Maternal Age and Child Achievement

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150-word abstract

Drawing data from the Children of the NLSY79, we estimate differences in teenage achievement and problem behavior for children born to younger and older mothers. We distinguish between the value for children of being born to a mother who delayed her first birth and the value of the additional years between her first birth and the birth of the child whose outcomes are under study. We find that each year the mother delays a first birth is associated with between a .026 sd and .036 sd increase in school achievement and a .038 sd reduction in teen behavior problems. Coefficients are at least half as large for additional years between the first and given birth, even in the presence of controls for cousin and sibling fixed effects. Our mediational analyses shows that the primary pathway by which delaying first births benefits children is by enabling mothers to complete more schooling.

Full Paper Abstract

Although the consequences of teen births for both mothers and children have been studied for decades, few studies have taken a broader look at the potential payoffs – and drawbacks – of being born to older mothers. A broader examination is important given the growing gap in maternal ages at birth for children born to mothers with low and high socioeconomic status. Drawing data from the Children of the NLSY79, our examination of this topic distinguishes between the value for children of being born to a mother who delayed her first birth and the value of the additional years (which is zero for first births) between her first birth and the birth of the child whose teenage achievements and behaviors are under study. We find that each year the mother delays a first birth is associated with between a .026 sd and .036 sd increase in school achievement and a .038 sd reduction in teen behavior problems. Coefficients are at least half as large for additional years between the first and given birth, even in the presence of controls for cousin and sibling fixed effects. Our mediational analyses showed that the primary pathway by which delaying first births benefits children is by enabling mothers to complete more schooling.

Maternal Age and Child Achievement

I. Introduction

Although the consequences of teen births for both mothers (Haveman, Wolfe, and Peterson, 1997) and children (Francesconi, 2008; Angrist & Lavy, 1996; Hoffman, 2008) have been studied for decades, few studies have taken a broader look at the potential payoffs – and drawbacks – of being born to older mothers. A broader examination is warranted given that the recent reductions in teen birth rates have masked a growing gap in maternal age at birth for children born to high and low SES mothers. Figure 1 presents Natality Detail File data for all births in the 1970, 1989 and 2006 showing age of mother by maternal schooling. The maternal age gap between children born to high school dropout and college graduate mothers grew by nearly 3 years -- from 4.3 years to 7.3 years. Using data from the PSID, Duncan et al. (2014) show that the maternal age gap between the top and bottom quintiles of the income distribution (measured at age 14-16) grew by nearly five years between cohorts of children born in the late 1950s and the early 1980s. In their accounting of the increases in the completed schooling gap between high and low-income children over this interval, Duncan et al. (2014) find that age of mother at the birth of the children can explain about one quarter of the increase – much more than the rise of single parent family structures among low-income families.

[Insert Figure 1 here]

Delaying a first birth beyond the teen years enables mothers to complete more schooling, begin a career and acquire a host of other experiences that might contribute to a healthier prenatal environment and a wealthier, safer and more stimulating post-natal environment for their first children. These same advantages, plus those associated with "on the job training" lessons from experiences rearing first births may accrue to delays in second and subsequent births. Although some of these same advantages may stem from being born to older fathers (Mare and Tzeng, 1989), our analyses focus on mothers' ages.

Parents draw on their human capital stocks—largely driven by educational experiences—as well as their socio-emotional and personality skills —including maturity, experience, self-esteem, and mental health—to promote their children's development. The educational and financial resources associated with higher levels of maternal human capital benefit children; mothers with lower levels of human capital must rely more on their non-cognitive skills to promote healthy child development. Because mental health improves across the life course and maturity develops with age, older mothers have higher levels of non-cognitive skills than younger mothers. Maternal age may thus be a more important determinant of children's outcomes when mothers have poor human capital stocks. In other words, such mothers can use the non-cognitive skills that come with age as a substitute for human capital to invest in their children.

