Better for Baby? Premarital Conceptions, "Shotgun" Marriage, and Child Well-Being

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Abstract

The retreat from post-conception marriage has contributed to increasing rates of nonmarital birth in recent decades (England, Wu, and Shafer 2012). Growing concern about single-parent families has motivated marriage promotion policies, yet research has not examined whether post-conception, pre-birth marriages are associated with better outcomes for children. Drawing on a sample of black and white mothers with premarital conceptions from the NLSY79, our study fills this gap. Using propensity score techniques, we find that post-conception marriages are not associated with children's behavior problems or math scores, but are associated with higher levels of reading comprehension among white children. They are also associated with improved parenting quality among white and black mothers. We find that, among white children, the benefit of post-conception marriage is strongest for those whose mothers are the least likely to enter into post-conception marriages. In contrast, for black children, the benefits are concentrated among those who are the most likely to enter such an arrangement.

Introduction

In previous decades premarital conceptions were relatively common but nonmarital births were rare, in part because there was a strong expectation that if a woman became pregnant the couple would marry and raise the child together (Ellwood and Jencks 2004). These marriages are colloquially called "shotgun" marriages, and formally called pre-birth, post-conception marriages. We refer to them here as post-conception marriages. The prevalence of post-conception marriage has decreased in recent decades, contributing to increasing rates of nonmarital birth. Research by England, Wu, and Shafer (2012) suggests that increases in nonmarital births to black and white women born during the baby boom were driven primarily by declines in post-conception marriages. According to a U.S. Census report (Bachu 1999), in 1960-1964, 10% of first births were conceived before marriage and 60% of these premaritally pregnant women entered into post-conception marriages. In contrast, in 1990-1994, nearly 41% of first births were conceived before marriage, and just 23% of these women married before the birth. These statistics obscure significant variation by race. In the early 1990s, 86% of first births to black women were conceived before marriage, and only 10% of these mothers married before the birth. Among white women, 45% of first births were conceived before marriage, and 29% of these mothers married before the birth.

Recent policy initiatives endorse marriage as an effective strategy for improving the lives of economically disadvantaged single mothers and their children, drawing on research (below) documenting associations between marriage and child well-being. These policy initiatives implicitly assume that the association between marriage and child well-being is causal. Supporters of such initiatives believe it is in society's best interest to promote marriage because it confers benefits to children, adults, and communities (Nock 2005). Marriage promotion

skeptics argue that the benefits of marriage are due to selection factors, and hypothesize that we might not see benefits among parents who wouldn't otherwise marry (Acs 2007). Additionally, if post-conception marriages bring together people who would otherwise not marry and are less well-suited for each other, they may be unstable or high-conflict, and therefore may be unlikely to confer benefits to children (Musick and Meier 2010). By focusing on a sample of mothers with premarital conceptions, and testing the linkage between post-conception marriage and child well-being, the current study sheds light on the policy-relevant topic of the extent to which such marriages confer benefits for children.

Single Parenthood and Child Well-Being

High levels of nonmarital childbearing have raised concerns about growing disparities in outcomes for children born to married versus unmarried parents (McLanahan 2004; McLanahan and Percheski 2008). There is general accord that marriage is associated with many benefits for adults and their children (Brown 2010; McLanahan and Sandefur 1994; Waite 1995). Children born to married parents score higher on measures of psychological adjustment and have more academic success than those born to unmarried single mothers or cohabiting parents (Amato 2005; Brown 2006; Ermisch and Francesconi 2001). However, it is important to note that unobserved selection factors may account for the observed association between family structure and child well-being. Some studies find that, after controlling for an extensive range of such characteristics, differences in outcomes between children in single- and married-parent families become statistically insignificant (Carlson and Corcoran 2001; Ginther and Pollak 2004). Other studies (Dunifon and Kowaleski-Jones 2002; Foster and Kalil 2007; Gennetian 2005) use change models to adjust for selection factors and often find small or insignificant associations between living arrangements and children's outcomes.

Extant research proposes four general mechanisms to explain differences in child well-being across family structures: economic resources, parental time and attention, family conflict and stress, and selection (Amato 2005; Magnuson and Berger 2009). First, nonmarital childbearing is associated with fewer economic and parenting resources for children. In 1999, nearly 44% of children in single-mother families were poor, compared to 7% of children in married-parent families (Manning and Brown 2006). The association between economic deprivation and single parenthood has important implications for child well-being, because economic deprivation is strongly associated with adverse behavioral, cognitive, and social outcomes of children (Brooks-Gunn and Duncan 1997; Lichter 1997).

Second, nonmarital childbearing is associated with less parental time and father involvement. Single parents do not have a partner with whom to share parenting responsibilities, and generally spend less time with their children (Astone and McLanahan 1991; Sandberg and Hofferth 2001; Sayer, Bianchi, and Robinson 2004). Additionally, nonresident fathers are less involved with their children on average than those who live with them (Manning and Lamb 2003). Parental involvement has important implications for child well-being. Indeed, parenting explains part of the association between family structure and child well-being (Carlson 2006).

Third, nonmarital childbearing is associated with increased family instability and conflict. Research from the Fragile Families study finds that children born to unmarried minority parents experience significantly more family structure changes compared to children who are born to married or white parents (Osborne and McLanahan 2007). Family structure transitions are associated with increased maternal stress, lower quality parenting, and decreased child well-being (Cavanagh and Huston 2006; Fomby and Cherlin 2007; Osborne and McLanahan 2007; Wu 1996).

Finally, as noted above, selection might play a role in the observed association between marriage and child well-being. There are two types of selection bias in observational data: baseline bias and differential treatment effect bias (Morgan and Winship 2007). Baseline bias is due to pre-existing characteristics that are associated with both the treatment (marriage) and the outcome (child well-being). In this case, it is possible that marriage does not directly confer benefits, but that children in two-parent families have better outcomes because the most secure, healthy, and advantaged individuals are more likely to marry and maintain a stable family structure in the first place (Acs 2007; Hofferth 2005). Failure to account for baseline selection bias could therefore artificially inflate estimated effects of family structure on child well-being (McLanahan and Percheski 2008).

Differential treatment bias suggests that the linkages between marriage and child well-being may differ across sub-groups. Indeed, research suggests that there are notable racial differences in the linkages between family structure and child well-being. For example, Dunifon & Kowaleski-Jones (2002) find that single parenthood is associated with reduced well-being among white children but not black children. In addition, Fomby and Cherlin (2007) find that family structure transitions are associated with poorer developmental outcomes among white children, but not black children.

The reasons for such racial differences are unclear, but likely relate to the mechanisms linking family structure and child well-being noted above. For example, research suggests that black children receive fewer economic advantages from their parents' marriages compared to white children (Manning and Brown 2006), potentially explaining the lack of benefits for marriage among black children. It is also possible that black families have access to a broader set of parenting resources outside the context of a traditional marriage, including strong kinship ties

(Hill 1972) and a tradition of caring for others' children (Roschelle 1997), meaning that single parenthood could be associated with less stress and conflict in black families, and thereby associated with less detrimental outcomes for black children, compared to white children. There also may be racial differences in patterns of single-parenthood over a child's lifetime. For example, black children are more likely to be born to and remain with a single mother, while white children are more likely to live with a single mother due to a separation or divorce (Blau and van der Klaauw 2008). Given evidence that family structure instability is harmful for children (Cavanagh and Huston 2006; Fomby and Cherlin 2007; Wu 1996), this could explain why white children living with a single mother may fare worse than black children living with a single mother. Finally, it is possible that the much higher prevalence of single-parenthood among blacks brings with it a lower stigma and potentially a greater set of supports, leading to improved outcomes for black children vis-à-vis white children (Heard 2007). Thus, research on single-parenthood provides evidence to suggest that marriage has differential effects on well-being for black vs. white children, suggesting that post-conception marriage may influence children differently depending on their race; we test this hypothesis.

