	0.009	*	0.018	0.010	*
Mother's education <= 9 grade	0.041	0.002	***	0.030	0.005	***	0.028	0.006	***
Mother's education more than HS	0.094	0.010	***	0.054	0.023	**	-0.023	0.028	
Latina	0.028	0.015		-0.051	0.032		0.020	0.046	
Mother's ethnicity unknown	0.018	0.012		0.009	0.036		0.195	0.053	***
Metro residence county	-0.023	0.004	***	-0.065	0.010	***	-0.050	0.012	***
Urban residence county	-0.058	0.005	***	-0.138	0.011	***	-0.123	0.013	***
Experience	0.057	0.000	***	0.059	0.001	***	0.053	0.001	***
Experience Square	-0.001	0.000	***	-0.001	0.000	***	-0.001	0.000	***
Mother's age in year	0.211	0.009	***	-0.131	0.042	***	-0.112	0.042	***
Mother's age in year square	-0.006	0.000	***	0.002	0.001	**	0.002	0.001	**
Intensity of welfare	0.000	0.000	***	0.000	0.000		0.001	0.000	
Birth occurred in 1996 or 1997	-0.005	0.002	**	0.014	0.005	***	0.029	0.006	***
Birth occurred after 1997	0.004	0.003		0.059	0.009	***			
Father's education <= 9 grade	0.013	0.002	***	0.006	0.005		0.022	0.006	***
Father's education more than HS	0.011	0.005	**	-0.004	0.012		0.016	0.014	
Father's age18 and 19	0.005	0.003	**	0.010	0.006	*	-0.004	0.007	
Father's age 20 and more	0.000	0.003		-0.001	0.006		-0.013	0.007	
Time control	-0.052	0.020		0.004	0.024		-0.021	0.021	
Number of observations	379177			109645			81671		

*, **, and *** indicate that estimated coefficients are statistically significant at 10%, 5% and 1% levels respectively.

TABLE C 3 Miscarriage Sample: Effects of Teenage Childbearing on the Black Mother's Subsequent Employment (Random Effects Probit)

Variables	Black and Toddler			Black and PreK			Black and School		
	Marginal Effects	Robust Std. Err.		Marginal Effects	Robust Std. Err.		Marginal Effects	Robust Std. Err.	
Teen	-0.008	0.006		-0.111	0.023	***	-0.107	0.029	***
Mother's education HS	0.048	0.004	***	0.074	0.012	***	0.076	0.016	***
Mother's education higher than HS	0.111	0.026	***	0.172	0.075	**	0.089	0.094	
Latina	0.039	0.032		-0.036	0.085		0.058	0.151	
Mother's ethnicity unknown	0.012	0.025		0.066	0.110		0.260	0.179	
Metro residence county	-0.016	0.009	*	-0.083	0.025	***	-0.095	0.034	***
Urban residence county	-0.049	0.010	***	-0.199	0.030	***	-0.217	0.041	***
Experience	0.060	0.001	***	0.088	0.001	***	0.084	0.002	***
Experience Square	-0.001	0.000	***	-0.001	0.000	***	-0.001	0.000	***
Mother's current age in year	0.149	0.009	***	-0.160	0.064	***	-0.278	0.056	***
Mother's current age in year square	-0.005	0.000	***	0.001	0.002		0.004	0.001	***
Intensity of welfare	-0.001	0.000	***	-0.001	0.001	*	-0.002	0.001	*
Birth occurred in 1996 or 1997	-0.004	0.004		-0.094	0.009	***	-0.060	0.012	***
Birth occurred after 1997	-0.033	0.003	***	-0.107	0.010	***			
Father's education <= 9 grade	0.015	0.005	***	0.013	0.014		0.019	0.018	
Father's education more than HS	0.009	0.010		-0.001	0.032		0.009	0.044	
Father's age18 and 19	0.008	0.005		0.019	0.016		0.006	0.021	
Father's age 20 and more	0.005	0.005		0.009	0.016		0.000	0.021	
Rho									
Number of Observations									

*, **, and *** indicate that estimated coefficients are statistically significant at 10%, 5% and 1% levels respectively.

TABLE C 4 Miscarriage Sample: Effects of Teenage Childbearing on the Black Mother's Subsequent Employment (Random Effects Linear Probability Model)

	Toddler			Preschool			School		
Variables	Coef.	Std. Err.		Coef.	Std. Err.		Coef.	Std. Err.	
Teen	0.021	0.006	***	-0.035	0.011	***	-0.037	0.013	***
Mother's education <= 9 grade	0.020	0.004	***	0.036	0.008	***	0.038	0.009	***
Mother's education more than HS	0.064	0.017	***	0.076	0.035	**	0.038	0.044	
Latina	0.028	0.025		-0.015	0.054		0.046	0.071	
Mother's ethnicity unknown				0.020	0.053		0.127	0.074	*
Metro residence county	-0.019	0.008	**	-0.047	0.016	***	-0.046	0.020	**
Urban residence county	-0.056	0.008	***	-0.100	0.016	***	-0.097	0.019	***
Experience	0.062	0.000	***	0.044	0.001	***	0.038	0.001	***
Experience Square	-0.001	0.000	***	-0.001	0.000	***	0.000	0.000	***
Mother's age in year	0.105	0.008	***	-0.004	0.037		-0.067	0.030	**
Mother's age in year square	-0.003	0.000	***	-0.001	0.001		0.001	0.001	
Intensity of welfare	-0.001	0.000	***	-0.001	0.000	***	-0.002	0.001	***
Birth occurred in 1996 or 1997	-0.006	0.003	*	-0.052	0.006	***	-0.023	0.007	***
Birth occurred after 1997	-0.023	0.003	***	-0.057	0.007	***	(dropped)		
Child's current age	-0.004	0.002	**						
Birth occurred in 1996 or 1997				0.007	0.008		0.015	0.010	
Birth occurred after 1997				0.000	0.019		0.019	0.023	
Father's education <= 9 grade				0.013	0.009		0.007	0.011	
Father's education more than HS	0.005	0.003		0.009	0.009		-0.001	0.011	
_cons	-0.819	0.071		0.546	0.383		1.242	0.346	
Rho		0.222		0.430				0.446	
Number of observations	379177			109645			81671		

*, **, and *** indicate that estimated coefficients are statistically significant at 10%, 5% and 1% levels respectively

TABLE C 5 Miscarriage Sample: Effects of Teenage Childbearing on the White Mother's Subsequent Employment (Pooled Probit)