Mothers' human capital and non-cognitive skills may also complement one another in the production of healthy child development. For instance, it may take a mature or patient mother to effectively transmit her high human capital to her children. Similarly, maturity or experience

could be the key ingredient in shaping high human capital mothers' effective decisions about other types of investments in children.

In light of the importance of this issue, we draw upon data from the Children of the NLSY79 to estimate the value for children of being born to a mother who delayed her first birth and the value of the additional years between her first birth and the birth of the child whose teenage achievements and behaviors are under study. We find that each year the mother delays a first birth is associated with between a .026 sd and .036 sd increase in school achievement and a .038 sd reduction in teen behavior problems. Coefficients are at least half as large for additional years between the first and given birth, even in the presence of controls for cousin and sibling fixed effects. Moreover, we find that these associations are roughly linear through the range of maternal ages represented in the sample.

Maternal age and child outcomes

Maternal age at childbirth appears to be a positive determinant of children's learning and educational attainment; financial independence from public programs such as welfare, food stamps, and Medicaid; (reduced) teen pregnancy; and adolescent and young adult problem behaviors such as fighting, truancy, and sexual activity; even after accounting for rich sets of covariates including maternal education, income, and race (Bradbury, 2011; Hardy et al., 1997; Haveman, Wolfe, and Peterson, 1997; Hoffman, 1998; Levine, Pollack, and Comfort, 2001; Miller 2008). Teen parenthood may be especially detrimental to children's human capital accumulation and their long-term outcomes. For example, the children of teen parents demonstrate poorer cognitive skill development than those of older parents (Moore, Morrison, and Greene, 1997).

A positive causal relationship between maternal age and their children's development could be a function of mothers' diminished human capital or non-cognitive skills. Younger parents may lose the opportunity to invest in their own human capital development if parenthood, and particularly the birth of the first child, limits educational attainment or interrupts labor market participation. Younger parents are also likely to have fewer financial resources, as income generally increases over the life course until it reaches a plateau in later adulthood (Featherman and Spenner, 1988; Ross and Mirowsky, 1999), and teen childbirth in particular is associated with lower parental earnings and higher rates of poverty (Maynard, 1997). A lack of emotional and/or financial preparedness means that young parents may not make optimal decisions about their children's early education and care, health care usage, and other human capital investments (Leigh and Gong, 2010). Additionally, family instability and single parenthood among younger parents may drive poorer child outcomes, as the children of young parents face an increased likelihood of growing up fatherless and teen marriages are more often than marriages at older ages to be unstable (Maynard, 1997; Turley, 2003).

At the same time, the relationship between parental age and child development could be negative. Older parents may be in poorer physical condition than younger parents or may dedicate less time to parenting given their higher opportunity cost of time, i.e. a higher market wage (Leigh and Gong, 2010). They also have a shorter time span in which to have multiple children, and children might be negatively affected by a reduction in birth spacing, as Buckles and Munnich (2012) demonstrate using an instrumental variables approach that exploits the random variation in birth spacing induced by miscarriage. Finally, a wider age gap between older

parents and their children may have a negative effect on the parent-child relationship, particularly during the child's adolescence (Heuvel, 1988).

Differences in relationship structure between younger and older parents seem to drive some of the disparities in children's outcomes. Francesconi (2008) employs a family fixed effect model and finds that the children of young parents in *non-intact* families fare worse along a range of young adult outcomes than those of older parents, but the children of young parents in *intact* families only exhibit slightly poorer outcomes than those of older.

While many early studies in this area are compromised by selection bias problems, a number using more rigorous empirical methods suggest a plausibly causal role of mothers' age at birth and at least some dimensions of children's development, though the findings in this area are mixed. Using a family fixed effects model, Angrist and Lavy (1996) find that the children of teen mothers are far more likely to repeat one or more grades than the children of older mothers; grade retention is a strong predictor of later outcomes such as school dropout and poorer cognitive skills. However, Geronimus, Korenman, and Hillemeier (1994) and Turley (2003) control for time-invariant family characteristics of the teen mothers by comparing cousins whose mothers are sisters and find little evidence that teen childbearing has negative consequences on early childhood cognitive and behavioral development.