Additionally, there may be differential treatment bias associated with the propensity to enter into post-conception marriages. The current study examines whether the well-being of children whose mothers enter a post-conception marriage differs depending on whether she was more vs. less likely to do so. This analysis is salient because recent policy proposals focus on encouraging marriage among those who are unlikely to marry. There are two possible patterns of heterogeneous treatment effects: positive selection and negative selection. There is evidence of positive selection if the mothers who are most likely to select into post-conception marriage are also the most likely to experience benefits for their children. This might occur if mothers enter

into post-conception marriage in anticipation of expected benefits. For example, sociological research finds that low-income unmarried mothers delay marriage but not childbearing in part because they view marriage as a capstone event that marks financial stability, stable employment, home ownership, and the achievement of a middle-class lifestyle (Edin and Kefalas 2005; Sassler, Miller, and Favinger 2009). From this perspective, mothers enter marriages only when they promise financial and family stability. There is evidence of negative selection if mothers who are most likely to select into post-conception marriage are the least likely to experience benefits for their children. Negative selection might occur if mothers enter into post-conception marriage on the basis of societal norms, rather than in response to anticipated benefits. For example, we might see negative selection if nonmarital childbearing is highly stigmatized and results in less social support for single mothers and their children (Heard 2007).

Prior empirical research suggests that those who legitimate a premarital conception with a post-conception marriage tend to be more advantaged, and come from families with greater resources to encourage a marriage (Lichter, Turner, and Sassler 2010; Manning 1993; Parnell, Swicegood, and Stevens 1994). Additional selection factors include the mother's family background characteristics, which might exert pressure to enter into post-conception marriage. For example, growing up in a nuclear family or with a strong religious background is associated with strong social norms against nonmarital births and an increased likelihood of marriage (Parnell, Swicegood, and Stevens 1994; Uecker and Stokes 2008). Residential characteristics also provide insight into the culture and norms of specific areas. Research finds that being raised in the south or in a rural environment is associated with post-conception marriage (Parnell, Swicegood, and Stevens 1994). Finally, the father's characteristics play a role. Men's earnings

and educational attainment are positively associated with marriage among white men, but not black men (Zavodny 1999).

Contributions of Current Study

Relying on panel data on mothers and children from the National Longitudinal Survey of Youth 1979, this study estimates the linkages between post-conception marriage and child well-being. We address concerns about selection bias with propensity score techniques. In performing such analyses, we examine whether the linkages between post-conception marriage and child well-being differ for black and white children. Within each group, we also examine whether the outcomes of children whose mothers are more likely to enter into post-conception marriages differ from those whose mothers entered into post-conception marriage, but have characteristics that suggested they were less likely to do so.

This study makes four key contributions to the literature. First, although there is a mounting body of research that suggests that marriage provides benefits to parents and children overall, scholarly research documenting the benefits for children of post-conception marriage is thin at best. Indeed, ours is the first study of which we are aware to address this topic. By focusing on this specific type of marriage, we fill a gap in the literature and provide information about a group that is likely to be targeted by marriage promotion policies. Second, this study extends prior research on racial differences in the effects of family structure on child well-being. Third, the use of propensity score techniques accounts for the fact that mothers entering into a marriage following the conception of a child but prior to the birth likely differ in many ways from those who do not. Finally, we test for heterogeneous effects in the influence of post-conception marriage on children, examining whether mothers who are more likely to enter a post-conception marriage see differential benefits compared to those who are less likely to do so.

Although prior research has examined heterogeneity in the returns to Catholic secondary education (Morgan 2001) and post secondary education (Brand and Xie 2010), we know of no other study that has taken a similar approach to studying the returns to marriage.

In performing these analyses, we address three research questions: (1) what is the influence of post-conception marriage on child well-being, after accounting for selection bias due to baseline characteristics? (2) what are the racial differences in these effects?, and (3) do the returns to marriage vary among those who are more vs. less likely to enter post-conception marriages?

Data

This study relies on data from the National Longitudinal Survey of Youth 1979 (NSLY79), which is uniquely suited to investigate consequences of premarital conception and marriage on child outcomes. The NLSY79 is a nationally representative, longitudinal birth cohort study following individuals who were born between 1957 and 1964. Respondents were interviewed annually through 1994 and biennially since. In 1986, the NLSY began biennial interviews of children born to female respondents of the NLSY79. The child sample is representative of American children born to the women of the NLSY79. These data are well suited to our study because children born to young mothers are overrepresented in the early waves of the survey (Wu and Li 2005).

Although the NLSY79 is a rich source of information for our research question, the data present some limitations for our analysis. The child sample is not a nationally representative cross-section of children, but is instead a cohort study that is representative of children whose mothers were age 14-22 in 1979. This time period is suited to the research question because post-conception marriage was more prevalent than it is today, and there are few opportunities for

researchers to examine the effects of these marriages on a contemporary sample. Nonetheless, insights gleaned from this research may not be generalizable to contemporary families. Finally, there is limited information about fathers, whose characteristics might have important implications for both selection into post-conception marriage and child behavioral outcomes.

The analytic sample for this study is black and white mothers who conceived their first child before their first marriage and gave birth between the ages of 14-25, and their first-born children. There are 10 possible observations corresponding to years in which child well-being assessments were gathered –1986, 1988, 1990, 1992, 1994, 1996, 1998, 2000, 2002, and 2004. We retain person-year observations with a completed child assessment, a non-missing response on at least one of the dependent variables measuring child well-being and parenting behaviors, and when the child is living with the mother at least part-time. Eighty-nine percent of our sample has complete data for all control variables, and we lose about 11% of our sample (n=510 person-year observations) due to missing data[1]. The amount of missing data ranges from 0%-3% on each of our key control variables. The sample that is dropped due to missing data differs from the retained sample on some key characteristics, however, which could potentially bias our results (results not shown). Among whites, the dropped sample is more likely to report low maternal cognitive test scores and more traditional gender ideology. Among blacks, the dropped sample is more likely to report low maternal cognitive test scores, lower income, higher rates of poverty, and fewer adults in the household. The final analytic sample is 970 unique respondents (n=461 white mothers, n=509 black mothers), and 4,025 person-year observations.

Measures

[1] We do not multiply impute missing data because we have a small amount of missing data and it is difficult to specify an imputation model that adequately addresses the unbalanced structure of our panel data (Paul Allison, personal communication, March 30, 2012). Listwise deletion is robust if predictor variables are not missing at random, as long as the probability of missing data is not influenced by the dependent variable.