	White and toddler			White and preschool			White and school		
Variables	Marginal Effect	Robust Std. Err.		Marginal Effect	Robust Std. Err.		Marginal Effect	Robust Std. Err.	
Teen	0.023	0.004	***	0.044	0.010	***	0.064	0.010	***
Mother's education <= 9 grade	0.040	0.003	***	0.031	0.006	***	0.029	0.007	***
Mother's education more than HS	0.053	0.017	***	0.076	0.045	*	-0.109	0.055	*
Latina	0.087	0.005	***	0.137	0.011	***	0.117	0.015	***
Mother's ethnicity unknown	0.038	0.012	***	-0.060	0.022	***	0.058	0.041	
Metro residence county	0.005	0.005		0.024	0.012	**	0.020	0.014	
Urban residence county	0.003	0.005		0.012	0.011		0.006	0.013	
Experience	0.064	0.000	***	0.054	0.001	***	0.040	0.001	***
Experience Square	-0.001	0.000	***	-0.001	0.000	***	0.000	0.000	***
Mother's age in year	0.172	0.013	***	-0.168	0.053	***	-0.134	0.054	***
Mother's age in year square	-0.006	0.000	***	0.003	0.001	**	0.002	0.001	*
Intensity of welfare	-0.003	0.000	***	-0.003	0.001	***	-0.004	0.001	***
Birth occurred in 1996 or 1997	-0.004	0.003		-0.009	0.006		0.010	0.007	
Birth occurred after 1997	0.000	0.005		0.023	0.011	**			
Father's education <= 9 grade	0.015	0.003	***	0.033	0.005	***	0.036	0.006	***
Father's education more than HS	0.022	0.006	***	0.013	0.014		0.013	0.018	
Father's age18 and 19	0.006	0.003	**	-0.005	0.006		0.009	0.007	
Father's age 20 and more	-0.016	0.003	***	-0.020	0.006	***	-0.004	0.007	
Time control									
Number of observations	244520			67764			48138		

*, **, and *** indicate that estimated coefficients are statistically significant at 10%, 5% and 1% levels respectively.

TABLE C 6 Miscarriage Sample: Effects of Teenage Childbearing on the White Mother's Subsequent Employment (Random Effects Probit)

	White and Toddler			White and Preschool			White and School		
	Marginal Effects	Standard Errors		Marginal Effects	Standard Errors		Marginal Effects	Standard Errors	
Teen	0.003	0.007		-0.023	0.020		0.025	0.020	
Mother's education HS	0.045	0.005	***	0.039	0.012	***	0.041	0.014	***
Mother's education higher than HS	0.063	0.043		0.100	0.127		-0.094	0.064	
Latina	0.094	0.012	***	0.181	0.035	***	0.185	0.051	***
Mother's ethnicity unknown	0.041	0.028		-0.064	0.039		-0.024	0.071	
Metro residence county	0.001	0.011		0.045	0.029		0.015	0.036	
Urban residence county	-0.002	0.011		0.030	0.025		-0.008	0.034	
Experience	0.073	0.001	***	0.073	0.002	***	0.060	0.002	***
Experience Square	-0.002	0.000	***	-0.001	0.000	***	-0.001	0.000	***
Mother's current age in year	0.092	0.013	***	-0.140	0.070	**	-0.295	0.056	***
Mother's current age in year square	-0.004	0.000	***	0.001	0.002		0.005	0.001	***
Intensity of welfare	-0.003	0.000	***	-0.004	0.001	***	-0.006	0.002	***
Birth occurred in 1996 or 1997	0.000	0.005		-0.052	0.010	***	-0.034	0.011	***
Birth occurred after 1997	-0.025	0.005	***	-0.053	0.011	***			
Father's education <= 9 grade	0.015	0.005	***	0.032	0.013	***	0.040	0.016	***
Father's education more than HS	0.014	0.014		0.011	0.035		0.003	0.046	
Father's age18 and 19	0.005	0.006		0.012	0.015		0.019	0.019	
Father's age 20 and more	-0.013	0.006	**	-0.009	0.014		0.006	0.018	
Rho									
Number of Observations									

*, **, and *** indicate that estimated coefficients are statistically significant at 10%, 5% and 1% levels respectively

TABLE C 7 Miscarriage Sample: Effects of Teenage Childbearing on the White Mother's Subsequent Employment (Random Effects Linear Probability Model)

	Toddler			Preschool			School		
Variable	Coef.	Std. Err.		Coef.	Std. Err.		Coef.	Std. Err.	
Teen	0.019	0.008	**	0.007	0.012		0.028	0.015	*
Mother's education <= 9 grade	0.029	0.005	***	0.030	0.009	***	0.034	0.011	***
Mother's education more than HS	0.052	0.030	*	0.079	0.060		-0.066	0.085	
Latina	0.077	0.007	***	0.102	0.015	***	0.103	0.021	***
Metro residence county	0.006	0.009		0.019	0.018		0.025	0.024	
Urban residence county	0.003	0.009		0.016	0.017		0.016	0.023	
Experience	0.065	0.001	***	0.040	0.001	***	0.034	0.001	***
Experience Square	-0.001	0.000	***	0.000	0.000	***	0.000	0.000	***
Mother's age in year	0.106	0.010	***	-0.004	0.045		-0.141	0.038	***
Mother's age in year square	-0.004	0.000	***	-0.001	0.001		0.002	0.001	***
Intensity of welfare	-0.002	0.000	***	-0.003	0.001	***	-0.004	0.002	***
Birth occurred in 1996 or 1997	-0.002	0.005		-0.036	0.007	***	-0.010	0.008	
Birth occurred after 1997	-0.012	0.004	***	-0.034	0.008	***	(dropped)		
ab_curageyy	0.005	0.003	*	0.026	0.008	***	0.030	0.011	***
Father's education <= 9 grade			*	0.019	0.022		0.015	0.031	
Father's education more than HS				0.000	0.010		0.009	0.013	
Father's age 20 and more	-0.007	0.004		-0.011	0.009		-0.001	0.012	
Rho		0.244		0.462			0.479		
Number of observations	244520			67764			48138		

*, **, and *** indicate that estimated coefficients are statistically significant at 10%, 5% and 1% levels respectively

TABLE C 8 Miscarriage Sample: Effect of Teenage Childbearing on the Mother's Subsequent Earnings