Natural experiments have also been used to measure the socioeconomic consequences of teen childbearing. Grogger and Bronars (1993) approximate the effect of a single birth by measuring the effect of increasing the number of teen births from one to two, comparing teen mothers with a singleton birth to those with a twin birth. They find lower rates of high school graduation and labor force participation as well as increased risk of poverty and welfare receipt among Black teen mothers, and higher poverty and welfare receipt as well as decreasing earnings and incomes among White teen mothers. Hotz, McElroy, and Sanders (2005) use an instrumental variable approach by comparing women who gave birth as teens to women who miscarried as teens, under the assumption that miscarriages are random. They find that most negative impacts on teen mothers found in previous research are overstated and/or short-lived, and teen childbirth actually has a positive effect on work hours and earnings. However, reanalyzing data from Hotz et al (2005), Hoffman (2008) finds that the positive impacts found among teens born in the early 1970s are overstated, and that teen childbearing has a negative effect on teens born in the late 1970s and early 1980s.

In contrast to focusing on teen childbearing, Miller (2008) studies the effects of motherhood delay on children's cognitive development using three biological fertility shocks as instrumental variables: a) whether first pregnancy resulted in a miscarriage; b) whether mother was using a contraceptive method at the time of conception of the first child; c) time elapsed from first conception attempt to first birth. One potential concern of using these variables as instruments is that they could be correlated to unobserved attitudes, beliefs or behaviors of the mother that if correlated with children human capital they could violate the exogeneity condition. Miller (2008) provides some evidence that the instruments are uncorrelated to religious affiliation or activities and career outcomes prior to motherhood, however this evidence doesn't rule out the concern of unobserved factors. She finds that delaying motherhood by one year leads to a 0.02-0.03 standard deviations increase in children's test scores.

The relationship between maternal age and socio-emotional skills

Mental health improves over the life course and maturity develops over time. Depression decreases in age as adolescents enter adulthood (Wickrama et al., 2008) and over the course of the thirties and forties (Mirowsky and Ross, 1992). Self-esteem increases during adolescence and into young adulthood (Erol and Orth, 2011), as does maturity (Martin, 2004; Mirowsky and Ross, 1992).

Younger parents may be emotionally unprepared for parenthood. A later first-time parent will have more time to develop emotionally and gain self-confidence before engaging in childrearing (Heuvel, 1988). Qualitative data suggest that older mothers may feel more mature and competent as parents than younger mothers, while younger mothers may feel more isolated and restless (Frankel and Wise, 1982).

As a result, a young parent may not have the parenting skills s/he would otherwise have had as an older parent (Leigh and Gong, 2010). Positive parenting behaviors increase in maternal age at first birth, while negative parenting behaviors decrease in maternal age at first birth (Conger et al., 1984). In fact, many of the negative associations between maternal age and children's educational underachievement, engagement in criminal activity, substance abuse, and mental health problems can be explained by the relationship between maternal age and enhanced child-rearing skills and home environments (Fergusson and Woodward, 1999).

Young parents provide lower levels of emotional support to their children compared to older parents (Hofferth, 1987; Moore, Morrison, and Greene, 1997). They have less knowledge about children's developmental milestones (Fergusson and Woodward, 1999); tend not to invest in the home learning environment to the same extent as older parents (Brooks-Gunn and Furstenberg, 1986); and offer less verbal stimulation to young children. Similarly, using multivariate regression models that control for an extensive list of family background characteristics, Powell, Steelman, and Carini (2006) find that the relationships between parental age and economic resources, social capital, and cultural capital invested in teenagers are generally positive and linear.