Dependent variables. We assess child well-being with three dependent variables: maternal reports of children's behavior and children's math and reading comprehension cognitive test scores. The Behavior Problem Index (BPI) is based on 28 questions that ask the mother to report their child's behavior and attitudes in the previous three months. Mothers first rate each item using a 3-point scale (often, sometimes, or not true); these ratings are dichotomized and summed such that higher scores indicate more behavior problems. The score was then normed by age and sex to have a national mean of 100 and a standard deviation of 15. The BPI is administered for children age 4 to 16. Child's cognitive development is assessed with the Peabody Individual Achievement Tests (PIAT) in math and reading comprehension. These assessments are administered to children age 5 to 16. PIAT scores were normed by age in the late 1960s to a national mean of 100 with a standard deviation of 15.

We also assess two measures of mothers' parenting quality: the cognitive stimulation and emotional support sub-scales of the Home Observation Measurement of the Environment-Short Form (HOME-SF). These measures are collected among parents of children age 0 to 16. These scales vary by age, and are a combination of interviewer observations and the mother's report of the home environment. The cognitive stimulation battery asks mothers to answer questions such as "How often do you get a chance to read to child?"; "When your family watches TV, do you or (father) discuss programs with him/her?"; and "How many books does child have?" The interviewer observations include items such as whether the child's play environment is safe and whether the home is reasonably clean. The emotional support battery asks mothers to answer questions such as "About how many times, if any, have you had to spank child in the past week?"; "How much choice is child allowed in deciding foods s/he eats at breakfast & lunch?"; and responses to tantrums or hitting. The interviewer observed items such as whether the mother

caressed, kissed, or hugged the child, conversed with the child, or conveyed a positive feeling about the child. The total raw score for the HOME-SF is the sum of individual item scores; the raw score varies by age group because the number of individual items varies according to the age of the child. There are no appropriate national norms available for these measures, but they were internally standardized to the full NLSY sample by age with a mean of 10 and standard deviation of 1.5 to allow comparison across children of different ages.

Independent variable. The key independent variable, post-conception marriage, is derived from the NLSY Fertility and Relationship History data file, which includes dates of marriage, divorce, and birth. Following prior research (Parnell, Swicegood, and Stevens 1994; Zavodny 1999), we define a post-conception marriage as a legal union that occurs 0-7 months before the mother's first birth (1=post-conception marriage, 0=single at birth). As noted above, our sample is restricted to women who had their first birth between the ages of 14-25 and were not married when they got pregnant. Thus, the omitted category in our analysis is young women who were single at their first birth (did not have a post-conception marriage).

Additional covariates. Our analyses adjust for selection factors measured prior to the mother's first birth. Mother's age at the birth of her first child is measured in years. Mother's cognitive ability was measured in 1980 with the Armed Forces Qualification Test (AFQT). The AFQT score is derived from four sections of the Armed Services Vocational Aptitude Battery (ASVAB): word knowledge, paragraph comprehension, math knowledge, and arithmetic reasoning. AFQT scores are normed by age, and are reported with a dummy variable that indicates whether the mother's score was in the 25^{th} percentile. Dummy variables indicate whether the mother was born in the South, whether she lived in a nuclear family (with her biological mother and father, the child's grandparents) at age 14, and whether the child's

grandmother was a teen mother. Mothers were asked to retrospectively report the religion into which they were born. The mother's religion at birth is measured with four categories: (a) None/other (referent), (b) Roman Catholic, (c) Liberal Protestant, which includes Episcopalian, Methodist, or Presbyterian, and (d) Conservative Protestant, which includes Baptist, Lutheran, and unspecified Protestant. Mothers were asked to report whether anyone in their household received newspapers, magazines, or had a library card when she was age 14. These responses were combined into a dummy variable where a value of 1 indicates that nobody in the household received these materials. A dummy variable indicates whether mothers lived in an urban area at age 14 (town or city receives a value of 1, country or farm area receives a value of 0).

We further adjust for child and household characteristics that are measured after the birth of the child. Child sex is indicated with a dummy variable (1= child is male, 0=child is female). Child low birth weight indicates whether the child was less than 5.5 pounds or less at birth (1=weighted 5.5 pounds or less at birth, 0=weighed more than 5.5 pounds at birth). The number of children in the household is a continuous measure of children age 18 or younger. Child's age at assessment is measured in years, and ranges from 0 to 16.

To assess different dimensions of the longer-term effects of post-conception marriage, we descriptively examine several measures of economic resources, family stability, and household composition that are collected concurrently with the child's well-being assessment. Maternal employment is represented with a dummy variable that indicates whether she worked in the past week (1=employed, 0=unemployed), and a categorical variable that indicates the amount of hours she worked last week (1-19 hours, 20-34 hours, 35-40 hours, or 41+ hours). Household income in the past year is reported in thousands of dollars, and is adjusted for inflation (reported

in 2004 dollars). A dichotomous variable indicates whether the household was below the federal poverty threshold in the previous year.

Household composition is measured with a continuous variable of the number of adults over age 18 in the household, and dummy variables indicating whether the child's biological father or grandmother lives in the household. Family stability is measured with a dummy variable indicating whether the mother never married, is currently married/remarried, or is separated, divorced, or widowed. A dummy variable indicates whether the mother's first marriage dissolved (1= dissolved, 0=intact or never married).

Finally, we include a seven-item scale that measures attitudes about traditional gender roles for women. Respondents were asked to rate their agreement with items such as "A woman's place is in the home, not in the office or shop" and "The employment of wives leads to more juvenile delinquency" using a four point scale. Each item was coded such that more traditional attitudes receive higher scores, and items were summed to create an overall scale of traditional gender ideology (range: 7-28).

Method

We adopt a counterfactual approach for our analyses, which is also known as a potential outcomes approach (see Morgan and Winship 2007 for a review). In our study, focusing on a sample of women with premarital conceptions, there are two potential states at the time of first birth: (1) post-conception marriage (treatment state) or (2) single (control state). To estimate average causal effects using observational rather than experimental data, we must rely on the unverifiable assumption that the average well-being of children born to mothers in post-conception marriages would be the same as the theoretical average well-being of children born to single mothers if they had entered into post-conception marriages, and vice versa, conditional on

observed variables that account for selection into the treatment. These assumptions are shown in equations (1a) and (1b). Here, Y^1 is the potential child well-being outcome under the treatment state, and Y^0 is the potential outcome in the control state. D is the treatment variable, and is equal to 1 for the treatment state and 0 for the control state. X is a vector of covariates that determines selection into the treatment.

$$\text{Assumption 1: } E[Y^1 \mid X, D = 1] = E[Y^1 \mid X, D = 0] \quad (1a)$$

$$\text{Assumption 2: } E[Y^0 \mid X, D = 1] = E[Y^0 \mid X, D = 0] \quad (1b)$$

The first step of our analysis is modeling the treatment selection mechanism. We estimate propensity scores, which are conditional probabilities of treatment selection, using logistic regression (Rosenbaum & Rubin, 1983). In equation (2), D is the treatment variable, and is equal to 1 for respondents who entered into post-conception marriages, and 0 for respondents who remained single. X is a vector of covariates that is associated with selection into pre-conception marriage.

$$\text{Logit}(D) = \hat{\alpha} + X\hat{\beta} + \varepsilon \qquad (2)$$

For the second step of our analysis, we follow Morgan and Todd's (2008) procedure for calculating weights using estimated propensity scores, $\hat{p}_i$, which are the conditional predicted probabilities of post-conception marriage from equation (2). The estimated propensity scores are used to form three sets of weights: $w_{i,\text{ATE}}$ (equation 3), $w_{i,\text{ATT}}$ (equation 4) and $w_{i,\text{ATC}}$ (equation 5) (Morgan & Todd, 2008, p.244).