Variables	Coef-ficient	Robust Std. Err.		Coef-ficient	Robust Std. Err.		Coef-ficient	Robust Std. Err.		Coef-ficient	Robust Std. Err.	
Child's current age	0	0		1	1		2	2		3	3	
Teen	-0.008	0.017		0.043	0.017	***	0.038	0.017	**	0.017	0.017	
Mother's age in year	0.508	0.118	***	0.154	0.088	*	0.117	0.092		0.155	0.102	
Mother's age in year square	-0.016	0.004	***	-0.004	0.003		-0.003	0.003		-0.004	0.003	
Experience	0.117	0.014	***	0.014	0.008	*	-0.002	0.008		0.003	0.007	
Experience Square	-0.002	0.000	***	0.000	0.000	**	0.001	0.000	***	0.000	0.000	***
Mother's education <= 9 grade	0.035	0.015	**	0.000	0.010		0.017	0.010	*	0.057	0.009	***
Mother's education HS	0.120	0.031	***	0.089	0.026	***	0.100	0.028	***	0.178	0.030	***
black	-0.062	0.006	***	-0.052	0.004	***	-0.065	0.004	***	-0.064	0.005	***
Latina	0.247	0.024	***	0.157	0.018	***	0.157	0.018	***	0.133	0.021	***
Mother's ethnicity unknown	0.053	0.034		0.058	0.026	**	0.025	0.028		0.077	0.032	***
Metro residence county	0.023	0.019		0.007	0.013		0.004	0.012		0.028	0.012	**
urban residence county	0.029	0.018		0.049	0.012	***	0.061	0.013	***	0.087	0.013	***
Sample Selection Control	0.504	0.069	***	0.004	0.048		-0.103	0.052	*	-0.064	0.052	
Time control	Yes			Yes			Yes			Yes		
Sector control	Yes			Yes			Yes			Yes		
Constant	2.662	1.104		6.059	0.816		6.243	0.831		5.564	0.956	***
Number of observations	25034			38172			42823			42506		

*, **, and *** indicate that estimated coefficients are statistically significant at 10%, 5% and 1% levels respectively.

Table C.8 Miscarriage Sample: Effect of Teenage Childbearing on the Mother's Subsequent Earnings (Continued)

Variables	Coef-ficient	Robust Std. Err.		Coef-ficient	Robust Std. Err.		Coef-ficient	Robust Std. Err.		Coef-ficient	Robust Std. Err.	
Child's current age	4	4		5	5		6	6		7	7	
Teen	0.041	0.020	***	-0.001	0.021		0.003	0.023		0.049	0.029	*
Mother's age in year	-0.108	0.120		0.090	0.143		0.216	0.161		-0.070	0.203	
Mother's age in year square	0.003	0.003		-0.002	0.003		-0.005	0.004		0.001	0.004	
Experience	0.005	0.008		0.007	0.009		0.018	0.010		0.028	0.011	***
Experience Square	0.000	0.000	***	0.000	0.000	**	0.000	0.000		0.000	0.000	
Mother's education <= 9 grade	0.038	0.009	***	0.073	0.010	***	0.063	0.010	***	0.099	0.012	***
Mother's education HS	0.221	0.033	***	0.237	0.039	***	0.256	0.043	***	0.193	0.068	***
black	-0.068	0.007	***	-0.071	0.009	***	-0.057	0.011	***	-0.039	0.014	***
Latina	0.094	0.023	***	0.071	0.025	***	0.072	0.030	**	0.131	0.036	***
Mother's ethnicity unknown	0.164	0.037	***	0.121	0.053	**	0.108	0.040	***	0.179	0.054	***
Metro residence county	0.014	0.014		-0.007	0.016		0.000	0.018		-0.007	0.020	
urban residence county	0.091	0.016	***	0.070	0.018	***	0.074	0.021	***	0.037	0.022	*
Sample Selection Control	-0.066	0.065		-0.054	0.072		0.037	0.084		0.188	0.106	*
Time control	Yes			Yes			Yes			Yes		
Sector control	Yes			Yes			Yes			Yes		
Constant	8.349			6.734	1.476		5.141	1.750		8.261	2.336	
Number of observations	37861			32405			25922			18712		

*, **, and *** indicate that estimated coefficients are statistically significant at 10%, 5% and 1% levels respectively.

Table C.8. Miscarriage Sample: Effect of Teenage Childbearing on the Mother's Subsequent Earnings (end)

Variables	Coef-ficient	Robust Std. Err.		Coef-ficient	Robust Std. Err.
Child's current age	8	8		9	9
Teen	0.013	0.040	*	0.082	0.075
Mother's age in year	0.187	0.297		-1.031	0.588
Mother's age in year square	-0.004	0.006	**	0.020	0.012
Experience	0.005	0.013	***	-0.031	0.024
Experience Square	0.000	0.000	***	0.001	0.000
Mother's education <= 9 grade	0.107	0.017	*	0.107	0.029
Mother's education HS	0.162	0.084	***	-0.153	0.355
black	-0.057	0.016	*	-0.088	0.036
Latina	0.101	0.043	**	-0.004	0.077
Mother's ethnicity unknown	0.135	0.080	**	0.074	0.266
Metro residence county	0.012	0.029	**	0.067	0.051
Urban residence county	0.074	0.028	**	0.164	0.052
Sample Selection Control	-0.028	0.130		-0.355	0.257
Time control	Yes			Yes	
Sector control	Yes			Yes	
Constant	5.577	3.495		21.052	7.426
Number of observations	11326			3278	

*, **, and *** indicate that estimated coefficients are statistically significant at 10%, 5% and 1% levels respectively.

TABLE C 9 Miscarriage Sample: Effect of Teenage Childbearing on the Black Mother's Subsequent Earnings
Threshold minimum wage (Pooled OLS)

	Black and toddler			Black and Preschool			Black and school		
Variables	Coef-ficient	Robust Std. Err.		Coef-ficient	Robust Std. Err.		Coef.	Robust Std. Err.	
Teen	0.045	0.005	***	-0.014	0.011		-0.025	0.012	**
Mother's current age in year	0.267	0.028	***	0.113	0.057	**	0.010	0.056	
Mother's current age in year square	-0.007	0.001	***	-0.003	0.001	**	-0.001	0.001	
Experience	0.055	0.005	***	0.028	0.008	***	0.029	0.007	***
Experience Square	-0.001	0.000	***	0.000	0.000		0.000	0.000	
Mother's education HS	0.049	0.007	***	0.048	0.009	***	0.093	0.009	***
Mother's education higher than HS	0.171	0.016	***	0.231	0.029	***	0.144	0.042	***
Latina	0.083	0.023	***	0.033	0.051		0.052	0.052	
Mother's ethnicity unknown	0.141	0.023	***	0.254	0.049	***	0.220	0.056	***
Metro residence county	-0.010	0.009		-0.034	0.015	**	-0.036	0.016	**
Urban residence county	0.005	0.010		0.023	0.020		0.014	0.020	
Control for sample selection	0.243	0.034	***	0.125	0.066	*	0.164	0.068	
Time Control	Yes			Yes			Yes		
Industry Control	Yes			Yes			Yes		
Number of observations	93024			42420			33742		

*, **, and *** indicate that estimated coefficients are statistically significant at 10%, 5% and 1% levels respectively.