Maternal non-cognitive skills have important consequences for healthy child development. For instance, children of depressed parents are at increased risk of developing internalizing and externalizing behavior problems (Cummings, 1994), and clinical depression and anxiety in particular. Both the severity and chronicity of mothers' depressive symptoms are associated with behavior problems in children and with lower vocabulary scores (Brennan et al., 2000). Such associations are seen in children of both genders and across socioeconomic statuses, but wealth serves as a partial buffer against the negative impact of maternal depression on children's cognitive and motor outcomes (Peterson and Albers, 2001), suggesting that high human capital among mothers can offset low levels of non-cognitive skills in promoting child development.

Maternal education and child outcomes

Given that delayed childbearing may enable mothers to complete more schooling, it is important to note that an emerging body of literature points to the (plausibly causal) role of parental education in shaping child development (see Bjorklund & Salvanes, 2011, for an

excellent summary of this work). First, more years of parental education produces higher earnings and increased family incomes, which enables parents to provide better child care and more stimulating home environments for their young children; live in safer, more affluent neighborhoods with better schools; and pay for children's college educations. Second, highly educated parents adopt different child socialization strategies than their less educated counterparts. They spend more time – and more "developmentally effective" time - with their children (Bianchi, Cohen, Raley, & Nomaguchi, 2004, Guryan, Hurst, & Kearney, 2008; Kalil, Ryan, & Corey, 2011), produce more cognitively stimulating home learning environments (Harris, Terrel & Allen, 1999), have higher expectations for their children's educational attainment (Davis-Keane, 2005) and are more likely to adopt parenting strategies that promote achievement (Steinberg et al., 1992). Skills acquired through schooling may enhance parents' abilities to organize their daily routines and resources in a way that enables them to accomplish their parenting goals effectively (Michael, 1972).

Present Study

The goal of this paper is to study the role of maternal age at childbearing distinguishing the value of two types of maternal experience: 1) the value for children of being born to a mother who delayed her first birth (general experience) and 2) the value of the additional years between her first birth and the birth of the child whose outcomes are under study (parenting or child-specific experience). Our analyses use data from the Children of the NLSY79 to estimate the associations between children's achievement and behavior problems at age 10-13 and the years of general and child-specific maternal experience prior to their births. We also attempt to account for these associations using mediators associated with the prenatal environment (maternal smoking and drinking, child birth weight), post-natal environment (the quality of the home environment, the number of years two parents are present and subsequent fertility), plus maternal education

Our correlational approach to examining the payoff to children of being born to an older mother harkens back to the labor economics approach to estimating the wage payoffs to different kinds of labor market experience (Mincer, 1970). In that literature, human capital accumulation was taken to be a product of time spent working in any capacity and the presumably higher-payoff time spent with the current employer and/or working in the current job position. In the empirical implementation of this model, wages were regressed on years of general labor market experience acquired prior to working for the current employer and years of specific experience with the current employer or in the current position.

In our case, child human capital accumulation is assumed to be the product of the advantages of the general experiences acquired by women who delay their first births and, for second and higher parity births, the more specific child-rearing and other advantages of additional years beyond the mother's first birth. We operationalize this by dividing the years between age 16 and the given child's birth into: 1) years prior to the birth of the first child, and 2) years between the first birth and the given birth. For the former, years prior to first becoming a mother provide opportunities to complete more schooling, begin a career and acquire early-adulthood experiences that can lead to more mature decision-making. Years following the birth of a first child can provide parenting-specific experience that might benefit subsequent children as well. Since second and subsequent birth children share parental time and family financial resources, so our regressions control for family size at the birth of the child as well.

II. Data

We use the U.S. National Longitudinal Study of Youth (NLSY79), a nationally representative sample of 12,686 young men and women who were 14-22 years old when first surveyed in 1979. Starting in 1986, all children born to the women (n=11,487) in the NLSY79 were administered questions and assessments from the Child and Young Adult Supplement of the National Longitudinal Study of Youth (CNLSY), consisting of a battery of assessments and questions (e.g. cognitive, socio-emotional, demographic, etc.) every other year until they reached the age of 14. This information was collected from both the children's mothers and the children themselves. All children born to NLSY women were tracked, which permits comparisons between siblings.