$$\text{For } d_i{=}1\text{: } w_{i,\text{ATE}} = \frac{1}{\hat{p}_i}$$
$$\text{For } d_i{=}0\text{: } w_{i,\text{ATE}} = \frac{1}{1-\hat{p}_i} \qquad (3)$$

$$\text{For } d_i=1\text{: } w_{i,\text{ATT}} = 1 \qquad \text{For } d_i=0\text{: } w_{i,\text{ATT}} = \frac{\hat{p}_i}{1-\hat{p}_i} \tag{4}$$

$$\text{For } d_i=1\text{: } w_{i,\text{ATC}} = \frac{1-\hat{p}_i}{\hat{p}_i} \qquad \text{For } d_i=0\text{: } w_{i,\text{ATC}} = 1 \tag{5}$$

These weights are similar to survey sampling weights insofar as they weight the samples to be representative of a target population. The ATE weights allow us to estimate the average effect of post-conception marriage across the sample. The ATT weights use the treatment group (post-conception marriage) as the target population, and weight the control group such that it is a representative sample of the population-level treatment group. In this case, members of the control group with higher propensity scores will receive higher weights. Members of the control group with very low propensity scores close to zero will have a very small weight, which essentially discards them from the analysis. The ATC weights use the control group (single at first birth) as the target population and attempt to weight the treatment group such that it is a representative sample of the population-level control group.

The goal is for these weights to effectively align the treatment and control groups, approximating an experimental design where treatment is randomly assigned and unrelated to other characteristics. In doing this, we assume that treatment selection is ignorable; in other words, that there are no additional confounding differences between mothers who enter post-conception marriages and mothers who remain single, after we control for observed covariates. If no statistically significant differences between the groups remain, the data are considered to be "balanced." We assess the balance between the treatment and control groups by estimating the average standardized mean differences between treatment and control groups across all

covariates in the model (Rubin 1973, Morgan & Todd, 2008). We also assess the standardized differences in standard deviations for continuous variables. These standardized differences allow us to compare the balance achieved under different weighting schemes. We experimented with model specification to achieve the best possible balance, adding interaction variables that are justified in light of past theory and research (Morgan & Todd, 2008).

In the third stage of analysis, we estimate weighted regressions. In equation (6), *Y* is the child well-being outcome, *D* is the treatment variable, δ is the estimated effect of *D* on *Y*, adjusted for *X*, and *X* is a vector of observed variables that are thought to determine *D* and *Y*. We first estimate regressions by applying the ATE weights, which estimate an average effect of post-conception marriage across the entire sample, assuming homogeneous treatment effects. We next assess causal effect heterogeneity by comparing the results from ATT and ATC weighted regressions. In other words, we compare the effect of post-conception marriage among children born to mothers who typically enter post-conception marriages (ATT) to the effect of post-conception marriage among children born to mothers who typically remain single (ATC).

$$Y = \hat{\alpha} + \hat{\delta}D + X\hat{\beta} + \varepsilon \qquad (6)$$

For all weighted regressions we include the full set of covariates used to estimate the propensity scores, as well as supplementary covariates to further adjust for child's characteristics that are unrelated to selection into post-conception marriage but might be associated with child well-being, such as child's age, child's sex, whether the child had a low birth weight, and the number of children in the household under age 18. We restrict all models to the region of common support, which is the range of the propensity score for which there are respondents in both the treatment and control groups.

There are several advantages of weighted regression using weights derived from propensity scores over unweighted OLS regression. Propensity scores are nonparametric and do not require assumptions about a linear relationship between the dependent variable and post-conception marriage. Further, it is difficult to identify causal effects through conditioning on all of the variables in X, because it is unlikely that we will find treatment and control cases with identical values on all covariates. Rosenbaum and Rubin (1983) demonstrate that conditioning on the propensity score as a function of these covariates remedies this concern. We can also address concerns about differential treatment effect bias and determine whether there is causal effect heterogeneity.

Our weighted regression approach also provides some advantages over traditional propensity score matching techniques. We pursue a doubly-robust method of balancing the data by incorporating covariates into both the propensity score and the weighted regressions. This supplemental parametric adjustment provides additional protection against model misspecification, and addresses any imbalance that remains after applying weights derived from the propensity scores (Robins and Rotnitzky 2001). This method also facilitates a straightforward application of survey weights to account for complex sampling design when estimating propensity scores. Finally, the method is more transparent than some pre-packaged matching algorithms (Morgan and Todd 2008).

Despite these advantages, our methodological approach also has some important limitations. The linear and logistic regression used in our analysis can only adjust for differences in observable characteristics. If there are unobservable characteristics that influence post-conception marriage and child well-being, our estimates will be biased. Our results also rely on the correct specification of the propensity score model, which is vulnerable to the limitations of

logistic regression. We likely have some degree of omitted variable bias in our propensity score models because we do not have full information about the biological father's characteristics. Nonetheless, the propensity score model performs quite well in balancing the data. Finally, like all studies that rely on this methodology, we invoke a strong assumption of ignorability that is plausible but impossible to verify. Although we have carefully specified our propensity score model to include a rich set of characteristics that predict selection into post-conception marriage, it is possible that unobserved or omitted variables threaten the ignorability assumption.

Results

Descriptive statistics by race and treatment status are presented in Table 1. Consistent with prior research, post-conception marriage is extremely rare among black mothers. Roughly half of white women with premarital conceptions entered into post-conception marriages (52%), compared to just 11% of black women. There are some noteworthy differences in terms of the characteristics that might be associated with selection into post-conception marriage. White mothers who entered post-conception marriages are less likely to report a low AFQT score (below the 25th percentile) compared to white mothers who remain single (16% vs. 30%). They are also more likely to have lived with a nuclear family at age 14 (73% among those in post-conception marriages vs. 56% among those who remained single) and less likely to have lived in an urban area. Black mothers who entered post-conception marriages are slightly older than black mothers who remained single, and more likely to have been raised Catholic.

Unconditional descriptive statistics indicate that post-conception marriage is associated with slightly better child well-being in terms of behavior and cognitive test scores. Specifically, it is associated with slightly higher reading comprehension scores among whites and blacks. It is

also associated with higher math scores among whites, and slightly lower behavioral problems among blacks.

The results from our propensity score models are presented in Appendix Table 1. Appendix Table 2 demonstrates that the ATE, ATT, and ATC weights derived from the propensity scores successfully balance the data. Although the data are not extremely unbalanced when using sampling weights, the balance is significantly improved when applying the weights. Appendix Table 2 also presents the weighted descriptive statistics for selection characteristics across treatment and control groups. This table further demonstrates that the weights result in very balanced data because there are no statistically significant differences between treatment and control groups. Any remaining imbalance can be addressed with supplemental parametric adjustment in the regression (Morgan and Todd 2008).