TABLE C 10 Miscarriage Sample: Effect of Teenage Childbearing on the Black Mother's Subsequent Earnings (Random Effects Linear Model)

	Black and toddler			Black and Preschool			Black and School		
Variable	Coef.	Std. Err.		Coef.	Std. Err.		Coef.	Std. Err.	
Teen	0.040	0.008	***	-0.031	0.016	*	-0.087	0.021	***
Mother's current age in year	0.171	0.020	***	0.174	0.058	***	-0.062	0.050	
Mother's current age in year square	-0.005	0.001	***	-0.004	0.001	***	0.000	0.001	
Experience	0.048	0.004	***	-0.001	0.005		0.040	0.005	***
Experience Square	-0.001	0.000	***	0.000	0.000	***	0.000	0.000	***
Mother's education HS	0.029	0.009	***	0.032	0.013	**	0.123	0.016	***
Mother's education higher than HS	0.147	0.026	***	0.208	0.047	***	0.257	0.064	***
Latina	0.017	0.043		0.061	0.076		0.163	0.110	
Metro residence county	-0.024	0.016		-0.007	0.025		-0.049	0.032	
Urban residence county	-0.009	0.016		0.067	0.025	***	-0.018	0.033	
Sample Selection Control	0.099	0.020	***	-0.091	0.023	***	0.115	0.029	***
Industry Control	Yes			Yes			Yes		
Rho	0.35			0.53			0.57		
Number of observations	93024			42177			33500		

*, **, and *** indicate that estimated coefficients are statistically significant at 10%, 5% and 1% levels respectively

TABLE C 11 Miscarriage Sample: Effect of Teenage Childbearing on the White Mother's Subsequent Earnings (pooled OLS)

	White and toddler			White and preschool			White and school		
Variables	Coef-ficient	Robust Std. Err.		Coef-ficient	Robust Std. Err.		Coef-ficient	Robust Std. Err.	
Teen	0.061	0.006	***	0.050	0.015	***	0.100	0.018	***
Mother's current age in year	0.210	0.027	***	0.059	0.086		0.072	0.091	
Mother's current age in year square	-0.005	0.001	***	-0.001	0.002		-0.002	0.002	
Experience	0.024	0.006	***	-0.004	0.007		0.020	0.008	***
Experience Square	0.000	0.000		0.000	0.000	***	0.000	0.000	
Mother's education HS	0.021	0.007	***	0.077	0.010	***	0.088	0.012	***
Mother's education higher than HS	0.048	0.026	*	0.299	0.069	***	0.017	0.119	
Latina	0.173	0.011	***	0.064	0.020	***	0.107	0.025	***
Mother's ethnicity unknown	0.030	0.020		0.083	0.038	**	0.034	0.041	
Metro residence county	0.003	0.009		0.049	0.017	***	0.022	0.022	
Urban residence county	0.062	0.009	***	0.118	0.017	***	0.081	0.021	***
Control for sample selection	0.052	0.037		-0.164	0.060	***	0.093	0.080	
Time Control	Yes			Yes			Yes		
Industry Control	Yes			Yes			Yes		
Number of observations		66598			23570		16854		

*, **, and *** indicate that estimated coefficients are statistically significant at 10%, 5% and 1% levels respectively.

TABLE C 12 Miscarriage Sample: Effect of Teenage Childbearing on the White Mother's Subsequent Earnings (Random Effects Linear Model)

	White and Toddler			White and Preschool			White and School		
Variable	Coefficient	Std. Err.		Coefficient.	Std. Err.		Coefficient.	Std. Err.	
Teen	0.059	0.010	***	0.046	0.021	***	0.063	0.028	***
Mother's current age in year	0.208	0.023	***	0.023	0.087		0.016	0.082	
Mother's current age in year square	-0.005	0.001	***	-0.001	0.002		-0.001	0.002	
Experience	0.048	0.006	***	0.010	0.007		0.039	0.008	***
Experience Square	-0.001	0.000	***	0.000	0.000		0.000	0.000	***
Mother's education HS	0.018	0.010	*	0.082	0.016	****	0.107	0.022	***
Mother's education higher than HS	0.060	0.047		0.303	0.100	****	0.120	0.207	
Latina	0.187	0.014	***	0.109	0.028	****	0.141	0.041	***
Metro residence county	0.002	0.016		0.061	0.031	**	0.038	0.043	
Urban residence county	0.050	0.015	***	0.126	0.030	***	0.092	0.042	**
Sample Selection Control	0.086	0.025	***	-0.041	0.031		0.091	0.039	**
Rho	0.35			0.56			0.61		
Number of Observations	66598			23412			47798		

*, **, and *** indicate that estimated coefficients are statistically significant at 10%, 5% and 1% levels respectively

TABLE D 1 . Miscarriage Sample: Effect of Teenage Childbearing on the Mother's Subsequent Welfare Participation