Due to the biennial measurement interval of the CNLSY, we combined two distinct samples of children—children born in even years (1980, 1982, 1984, etc.) and children born in odd years (1981, 1983, 1985, etc.). These two samples of children were pooled so that the target sample consists of 11,487 children. Of 11,487 children, children born before 1983 (n=3758) were dropped from the analysis, as these children would not have had the home environment assessed by a trained interviewer at age 2 or 3. The analysis sample consists of 5274 children whom completed the math and reading assessments and 5565 whom completed the socio-emotional development assessment at least once between ages 10 and 13 in the child supplement of the CNLSY.

Measures

Dependent Variables

Reading and math achievement. We use math and reading scores between ages 10 and 13 from the Peabody Individual Achievement Tests (PIAT, reading recognition and math) to measure middle childhood academic skills. For children that had more than one non-missing score during this time (i.e. valid scores at age 10 and 12 or at age 11 and 13), the average of the two scores was used. For the purposes of analysis, scores are standardized to have a mean of 0 and standard deviation of 1 (based on the full NLSY sample distribution). Means, standard deviations and ranges of dependent and predictor variables are shown in Table 1. Table 2 presents a correlation matrix for dependent and key predictor variables. The PIAT reading recognition and math test scores are moderately positively correlated (r=.65).

[Insert Tables 1 and 2 here]

Externalizing behaviors. We use scores between ages 10 and 13 of the maternally-reported externalizing behaviors subscale from the Behavioral Problem Index in the CNLSY as a measure for socioemotional development. Example items include "cheats or tells lies," "is disobedient in school," and "is not liked by other children." Externalizing behaviors show a r=-.22 and r= -.24 correlation with math and reading achievement, respectively.

Predictor Variables

Years between age 16 and birth of first child (general life experience). Years of experience before first child is the difference between a mother's age at age 16 and her age at her first child's birth. Values range between 0 (birth occurred at age 16) and 29.5 (age 45.5) years of experience.

Years between first and given child (parenting experience). Years between first and n^{th} child is the number of years apart a given child is born after the first child of the family. If a given

child is the first-born child, there will be zero years. Values range between 0 years (twins and first-borns) and 30.6 years.

Number of siblings before birth. We count the total number of siblings at the time of the given child's birth. If a given child is the first-born child or an only child, there will be zero siblings.

Mediators

To account for factors that may potentially mediate the relationship between a mother's life and parenting experiences and child's human capital, we construct a number of mediators. Demographic mediators include years of mother's education at the birth of a given child, the fraction of years between birth and age 12 the biological father was in the household, and the average number of siblings between a child's birth and when he or she was age 13. Birth weight and prenatal cigarette and alcohol use accounted for certain measurable fetal origins. We also examine the mediating role of the early life home environment by using the Home Observation Measurement of the Environment-Short Form (HOME) score assessed by survey responses and a trained observer of a given child at age 2 or 3.

Control Variables

To reduce selection bias, demographic characteristics are included in our empirical models. Covariates in our model include race (black or Hispanic), gender, and mothers' percentile scores on the Armed Forces Qualifying Test (AFQT, a measure of mothers' academic aptitude assessed in 1980). Also included as covariates are if the mother ever fought or stole when she was 18 and if the mother is US born.

Missing Data

The longitudinal nature of data collection results in missing data for the NLSY. To handle the missing data, we used a dummy variable adjustment for the mediators and control variables in the analysis. The mediators and covariates in the analysis were missing up to 22.6% of cases[1].

III. Methods

We begin by estimating Ordinary Least Squares (OLS) regressions of children middle childhood outcomes on the two measures of maternal experience: general life experience and parenting experience. The model also control for child and maternal characteristics as described in the previous section. The estimated model is:

$$Outcome_{i,j} = \beta_1 general\ experience_j + \beta_2 parenting\ experience_{i,j} + X_{i,j}\alpha + \varepsilon_{i,j}$$

where $Outcome_{i,j}$ is the achievement and behavioral outcomes for child i born to mother j. $general\ experience_j$ correspond to the years between age 16 and the first birth and just varies by mother. $Parenting\ experience_{i,j}$ denotes the years between first and a given child and varies by child and mother. $X_{i,j}$ captures the control covariates and $\varepsilon i,j$, is the error term.