Our first research question asks whether post-conception marriage is associated with improved child well-being, and our second research question asks whether there are racial differences in this association. Table 2 presents the results from the ATE-weighted regressions predicting the relationship between post-conception marriage and child's BPI, math scores, reading comprehension scores, mother's emotionally supportive parenting, and mother's cognitively stimulating parenting. Recall that these estimates assume a homogeneous treatment effect. These results suggest that post-conception marriage is not associated with child's BPI or math scores among both whites and blacks. Post-conception marriage is associated with higher reading comprehension scores among whites ($b = 2.776$, $p < .05$; about 21% of a standard deviation), but does not reach statistical significance among blacks. In contrast, post-conception marriage is associated with higher quality parenting behavior among both whites and blacks. Among whites, it is associated with about 23% of a standard deviation increase in emotionally

supportive parenting and 29% of a standard deviation increase in cognitively stimulating parenting. Among blacks, it is associated with about 25% of a standard deviation increase in emotionally supportive parenting and 32% of a standard deviation increase in cognitively stimulating parenting.

Our third research question asks whether the returns to marriage vary among those who are more vs. less likely to enter post-conception marriages (i.e., whether there is evidence of causal effect heterogeneity). We answer this question by comparing estimates from ATT- and ATC-weighted regressions. Table 3 summarizes the results from ATE-, ATT-, and ATC-weighted regressions predicting child's BPI, math scores, reading comprehension scores, mother's emotionally supportive parenting, and mother's cognitively stimulating parenting (full tables are available upon request). Taken together, the weighted ATT- and ATC- weighted estimates provide evidence of causal effect heterogeneity among both whites and blacks. Among whites, the effect of post-conception marriage on children's BPI, math scores, and reading comprehension scores is stronger in the ATC-weighted regressions. The effect of post-conception marriage on parenting quality is also slightly stronger in the ATC-weighted models, but the difference is not as stark. The larger effects in the weighted ATC models suggest that the children who benefitted most were those whose parents entered into post-conception marriages even though their characteristics suggest they were more likely to remain single. The results among whites demonstrate a pattern of negative selection.

Among black children, the effect of post-conception marriage on BPI, math scores, and reading comprehension scores is stronger in the ATT-weighted regressions. There is no evidence of causal effect heterogeneity in the effect of post-conception marriage on parenting quality among blacks. Contrary to the results among whites, the black children who benefitted most in

terms of behavioral problems and cognitive test scores were those whose parents entered into post-conception marriages and had characteristics that suggested they were likely to do so. The results among blacks demonstrate a pattern of positive selection.

To shed more light on our results, we descriptively examine several measures of economic resources, family stability, and household composition that are collected concurrently with the child's well-being assessment (Table 4). Overall, post-conception marriage is associated with enduring benefits in terms of economic resources, parenting behavior, and household composition (measured at the child's assessment). Both white and black mothers who entered post-conception marriages were less likely to experience poverty, more likely to be currently married, and more likely to be currently living with the child's biological father compared to those who were single at birth.

While post-conception marriage is associated with some benefits, it is also associated with a higher degree of family instability. Although white and black mothers who entered post-conception marriages are more likely to report being currently married at the time of the child interview, their first marriage were more likely to have dissolved compared to mothers who were single at first birth. Among whites, the difference remains marginally significant even after conditioning on having a first marriage. This instability may offset the gains in well-being associated with post-conception marriage, and might explain why the effects are small.

Nonmarital childbearing is associated with longer term consequences for union prospects, particularly for black mothers. Black mothers who remained single at birth are more likely to never marry compared to white mothers (56% of black mothers who were single at birth never married vs. 28% of white single mothers). Despite this disparity, there are no statistically

significant differences in the number of adults over age 18 in the household, perhaps because black mothers who were single at first birth are more likely to live with the child's grandmother.

Discussion and Conclusion

A large literature documenting associations between marriage and child well-being has motivated marriage promotion policies, which encourage marriage among parents who wouldn't otherwise marry. The rise in single-parent families can be mitigated through marriages that occur before a premarital conception, post-conception but pre-birth (colloquially called "shotgun" marriages), or marriages among single parents after a nonmarital birth. Although research has explored the effects of living with two biological parents relative to other family forms (Amato 2005; Carlson and Corcoran 2001; Manning and Lamb 2003), and the effects of entering into marriage after a nonmarital birth (Acs 2007; Foster and Kalil 2007; Wagmiller Jr. et al. 2010; Williams, Sassler, Frech, Cooksey and Addo 2011), to our knowledge there is no research on the implications of post-conception marriages for children. Our study fills this gap in the literature by estimating the association between post-conception marriages and several metrics of child well-being. We also explore racial differences in the implications of post-conception marriage for children born to black and white mothers. We address concerns about two types of selection bias with propensity score techniques. We use a counterfactual approach to examine whether the returns to post-conception marriage vary among those who are more vs. less likely to enter into post-conception marriages.

Overall, we find mixed evidence linking post-conception marriage and child well-being, after accounting for selection factors. We do not find any evidence that post-conception marriage is associated with children's behavior problems or math scores on average, among white or black children. Where we do find linkages, the associations are modest. We find that post-conception

marriage is associated with small improvements in parenting quality among both whites and blacks on average, and small gains in reading comprehension scores among white children but not black children. Post-conception marriage is therefore only slightly more beneficial for white children than for black children.

Why are the benefits of post-conception marriage so small? Our descriptive statistics indicate that post-conception marriage is associated with increased economic resources and increased likelihood of the child's biological father living with the family at the time of child assessment. At the same time, mothers who enter into post-conception marriages are more likely to experience the dissolution of their first marriage compared to mothers who remained single at first birth. This might negate some of the positive benefits of post-conception marriage, given evidence that family instability is associated with poorer child outcomes (Cavanagh and Huston 2006; Fomby and Cherlin 2007; Wu 1996).

There may also be some consequences for not entering a post-conception marriage. According to our descriptive statistics, over half of black mothers who were single at their child's birth will never marry in the future. In comparison, only a third of white mothers who were single at birth will never marry. This is consistent with prior research that suggests that unwed, low-income mothers are less likely to get married than those who did not have a nonmarital birth, particularly among black mothers (Graefe and Lichter 2002; Graefe and Lichter 2008). Although black mothers in our study who are single at first birth are more likely to remain single moving forward, they are also more likely to live with the child's grandmother, which might provide more adult supervision for children despite having a single-parent household (but see Dunifon and Kowaleski-Jones 2007, which finds that grandparents have positive effects for

white but not black children). They are also less likely to experience the negative effects of family instability.

Although these findings provide some general insight into the benefits of post-conception marriage on average, we find evidence that the pattern varies across the population depending on the mother's propensity to enter into post-conception marriage. The benefits of post-conception marriage are stronger for the children of white mothers who entered into post-conception marriages but have characteristics that would suggest they were more likely to remain single. In contrast, the effect of post-conception marriage is stronger for the children of black mothers who entered post-conception marriages and have characteristics that suggest they were likely to do so. This finding suggests that marriage promotion policies may be least effective among the very population that they target—disadvantaged black women who are unlikely to marry.