Variables	Marginal Effect	Robust Std. Err.		Marginal Effect	Robust Std. Err.		Marginal Effect	Robust Std. Err.		Marginal Effect	Robust Std. Err.	
Child's current age	0			1			2			3		
Teen	-0.013	0.004	***	0.029	0.003	***	0.019	0.004	***	0.000	0.004	
Rural residence county	0.014	0.005	***	0.011	0.005	**	0.007	0.005		-0.010	0.005	**
Urban residence county	-0.009	0.002	***	-0.008	0.002	***	-0.012	0.002	***	-0.001	0.005	
Black	0.059	0.008	***	0.110	0.009	***	0.128	0.010	***	0.107	0.010	***
Non-Latina*	0.026	0.010	***	0.043	0.010	**	0.033	0.011	***	0.042	0.011	***
Mother's education unknown	-0.011	0.011		0.035	0.017	***	0.036	0.019	**	0.075	0.025	***
Mother's education up to 8th grade	0.014	0.011		0.061	0.016	***	0.074	0.018	***	0.137	0.025	***
Mother's education <= 9 grade	-0.001	0.010		0.045	0.009	***	0.046	0.010	***	0.070	0.010	***
Father's education unknown	0.021	0.007		0.032	0.008	***	0.024	0.008	***	0.038	0.008	***
Father's education up to 8th grade	0.014	0.009	***	0.051	0.011	***	0.044	0.011	***	0.039	0.012	***
Father's education <= 9 grade	0.019	0.006	***	0.041	0.006	***	0.038	0.007	***	0.038	0.007	***
Father's age unknown	0.039	0.005	***	0.044	0.005	***	0.044	0.005	***	0.022	0.005	***
fagelt18*	0.014	0.003	***	0.012	0.003	***	0.004	0.003		0.001	0.004	
Father's age18 and 19	0.000	0.003		-0.005	0.003	*	0.001	0.003		-0.001	0.003	
Child's weight less than 1500g	-0.035	0.004	***	-0.045	0.004	***	-0.035	0.004	***	-0.025	0.005	***
Child's weight between 1500g and 2500g	0.000	0.002		0.001	0.003		-0.004	0.003		0.000	0.003	
Mother's age in year	0.018	0.001	***	0.026	0.001		0.009	0.001	***	-0.002	0.001	**
Intensity of welfare	0.006	0.000	***	0.005	0.000	***	0.003	0.000	***	0.003	0.000	***
Birth occurred in 1996 or 1997	-0.011	0.005	**	0.011	0.006	*	0.019	0.007	***	0.013	0.006	**
Birth occurred after 1997	-0.028	0.008		0.006	0.008		0.017	0.009	***	0.008	0.008	
Time Control	Yes			Yes			Yes			Yes		
Number of observations		168888			168888			162667			146125	

*, **, and *** indicate that estimated coefficients are statistically significant at 10%, 5% and 1% levels respectively.

TABLE D 1. Miscarriage Sample Effect of Teenage Childbearing on the Mother's Subsequent Welfare Participation

Variable	Marginal Effect	Robust Std. Err.		Marginal Effect	Robust Std. Err.		Marginal Effect	Robust Std. Err.		Marginal Effect	Robust Std. Err.	
Child's age	4			5			6			7		
Teen	-0.008	0.005	*	-0.010	0.005	**	-0.011	0.005	**	-0.010	0.006	*
Rural residence county	-0.014	0.006	***	-0.009	0.005		-0.019	0.005	***	-0.002	0.006	
Urban residence county	-0.001	0.005		-0.012	0.002	***	-0.002	0.002		0.001	0.002	
Black	0.127	0.011	***	0.133	0.013	***	0.123	0.016	***	0.097	0.017	***
Non-Latina	0.039	0.012	***	0.013	0.015		0.032	0.015	*	0.021	0.018	
Mother's education unknown	0.089	0.030	***	0.083	0.030		0.094	0.036	***	0.094	0.041	***
Mother's education up to 8th grade	0.163	0.029	***	0.135	0.029	***	0.138	0.033	***	0.123	0.036	***
Mother's education <= 9 grade	0.073	0.011	***	0.059	0.012	***	0.060	0.013	***	0.052	0.013	***
Father's education unknown	0.050	0.009	***	0.051	0.009	***	0.023	0.009	***	0.044	0.009	***
Father's education up to 8th grade	0.078	0.015	***	0.092	0.016	***	0.070	0.016	***	0.082	0.019	***
Father's education <= 9 grade	0.049	0.008	***	0.052	0.009	***	0.022	0.008	***	0.029	0.009	***
Father's age unknown	0.024	0.005	***	0.024	0.006	***	0.021	0.005	***	-0.002	0.005	
fagelt18*	0.002	0.004		-0.005	0.004		-0.004	0.004		-0.003	0.004	
Father's age18 and 19	0.002	0.003		0.001	0.003		0.002	0.003		-0.007	0.003	**
Child's weight less than 1500g	-0.016	0.005	***	-0.014	0.006	**	-0.004	0.006		0.002	0.007	
Child's weight between 1500g and 2500g	-0.001	0.003		-0.002	0.003		-0.001	0.003		-0.002	0.003	
Mother's age in year	-0.005	0.001	***	-0.010	0.001	***	-0.011	0.001	***	-0.009	0.001	***.
Intensity of welfare	0.003	0.000	***	0.003	0.000	***	0.002	0.000	***	0.002	0.000	***
Birth occurred in 1996 or 1997	0.008	0.006		-0.013	0.005		0.012	0.005	**	0.005	0.005	
Birth occurred after 1997	0.015	0.008	*	-0.005	0.007		0.017	0.008	**	0.007	0.017	
Time Control	Yes			Yes			Yes			Yes		
Number of observations		125888			109703			92050			72828	

*, **, and *** indicate that estimated coefficients are statistically significant at 10%, 5% and 1% levels respectively.

Table D.1. Miscarriage Sample Effect of Teenage Childbearing on the Mother's Subsequent Welfare Participation

Variables	Marginal Effect	Robust Std. Err.		Marginal Effect	Robust Std. Err.	
Child's current age	8			9		
Teen	0.000	0.006		0.003	0.006	
Rural residence county	-0.001	0.007		0.004	0.008	
Urban residence county	-0.005	0.007		0.010	0.003	***
Black*	0.049	0.016		0.038	0.016	**
Non-Latina*	0.015	0.022		0.062	0.002	***
Mother's education unknown	-0.007	0.023		-0.003	0.032	
Mother's education up to 8th grade	0.060	0.031		0.072	0.049	*
Mother's education <= 9 grade	0.023	0.017	**	0.028	0.021	
Father's education unknown	0.051	0.009		0.020	0.010	*
Father's education up to 8th grade	0.109	0.024	***	0.030	0.019	*
Father's education <= 9 grade	0.032	0.010	***	0.004	0.010	
Father's age unknown	-0.014	0.005	***	-0.005	0.006	
fagelt18*	-0.007	0.004	***	0.005	0.005	
Father's age18 and 19	-0.009	0.003		-0.003	0.004	
Child's weight less than 1500g	0.012	0.008	***	0.010	0.009	
Child's weight between 1500g and 2500g	0.008	0.004		0.012	0.004	***
Mother's age in year	-0.006	0.001	**	-0.004	0.002	
Intensity of welfare	0.002	0.000	***	0.001	0.000	***
Birth occurred in 1996 or 1997	0.005	0.004		0.012	0.014	
Birth occurred after 1997	-0.004	0.004				
Time Control	Yes			Yes		
Number of observations		54309			33795	

*, **, and *** indicate that estimated coefficients are statistically significant at 10%, 5% and 1% levels respectively.