Racial differences in the returns to post-conception marriage raise questions about the mechanisms linking post-conception marriage to child well-being among whites and blacks. Unfortunately, our analyses cannot address these questions. We can only conjecture, using prior theoretical and empirical research to guide our interpretation. Consistent with prior research, we find that post-conception marriage is a rare event among black mothers in our sample (Bachu 1999). The much higher prevalence of single-parenthood among blacks might result in lower stigma and stronger social support, leading to improved outcomes for black children vis-à-vis white children with single mothers (Heard 2007). Because there may be little social pressure to legitimate a premarital conception, black mothers who enter into post-conception marriages may only do so if they expect some benefit. It is also possible that some black mothers with premarital conceptions do not marry because they do not have appropriate partners; widespread joblessness and low earnings may limit their pool of "marriageable men" (Wilson and

Neckerman 1987). Qualitative research finds that young mothers are hesitant to marry until they are financially established (Edin and Kefalas 2005; Miller, Sassler, and Kusi-Appouh 2011). Men with tenuous employment and low wages would not necessarily provide increased economic resources within the context of marriage.

Our study provides new evidence on the linkages between post-conceptions marriages and child well-being, but also highlights opportunities for further research in this area. We focus on the effects of union status at the mother's first birth on child well-being among children age 0-18, but do not examine how these effects vary at different stages of child development. Due to low sample size, we also don't directly examine how the instability or quality of post-conception marriages influences child well-being. Future research may be able to disaggregate the effects of post-conception marriages that endured or dissolved.

Our analysis has some important limitations. Our empirical strategy relies on the assumption that selection is completely captured by observable variables, and we cannot address bias associated with unobservable characteristics. We do not have information about the biological father's characteristics, so we likely have some degree of omitted variable bias in our estimates. Nevertheless, our propensity score approach successfully balances the data and our doubly-robust estimation provides some assurance against model misspecification.

In summary, our study fills a gap in the literature by estimating the effect of post-conception marriage on child well-being. Our analysis draws on rich, longitudinal data and employs propensity score techniques to address two types of selection bias. Although we find that post-conception marriage is associated with some small gains in child well-being overall, the results are far from definitive in supporting marriage promotion policies. In fact, our results

suggest that these policies are likely to be ineffective among black mothers with premarital conceptions who would not otherwise marry.

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Table 1. Descriptive statistics by race and union status at birth (weighted with sampling weight)

	Whites						
	Single			Post-Conception Marriage			
	Obs	Mean	Std. Dev.	Obs	Mean	Std. Dev.	
Maternal selection characteristics (prior to first birth)							
Mother's age at first birth	743	20.26	2.57	950	20.18	2.50	
Mother low AFQT score (<25%)	743	0.30		950	0.16		**
Mother born in south	743	0.22		950	0.26		
Mother lived nuclear family age 14	743	0.56		950	0.73		**
Mother raised Catholic	743	0.31		950	0.34		
Mother raised conservative Protestant	743	0.39		950	0.40		
Mother raised liberal Protestant	743	0.10		950	0.13		
Mother raised with no/other religion	743	0.20		950	0.14		
Mother no literacy material in home age 14	743	0.17		950	0.16		
Mother lived urban area age 14	743	0.82		950	0.69		*
Grandmother a teen mother	743	0.12		950	0.13		
Child characteristics							
Child is male	743	0.50		950	0.51		
Child low birthweight	743	0.05		950	0.07		
Child age at assessment (years)	743	8.39	3.66	950	8.66	3.57	
Household composition (measured at child assessment)							
# kids in household	743	1.97	0.90	950	2.04	0.87	
Child well-being							
Behavior Problems Index	613	111.09	14.95	802	106.89	13.59	**
PIAT Math score	553	101.10	11.81	733	103.16	12.05	
PIAT Reading comprehension score	479	101.80	13.90	654	105.18	12.30	*
Parenting behavior							
Emotionally supportive parenting	674	9.84	1.52	859	10.26	1.33	***
Cognitively stimulating parenting	683	9.87	1.45	878	10.32	1.35	**

*Note: asterisks indicate statistically significant difference between post-conception and single. *** p<0.001, ** p<0.01, * p<0.05, † p<0.10*

Table 1. Descriptive statistics by race and union status at birth (weighted with sampling weight) (continued)

	Blacks						
	Single			Post-Conception Marriage			
	Obs	Mean	Std. Dev.	Obs	Mean	Std. Dev.	
Maternal selection characteristics (prior to first birth)							
Mother's age at first birth	2098	19.86	2.51	234	20.42	1.96	†
Mother low AFQT score (<25%)	2098	0.65		234	0.53		
Mother born in south	2098	0.58		234	0.63		
Mother lived nuclear family age 14	2098	0.43		234	0.41		
Mother raised Catholic	2098	0.06		234	0.14		
Mother raised conservative Protestant	2098	0.71		234	0.61		
Mother raised liberal Protestant	2098	0.07		234	0.15		
Mother raised with no/other religion	2098	0.17		234	0.10		
Mother no literacy material in home age 14	2098	0.24		234	0.27		
Mother lived urban area age 14	2098	0.83		234	0.84		
Grandmother a teen mother	2098	0.21		234	0.17		
Child characteristics							
Child is male	2098	0.49		234	0.49		
Child low birthweight	2098	0.11		234	0.05		
Child age at assessment (years)	2098	8.90	3.60	234	9.05	3.47	
Household composition (measured at child assessment)							
# kids in household	2098	2.36	1.26	234	2.20	0.81	
Child well-being							
Behavior Problems Index	1764	108.03	13.90	197	107.06	12.48	
PIAT Math score	1692	95.00	12.24	188	98.89	12.47	*
PIAT Reading comprehension score	1500	97.91	13.55	168	102.29	13.65	*
Parenting behavior							
Emotionally supportive parenting	1778	9.20	1.59	206	9.57	1.66	*
Cognitively stimulating parenting	1884	9.49	1.52	213	10.05	1.42	**

*Note: asterisks indicate statistically significant difference between post-conception and single. *** p<0.001, ** p<0.01, * p<0.05, † p<0.10*

Table 2. ATE-weighted regression estimates for average treatment effects of post-conception marriage on child well-being and parenting

	Whites				
	BPI	PIAT Math	PIAT Reading Comp.	Emotionally Supportive Parenting	Cognitively Stimulating Parenting
Post-conception marriage	-2.264	1.578	2.776*	0.330**	0.408**
	(1.527)	(1.131)	(1.193)	(0.108)	(0.129)
Mother's age at first birth	-0.198	0.695**	0.228	-0.012	0.032
	(0.322)	(0.258)	(0.222)	(0.023)	(0.026)
Mother low AFQT score (<25%)	6.087**	-6.919***	-6.756***	-0.457***	-0.641***
	(1.978)	(1.358)	(1.616)	(0.136)	(0.186)
Mother born in south	-1.809	-0.895	-0.261	-0.173	-0.287†
	(1.889)	(1.454)	(1.609)	(0.154)	(0.172)
Mother lived nuclear family age 14	-1.867	0.204	0.696	-0.018	-0.218
	(1.577)	(1.180)	(1.375)	(0.114)	(0.136)
Mother raised Catholic	-3.638	0.738	-1.018	0.289*	0.245
	(2.345)	(1.653)	(1.898)	(0.141)	(0.167)
Mother raised conservative Protestant	-3.288	0.587	-1.942	0.134	0.261
	(2.128)	(1.631)	(1.854)	(0.146)	(0.187)
Mother raised liberal Protestant	-1.002	-0.556	-2.984	0.116	0.196
	(2.646)	(2.317)	(2.693)	(0.238)	(0.271)
Mother no literacy material in home age 14	0.463	-1.955	-1.146	0.262†	-0.034
	(1.826)	(1.777)	(1.430)	(0.141)	(0.182)
Mother lived urban area age 14	2.379	-0.515	-1.546	-0.070	-0.111
	(2.087)	(1.484)	(1.572)	(0.127)	(0.174)
Grandmother a teen mother	0.755	-2.697†	-2.934†	-0.127	-0.138
	(2.611)	(1.536)	(1.555)	(0.153)	(0.184)
Child is male	-2.465†	1.589	-0.066	0.121	-0.247†
	(1.493)	(1.174)	(1.231)	(0.110)	(0.135)
Child low birthweight	1.266	-4.773*	-4.726*	-0.202	-0.518
	(1.848)	(2.278)	(2.401)	(0.221)	(0.321)
Child age at assessment (years)	0.036	0.141	-1.265***	-0.021	-0.000
	(0.142)	(0.128)	(0.145)	(0.016)	(0.013)
# kids in household	-0.140	-1.096†	-1.531*	0.062	-0.013
	(0.817)	(0.612)	(0.651)	(0.064)	(0.068)
Constant	115.667***	90.313***	118.572***	10.192***	9.705***
	(7.140)	(6.005)	(5.391)	(0.519)	(0.608)
Observations	1,407	1,277	1,126	1,521	1,551
R-squared	0.066	0.122	0.167	0.049	0.084
Unique respondents	425	406	389	455	457