TABLE D 2 Miscarriage Sample: Effect of Teenage Childbearing on the Black Mother's Subsequent Welfare Participation (Pooled Probit)

	Black and toddler			Black and Preschool			Black and school		
Variables	Marginal Effect	Robust Std. Err.		Marginal Effect	Robust Std. Err.		Marginal Effect	Robust Std. Err.	
Teen	0.019	0.003	***	0.002	0.005		0.003	0.004	
Rural residence county	-0.027	0.004	***	0.006	0.007		-0.010	0.005	*
Urban residence county	-0.014	0.004	***	0.013	0.007	*	0.006	0.002	***
Non-Latina	0.064	0.009	***	0.093	0.016	***	0.075	0.014	***
Mother's education unknown	0.045	0.013	***	0.115	0.030	***	0.043	0.024	**
Mother's education up to 8th grade	0.083	0.011	***	0.178	0.027	***	0.112	0.024	***
Mother's education <= 9 grade	0.053	0.008	***	0.089	0.015	***	0.051	0.013	***
Father's education unknown	0.045	0.006	***	0.064	0.010	***	0.042	0.008	***
Father's education up to 8th grade	0.084	0.010	***	0.134	0.019	***	0.084	0.016	***
Father's education <= 9 grade	0.060	0.005	***	0.073	0.009	***	0.026	0.007	***
Father's age unknown	0.054	0.004	***	0.037	0.007	***	0.003	0.005	
fagelt18*	0.014	0.003	***	-0.005	0.005		-0.003	0.004	
Father's age18 and 19	0.003	0.002		-0.003	0.004		-0.005	0.003	
Child's weight less than 1500g	-0.052	0.003	***	-0.024	0.006	***	0.007	0.006	
Child's weight between 1500g and 2500g	-0.002	0.002		-0.005	0.003		0.008	0.003	***
Child's current age	-0.005	0.001	***						
Mother's age in year	0.017	0.001	***	-0.013	0.001	***	-0.014	0.001	***
Intensity of welfare	0.006	0.000	***	0.004	0.000	***	0.002	0.000	***
Birth occurred in 1996 or 1997	-0.011	0.002	***	-0.003	0.004		0.000	0.003	
Birth occurred after 1997	-0.004	0.004		0.007	0.006		0.006	0.006	
Time Control	Yes			Yes			Yes		
Number of observations	413679			136331			147301		

*, **, and *** indicate that estimated coefficients are statistically significant at 10%, 5% and 1% levels respectively.

TABLE D 3 . Miscarriage Sample: Effect of Teenage Childbearing on the White Mother's Subsequent Welfare Participation (Pooled Probit)

	White and toddler			White and Preschool			White and School		
Variables	Marginal Effect	Robust Std. Err.		Marginal Effect	Robust Std. Err.		Marginal Effect	Robust Std. Err.	
Teen	-0.004	0.002	***	-0.013	0.003	***	-0.010	0.003	***
Rural residence county	0.001	0.002		0.000	0.003		0.003	0.003	
Urban residence county	-0.007	0.001	***	-0.011	0.002	***	-0.003	0.001	**
Nonlat~a*	0.004	0.005		0.002	0.007		-0.008	0.008	
Mother's education unknown	-0.001	0.008		0.018	0.023		0.955	0.015	***
Mother's education up to 8th grade	0.031	0.011	***	0.046	0.027	**	0.950	0.025	***
Mother's education high school	0.015	0.006	**	0.020	0.011		0.104	0.009	***
Father's education unknown	0.014	0.003	***	0.026	0.007	***	0.018	0.005	***
Father's education up to 8th grade	0.007	0.004	*	0.034	0.011	***	0.033	0.010	***
Father's education high school	0.008	0.003	***	0.019	0.006	***	0.005	0.005	
Father's age unknown	0.015	0.002	***	0.010	0.003	***	-0.004	0.002	
fagelt18*	0.000	0.001		-0.002	0.002		0.000	0.002	
Father's age18 and 19	-0.005	0.001	***	0.005	0.002	**	0.000	0.002	
Child's weight less than 1500g	-0.011	0.003	***	0.002	0.005		0.004	0.005	
Child's weight between 1500g and 2500g	-0.001	0.001		0.002	0.002		0.003	0.002	
Child's current age	-0.007	0.001	***						
Mother's age in year	0.005	0.001	***	-0.002	0.001		0.001	0.001	**
Intensity of welfare	0.002	0.000	***	0.001	0.000	***	0.002	0.000	***
Birth occurred in 1996 or 1997	-0.009	0.001	***	-0.001	0.002		0.009	0.002	***
Birth occurred after 1997	-0.011	0.002	***	0.001	0.003		0.026	0.005	***
Number of observations		268763			86318			88260	

*, **, and *** indicate that estimated coefficients are statistically significant at 10%, 5% and 1% levels respectively.

TABLE D 4. Miscarriage Sample: Effect of Teenage Childbearing on the Black Mother's Subsequent Welfare Participation (Random Effect Linear Probability Model)

	Black and Toddler			Black and Preschool			Black and School		
Variables	Coefficient	Std. Err.		Coefficient.	Std. Err.		Coefficient.	Std. Err.	
Teen	0.014	0.006	**	0.000	0.009		-0.027	0.008	***
Rural residence county	-0.031	0.010	***	0.004	0.014		0.015	0.013	
Urban residence county	-0.018	0.011	*	0.010	0.014		0.010	0.013	
Non-latina	0.063	0.027	**	0.086	0.041	**	0.058	0.047	
Mother's education unknown	0.036	0.027		0.063	0.037	*	0.013	0.035	
Mother's education up to 8th grade	0.066	0.022	***	0.120	0.031	***	0.076	0.028	***
Mother's education high school	0.053	0.021	***	0.063	0.030	**	0.038	0.028	
Fathers' education unknown	0.038	0.003	***				-0.028	0.001	***
Mother's age in year	0.012	0.000	***	-0.015	0.001	***	0.002	0.000	***
Intensity of welfare	0.007	0.000	***	0.004	0.000	***	-0.024	0.004	***
Birth occurred in 1996 or 1997	-0.013	0.005	***	-0.001	0.005		-0.058	0.007	***
Birth occurred after 1997	0.006	0.004		-0.012	0.006	**	0.704	0.057	***
_cons	-0.185	0.036		0.327	0.060	***			
Rho	0.390			0.527			0.396		
Number of observations	413679			136331			147301		