**** p<0.001, ** p<0.01, * p<0.05, † p<0.10*

Table 2. ATE-weighted regression estimates for average treatment effects of post-conception marriage on child well-being and parenting (continued)

	Blacks				
	BPI	PIAT Math	PIAT Reading Comp.	Emotionally Supportive Parenting	Cognitively Stimulating Parenting
Post-conception marriage	0.600	1.005	1.547	0.357*	0.455**
	(1.468)	(1.370)	(1.458)	(0.169)	(0.141)
Mother's age at first birth	0.208	0.513	0.298	-0.016	-0.024
	(0.356)	(0.317)	(0.323)	(0.038)	(0.030)
Mother low AFQT score (<25%)	4.889**	-3.799**	-6.049***	-0.213	-0.539***
	(1.482)	(1.223)	(1.530)	(0.162)	(0.153)
Mother born in south	-3.525*	2.175	1.074	-0.216	-0.245
	(1.724)	(1.548)	(1.543)	(0.217)	(0.157)
Mother lived nuclear family age 14	0.021	-3.343*	-2.448†	0.359†	0.323*
	(1.603)	(1.444)	(1.400)	(0.197)	(0.150)
Mother raised Catholic	3.058	5.536†	0.581	-0.132	-0.328
	(3.389)	(3.188)	(2.591)	(0.239)	(0.379)
Mother raised conservative Protestant	2.489†	-0.807	-5.744***	-0.550**	-0.286
	(1.470)	(1.750)	(1.715)	(0.199)	(0.248)
Mother raised liberal Protestant	-1.032	6.029*	-1.672	-0.321	-0.025
	(2.376)	(2.531)	(2.616)	(0.240)	(0.314)
Mother no literacy material in home age 14	0.997	2.451	1.104	0.125	0.071
	(1.433)	(1.603)	(1.571)	(0.178)	(0.184)
Mother lived urban area age 14	1.691	-0.462	-0.957	0.152	0.442*
	(2.023)	(1.917)	(1.710)	(0.178)	(0.188)
Grandmother a teen mother	2.012	-1.559	-1.151	0.029	0.085
	(1.525)	(1.411)	(2.104)	(0.172)	(0.192)
Child is male	0.953	0.156	-0.382	0.152	0.121
	(1.343)	(1.340)	(1.452)	(0.164)	(0.144)
Child low birthweight	1.503	1.071	0.353	0.143	-0.169
	(1.749)	(1.833)	(1.583)	(0.190)	(0.242)
Child age at assessment (years)	0.039	-0.047	-2.467***	-0.016	0.027†
	(0.138)	(0.170)	(0.224)	(0.018)	(0.015)
# kids in household	1.169*	-1.043†	-1.036	-0.069	-0.103†
	(0.580)	(0.533)	(0.649)	(0.071)	(0.057)
Constant	94.860***	90.306***	129.837***	10.112***	10.116***
	(8.193)	(7.630)	(8.376)	(0.909)	(0.787)
Observations	1,902	1,823	1,618	1,931	2,039
R-squared	0.079	0.124	0.316	0.060	0.102
Unique respondents	484	479	472	484	485

**** p<0.001, ** p<0.01, * p<0.05, † p<0.10*

Table 3. Summary of post-conception marriage coefficients predicting child well-being

	Whites					
	ATE Weight	ATT Weight	ATC Weight	|ATT-ATC|	95% confidence interval of |ATT-ATC|	
Behavior Problem Index	-2.264	-1.658	-3.267*	1.609	-2.722	5.940
	(1.527)	(1.575)	(1.550)			
PIAT Math scores	1.578	1.274	1.943†	0.669	-2.518	3.856
	(1.131)	(1.199)	(1.098)			
PIAT Reading comprehension scores	2.776*	2.214†	3.554**	1.340	-2.068	4.748
	(1.193)	(1.223)	(1.236)			
Emotionally supportive parenting	0.330**	0.287*	0.398***	0.111	-0.195	0.417
	(0.108)	(0.113)	(0.108)			
Cognitively stimulating parenting	0.408**	0.373**	0.461***	0.088	-0.281	0.457
	(0.129)	(0.136)	(0.130)			
	Blacks					
	ATE Weight	ATT Weight	ATC Weight	|ATT-ATC|	95% confidence interval of |ATT-ATC|	
Behavior Problem Index	0.600	0.006	0.691	0.685	-3.562	4.932
	(1.468)	(1.581)	(1.482)			
PIAT Math scores	1.005	2.638†	0.816	1.822	-2.007	5.651
	(1.370)	(1.382)	(1.381)			
PIAT Reading comprehension scores	1.547	2.669*	1.411	1.258	-2.683	5.199
	(1.458)	(1.349)	(1.491)			
Emotionally supportive parenting	0.357*	0.337*	0.357*	0.020	-0.440	0.480
	(0.169)	(0.161)	(0.171)			
Cognitively stimulating parenting	0.455**	0.489***	0.445**	0.044	-0.352	0.440
	(0.141)	(0.144)	(0.142)			

Asterisks indicate statistically significant differences from control group (single at birth)
**** p<0.001, ** p<0.01, * p<0.05, † p<0.10*

Table 4. Descriptive statistics by race and union status at birth (weighted with sampling weight)

	Whites						
	Single			Post-Conception Marriage			
	Person-Year Obs	Mean	Std. Dev.	Person-Year Obs	Mean	Std. Dev.	
Economic resources (measured at child assessment)							
Mother was employed last week	743	0.63		950	0.66		
Mother worked 1-19 hours last week	723	0.08		915	0.08		
Mother worked 20-34 hours last week	723	0.13		915	0.16		
Mother worked 35-40 hours last week	723	0.26		915	0.29		
Mother worked 41+ hours last week	723	0.15		915	0.12		
HH income in 2004 dollars (,000)	633	31.89	26.82	865	48.38	51.75	***
HH under poverty line	649	0.35		875	0.14		***
Household composition (measured at child assessment)							
# adults over age 18 in household	743	1.89	0.69	950	1.96	0.67	
Mother never married	726	0.33		950	0.00		***
Mother is currently married/remarried	727	0.50		950	0.73		***
Mother is currently separated/divorced/widowed	727	0.18		950	0.27		*
Mother's first marriage dissolved (0= first marriage intact or never married)	743	0.22		950	0.41		***
Mother's first marriage dissolved (conditioned on having a first marriage)	479	0.31		950	0.41		†
Child's bio dad in household	738	0.33		935	0.63		***
Child's grandmother in household	743	0.10		950	0.06		
Maternal traditional gender ideology	725	14.97	3.05	941	14.66	3.06	