*, **, and *** indicate that estimated coefficients are statistically significant at 10%, 5% and 1% levels respectively

TABLE D 5 Miscarriage Sample: Effect of Teenage Childbearing on the Black Mother's Subsequent Welfare Participation (Panel Probit Model)

Variable	Black and Toddler			Black and Preschool			Black and School		
	Marginal Effects	Std. Err.		Marginal Effects	Std. Err.		Marginal Effects	Std. Err.	
Teen	0.010	0.004	***	0.001	0.003		-0.005	0.003	*
Rural residence county	-0.022	0.008	***	-0.001	0.005		0.004	0.003	
Urban residence county	-0.009	0.007		0.003	0.006		0.003	0.004	
Latina	0.058	0.055		0.042	0.066		0.053	0.078	
Mother's education unknown	0.031	0.027		0.085	0.060		0.011	0.018	
Mother's education up to 8th grade	0.070	0.028	***	0.160	0.066	**	0.044	0.027	*
Mother's education high school	0.032	0.009	***	0.022	0.004	***	0.009	0.004	**
Fathers' education unknown	0.026	0.002	***						
Mother's age in year	0.008	0.000	***	-0.006	0.001	***	-0.007	0.000	***
Intensity of welfare	0.004	0.000	***	0.001	0.000	***	0.001	0.000	***
Birth occurred in 1996 or 1997	0.008	0.003	***	-0.001	0.002		-0.007	0.001	***
Birth occurred after 1997	0.021	0.003	***	-0.005	0.002	***	-0.010	0.001	***
Rho	0.69			0.80			0.74		
Number of Observations	413679			136331			147301		

*, **, and *** indicate that estimated coefficients are statistically significant at 10%, 5% and 1% levels respectively

TABLE D 6 Miscarriage Sample: Effect of Teenage Childbearing on the White Mother's Subsequent Welfare Participation (Random Effect Linear Probability Model)

	Toddler			*Preschool*			*School*		
Variables	Coefficient	Std. Err.		Coefficient.	Std. Err.		Coefficient.	Std. Err.	
Teen	-0.018	0.004	***	-0.012	0.005	***	-0.024	0.005	***
Rural residence county	-0.009	0.005	*	0.000	0.007		0.000	0.007	
Urban residence county	-0.003	0.006		-0.011	0.003	***	-0.002	0.003	
Non-latina	0.002	0.013		-0.003	0.015		-0.011	0.015	
Mother's education unknown	-0.002	0.020		0.012	0.025		0.041	0.028	
Mother's education up to 8th grade	0.017	0.018		0.032	0.023		0.044	0.025	*
Mother's education high school	0.010	0.018		0.020	0.023		0.034	0.025	
Teen	-0.002	0.000	***	-0.003	0.001	***	-0.006	0.000	***
Intensity of welfare	0.004	0.000	***	0.002	0.000	***	0.002	0.000	***
Birth occurred in 1996 or 1997	-0.014	0.003	***	0.002	0.003		-0.004	0.003	
Birth occurred after 1997	-0.006	0.003	***	-0.004	0.003		-0.011	0.004	***
Rho	0.341			0.422			0.354		
Number of observations	268763			86318			88260	268763	

*, **, and *** indicate that estimated coefficients are statistically significant at 10%, 5% and 1% levels respectively

TABLE D 7 Miscarriage Sample: Effect of Teenage Childbearing on the White Mother's Subsequent Welfare Participation (Random Effect Panel Probit Model)

Variable	White Toddler			White and Prescool			White and School	
	Marginal Effects	Std. Err.		Marginal Effects	Std. Err.		Marginal Effects	
Teen	-0.001	0.000	***	-0.001	0.000	**	-0.002	0.002
Rural residence county	-0.001	0.000	**	0.000	0.000		0.000	0.000
Urban residence county	0.000	0.000		0.000	0.000	***	0.000	0.000
Non-latina	-0.001	0.000	***	0.000	0.000	***	0.000	0.000
Mother's education unknown	0.000	0.001		0.000	0.000		0.000	0.001
Mother's education up to 8th grade	0.000	0.001		0.001	0.002		0.993	4.015
Mother's education high school	0.003	0.002		0.004	0.005		0.964	14.159
Fathers' education unknown	0.001	0.000	*	0.000	0.000	**	0.008	0.738
Mother's age in year	0.000	0.000	***	0.000	0.000	***	0.000	0.000
Intensity of welfare	0.000	0.000	***	0.000	0.000	***	0.000	0.000
Birth occurred in 1996 or 1997	0.000	0.000	***	0.000	0.000		0.000	0.000
Birth occurred after 1997	0.000	0.000		0.000	0.000		0.000	0.000
Rho	0.69			0.70			0.67	
Number of Observations	268763			86318			88260	

*, **, and *** indicate that estimated coefficients are statistically significant at 10%, 5% and 1% levels respectively

TABLE D 8 . Propensity Score Effect of Teenage Childbearing on the Mothers' Welfare Participation

Variables	Coefficient	Bootstrapped Std. Err.		number of obser-vations
		Nearest Neighbor		
Employment	-0.062	0.047		*540*
Earnings	0.029	0.101		228
		Kernel Matching		
Employment	-0.047	0.032		896
Earnings	-0.194	0.056	***	441
		Radius Matching		
Employment	-0.071	0.035	***	896
Earnings	-0.116	0.072	*	319

*, **, and *** indicate that estimated coefficients are statistically significant at 10%, 5% and 1% levels respectively.

APPENDIX B: DATA PROCESSING AND LIMITATIONS

Data Processing on Sample Selection

Sisters' sample

All the sisters are raised in families on welfare and we compute their ages in each month. The welfare data offers the mothers' date of birth but the Vital Statistics contains the mothers' age but not her date of birth. When we merge the birth and welfare file, we keep only the pairs of sisters whose age are about the same in both files. In practice, we keep sisters whose difference in age in both files does not exceed one year. The reason is that some pregnant women may provide their age at prenatal care. If they have a birthday before giving birth, their information may not be updated in the medical record. On the other hand, some women may provide their age at the next birthday especially if that birthday is near. Besides, this study is based on sisters' pairs so when one sister is eliminated because of an issue with her age, we lose the other sister as well even if her information is correct. Note that all the sisters are raised on welfare and the welfare dataset starts only from 1990. Thus, many sister-pairs found in the welfare dataset are not old enough to either give birth and/or to work.

Miscarriage sample

This miscarriage sample is based on the Vital Statistics files which do not provide any information on the mothers' socioeconomic background. To circumvent this lack of socioeconomic background, we explore a subset of mothers who grew up in a family on welfare. But they are much younger and mostly give birth in the late 1990s. This restricts

the sample size and the length of time when their labor market analysis is possible. Note a limitation of this sample: a history of pregnancies is not available, so we cannot include in the sample women who have had a miscarriage and never gave birth or those who have had a miscarriage but have a child in the twenties.

Propensity Score Matching sample

This sample is based on the miscarriage sample. However, when we merge the miscarriage sample with the welfare dataset to identify mothers who are raised in welfare families, we also exclude the mothers whose ages do not coincide in both samples.

Data Processing on Variable Creation

Time-Variant Variables for All Samples

The time-variant characteristics are the ages of mothers' and children's at the time of employment or welfare benefit, as well as the young mother's work experience. The welfare data provide the mothers' date of birth and we use this information for the sisters' and the propensity score samples since they are composed of women raised on welfare. To determine the mother's age in the quarter of analysis, we assume both quarterly income and welfare benefits are received on the first day of the quarter and we subtract the date of birth from the date of the employment, earnings, or welfare receipt. The Vital Statistics provide the year and the month of birth of the children, and we assume they are born on the 3rd of the month (after their mothers' pay day). Since the mothers' date of birth is not available in the miscarriage sample, we calculate their age by adding the

children's age in year to their age at the time of delivery. In practice, this means that we assign to them their children's month of birth.

The experience variable counts the number of quarters in which the mothers have earned a positive income before the current quarter of employment. To deal with potential outliers or mistakes in the wage data, we excluded from the miscarriage sample all the girls who were making a positive income before age eight and from the propensity sample all the girls who were making positive income before the age of twelve. We adopted these two different age thresholds because of the sample composition. The miscarriage sample represents all the young women in Georgia who were pregnant as teens and willing to carry the pregnancy to term, irrespective of their parents' socioeconomic conditions. Some of them may come from families or households that own a business and the girl is allowed by law to work for her parent's or guardian's business. In that case, she should not be excluded from the sample. We set the threshold at eight for the miscarriage sample because at that age, an average girl is in third grade when she can read and count. However, all women in the propensity score sample appeared in the welfare file by age fourteen. Since the welfare program is means tested, it is not probable that the young girls are employed in the business of their parents or guardian and earning enough income to be covered by the wage-employer datasets. Therefore, we assume the young girls have not been making any positive income before they turn twelve. In addition, we count the experience from the age of fourteen and indicate by a dummy if she has worked between the ages twelve and fourteen. Note that in Georgia, the legal age to hold employment is fourteen (with the exception of domestic

employment and other seasonal jobs) unless the child is working for a business owned by a parent or a legal guardian.

Income

For those who work for more than one employer during a quarter, we ascribe to them the industry where they earn the highest income during that quarter. The industry variable is represented by NAIC, North American Industrial Code with five digits, the finer distinction. The Bureau of Labor Statistics (BLS) regroups all the NAIC codes into twenty broad categories. We adopt its convention and create one more category for the missing information.

Deflated Income

The BLS offers a list of bi-annual Consumer Price Index of urban areas in the U.S. based on the years 1982-1984. We used that bi-annual rate to deflate all the current incomes so that we can compare the results. Note that there are a few very rich mothers in the miscarriage sample. Since this sample represents the population of Georgia and not a sub-sample of women who grew up on welfare, it is very difficult to judge if these are very genuine incomes earned by those mothers, or if these are mistakes. In doubt we left them in the sample and run the regressions with them. Some sensitivity analyses run without the very rich did not change the results.

Unemployment rate and cohort dummies

In the sisters' analysis, we include the quarterly unemployment rate of Georgia. This rate has been calculated as a simple average of three-monthly unemployment rates of the State. The miscarriage sample analysis includes cohort dummy variables. These

dummy variables indicate whether the birth occurred before the welfare reform (years 1994 and 1995), during the reform implementation period (years 1996 and 1997), or after the reform (1998 and later). These dummies control for cohort effects - i.e., they indicate if women who gave birth in each of these different periods are intrinsically different.

School age

In Georgia, children who are four years old on September 1st can attend a public pre-kindergarten; the five-year-olds can attend kindergarten; and the six-year-olds can go to school. So we create three categories based on these ages. Toddler =1 represents a mother whose child is aged zero to three or whose child is four years old but born after September first. Preschool =1 represents a mother whose child is aged four, five or six but born after September first. School=1 represents a mother whose child is aged seven and older or six but is born before September first.

Time-Invariant Variables for All Samples

Education Variables for the Sisters Sample

The time-invariant education attainment is collected at the time of the birth so it reflects accurately the teen mothers' education then. In the sisters' sample, some of the non-teen mothers are not yet mothers at the beginning of the analysis, but we ascribe to them the education level at the birth of their first child. This ascription does not introduce any significant measurement bias for two reasons. First, the education level of the high school dropout does not change (mothers aged eighteen or more whose education is less than twelfth grade at the time of delivery are probably high school dropout). Second, we

use broad categories for the education levels, thus small changes within categories do not matter here. Since all women are not mothers in the year 2000 at the beginning of the analysis, the children fathers' characteristics are not included in the employment equations.

Data Limitations

Vital Statistics

The Birth data do not contain some important dates for analysis. The date of birth of the mothers and the date of previous fetal deaths events are not collected. Therefore, we could not include in the counterfactuals older mothers who have had a miscarriage as a teen. The only date related to previous fertility event included in the birth file is that of the last pregnancy termination, if any. Since there might be some unobserved heterogeneity among young women who have had abortion and those who give birth to a child (Hotz et al., 1999), we exclude them from the control group.

Wage and Employer Data

The wage and employer data do not provide variables on hours of work, wages, or any indication that the worker is paid by salary or wages. The limitations on the hours of work and wages made it difficult to determine reliably if the mother works full-time or part-time. For example, a mother working twenty hours a week at a security job earns about $10-$12 an hour. Her earnings equal those of another woman who works forty hours a week at the minimum wage of $5.15. In order to avoid any misclassification, we consider as workers individuals who make an income equivalent to the earnings of a worker paid at the minimum wage, who works twenty hours of work a week, thirteen

weeks a quarter. This threshold based on the part-time hours and the then current minimum ensures that those who work for higher pay but fewer hours and those who work at lower wages but longer hours are all considered as workers. The data provide information on the employer and the industry but not on occupation.

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