Note: asterisks indicate statistically significant difference between post-conception and single.
**** p<0.001, ** p<0.01, * p<0.05, † p<0.10*

Table 4. Descriptive statistics by race and union status at birth (weighted with sampling weight) (continued)

	Blacks						
	Single			Post-Conception Marriage			
	Person-Year Obs	Mean	Std. Dev.	Person-Year Obs	Mean	Std. Dev.	
Economic resources (measured at child assessment)							
Mother was employed last week	2098	0.57		234	0.68		*
Mother worked 1-19 hours last week	2041	0.03		227	0.02		
Mother worked 20-34 hours last week	2041	0.09		227	0.15		
Mother worked 35-40 hours last week	2041	0.32		227	0.37		
Mother worked 41+ hours last week	2041	0.11		227	0.13		
HH income in 2004 dollars (,000)	1679	28.67	51.64	190	55.23	123.61	*
HH under poverty line	1726	0.47		192	0.20		***
Household composition (measured at child assessment)							
# adults over age 18 in household	2098	1.98	1.20	234	1.89	0.82	
Mother never married	2092	0.58		234	0.00		***
Mother is currently married/remarried	2060	0.26		234	0.63		***
Mother is currently separated/divorced/widowed	2060	0.16		234	0.37		***
Mother's first marriage dissolved (0= first marriage intact or never married)	2098	0.08		234	0.30		***
Mother's first marriage dissolved (conditioned on having a first marriage)	874	0.19		234	0.30		†
Child's bio dad in household	2092	0.18		233	0.57		***
Child's grandmother in household	2094	0.22		234	0.09		***
Maternal traditional gender ideology	2070	14.48	3.32	234	14.57	3.01	

Note: asterisks indicate statistically significant difference between post-conception and single.

**** p<0.001, ** p<0.01, * p<0.05, † p<0.10*

Appendix Table 1. Propensity score models predicting likelihood of post-conception marriage

	Whites	Blacks
Mother's age at first birth	1.010	1.089
	(0.055)	(0.070)
Mother low AFQT score (<25%)	0.444**	0.774
	(0.139)	(0.271)
Mother born in south	0.437	0.560
	(0.355)	(0.748)
Mother lived nuclear family age 14	1.703†	1.115
	(0.506)	(0.427)
Mother raised Catholic	1.613	4.039
	(0.721)	(5.211)
Mother raised conservative Protestant	1.301	1.516
	(0.570)	(1.623)
Mother raised liberal Protestant	1.685	8.926†
	(0.985)	(10.469)
Mother no literacy material in home age 14	0.755	1.785
	(0.447)	(0.923)
Mother lived urban area age 14	0.379*	0.506
	(0.161)	(0.373)
Grandmother a teen mother	1.250	0.901
	(0.509)	(0.370)
South X Catholic	3.594	0.644
	(4.062)	(1.025)
South X Conservative Protestant	2.168	0.939
	(1.832)	(1.177)
South X Liberal Protestant	2.142	0.227
	(2.367)	(0.340)
South X urban	2.045	4.115
	(1.438)	(3.919)
Nuclear family X no literacy	1.784	0.416
	(1.319)	(0.331)
Constant	1.445	0.016**
	(1.638)	(0.021)
Observations	1,693	2,332
Pseudo R2	0.0708	0.0608
Cluster	461	509

Coefficients are odds ratios
Robust standard errors in parentheses
**** p<0.001, ** p<0.01, * p<0.05, † p<0.10*

Appendix Table 2. Average of standardized mean and standardized deviation differences between treatment and control

	Whites		Blacks	
	Mean	Std. Dev.	Mean	Std. Dev.
Sampling weight	0.12	0.03	0.15	0.24
ATE weight	0.02	0.01	0.04	0.25
ATT weight	0.04	0.01	0.01	0.26
ATC weight	0.02	0.01	0.04	0.25

Appendix Table 2 (continued). Weighted descriptive statistics

	Whites				Blacks			
	Single		Post-conception		Single		Post-conception	
Variable	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
ATE weights								
Mother's age at first birth	20.17	2.55	20.19	2.51	19.92	2.52	19.97	1.95
Mother low AFQT score (<25%)	0.21		0.20		0.64		0.69	
Mother born in south	0.24		0.24		0.58		0.60	
Mother lived nuclear family age 14	0.67		0.67		0.43		0.43	
Mother raised Catholic	0.35		0.33		0.07		0.06	
Mother raised conservative Protestant	0.39		0.39		0.70		0.72	
Mother raised liberal Protestant	0.11		0.12		0.08		0.07	
Mother raised with no/other religion	0.15		0.15		0.16		0.15	
Mother no literacy material in home age 14	0.16		0.16		0.24		0.26	
Mother lived urban area age 14	0.73		0.74		0.83		0.80	
Grandmother a teen mother	0.14		0.13		0.20		0.21	
ATT weights								
Mother's age at first birth	20.10	2.53	20.18	2.50	20.42	2.54	20.42	1.96
Mother low AFQT score (<25%)	0.15		0.16		0.55		0.53	
Mother born in south	0.26		0.26		0.63		0.63	
Mother lived nuclear family age 14	0.74		0.73		0.42		0.41	
Mother raised Catholic	0.38		0.34		0.13		0.14	
Mother raised conservative Protestant	0.39		0.40		0.62		0.61	
Mother raised liberal Protestant	0.12		0.13		0.15		0.15	
Mother raised with no/other religion	0.11		0.14		0.10		0.10	
Mother no literacy material in home age 14	0.16		0.16		0.28		0.27	
Mother lived urban area age 14	0.68		0.69		0.85		0.84	
Grandmother a teen mother	0.15		0.13		0.16		0.17	
ATC weights								
Mother's age at first birth	20.26	2.57	20.21	2.54	19.86	2.51	19.92	1.94
Mother low AFQT score (<25%)	0.30		0.27		0.65		0.71	
Mother born in south	0.22		0.22		0.58		0.60	
Mother lived nuclear family age 14	0.56		0.57		0.43		0.43	
Mother raised Catholic	0.31		0.33		0.06		0.06	
Mother raised conservative Protestant	0.39		0.38		0.71		0.73	
Mother raised liberal Protestant	0.10		0.11		0.07		0.06	
Mother raised with no/other religion	0.20		0.18		0.17		0.16	
Mother no literacy material in home age 14	0.17		0.16		0.24		0.26	
Mother lived urban area age 14	0.82		0.81		0.83		0.80	
Grandmother a teen mother	0.12		0.13		0.21		0.21	
Observations	743		950		2098		234	

**** p<0.001, ** p<0.01, * p<0.05, † p<0.10*