The timing of fertility decisions is endogenous meaning that there could be unobserved characteristics imbedded in the error term that we are not able to control for and that can be

[1] Dummy variable approach was used for mediators when they were used as independent variables.

correlated with both child development and maternal age at birth. In other words, women who decide to have a child during teenage years may be different in observed and unobserved ways from women who decide to have a child later, and similarly for women who delay motherhood until late adulthood. Therefore, we should be careful in interpreting these OLS estimates as causal relations between the two types of maternal experience and child human capital.

We attempt to address the selection problem by using the following identification strategies. For the case of general experience, we compare child outcomes from mothers who are sisters and therefore shared the same family background but who began childbearing at different ages. We refer to this strategy as "cousin fixed effects". The estimated model in this case is:

$$Outcome_{i,j,h} = \beta_1 general\ experience_j + \beta_2 parenting\ experience_{i,j} + X_{i,j}\alpha + \omega_h + \epsilon_{i,j,h}$$

where h denotes maternal household and ω_h controls for time invariant unobserved characteristics related to maternal family background factors. Additionally, we also attempt to use an instrumental variables approach that relies on miscarriages before the first child as instruments following prior literature (Hotz et al. (2005)). However, results so far have been very noisy. We plan to exploit the changes in abortion laws during the 1970's and 1980's when most of our first children were born.

For the case of maternal parenting experience, since it varies across children born to the same mother, we exploit the sibling sample in the CNLSY79. Therefore, we compare the middle childhood outcomes for children born to the same mother but at different times in her life cycle. We refer to this strategy as "sibling fixed effects". The estimated model in this case is:

$$Outcome_{i,j} = \beta_2 parenting\ experience_{i,j} + X_{i,j}\alpha + \pi_j + \xi_{i,j}$$

where π_j controls for unobserved maternal characteristics that are time invariant and common to all children born to the same mother. Note than general experience is omitted as it doesn't vary across siblings born to the same mother.

Next, we augment our estimated models by adding the mediators explained in the previous section. The mediators correspond to variables that we hypothesized as intermediate factors through which maternal age can affect child outcomes, such as maternal education. Additional, mediation analyses involve understanding the relationship between the mediators and maternal age experiences. Thus, we estimate models where the mediators are treated as dependent variables. The next section presents our results.

IV. Results

Key regression results for our child outcome measures are presented in Tables 3-5, beginning with early-adolescent math scores. With controls for total number of siblings at birth and our full set of control variables (column 1), each additional year between age 16 and the mother's first birth is associated with a .036 standard deviations (sd) increase in math scores, .026 sd improvement in reading scores and a reduction of .038 sd in externalizing problems. The estimated coefficient is more than 9 times its standard error for math, 8.6 times its standard error for reading, and 9.5 times its standard error for externalizing. The corresponding association for years between the first and given birth is smaller– .027 sd per year for math scores, 0.031 for reading and -.021 sd for externalizing behaviors scores. Models fitting categorical, quadratic, and

spline forms to these two relationships failed to find improvement in model fit (results not shown).

[Insert Table 3, 4, and 5 here]

Concerns that these two segments of maternal experience are endogenous led us to attempt to estimate our coefficients on general life experience using instrumental variables, cousin fixed effects, and on subsequent experience using sibling fixed effects. For the instrumental variables model, we attempted to replicate the miscarriage-based instrumental variables models of Hotz et al. (2005), but failed to generate a strong enough first-stage prediction to produce acceptably precise coefficient estimates. Our cousin fixed effects models compare children born to mothers who are sisters, which controls for shared unobserved time-invariant maternal family characteristics. Overall, cousin fixed effects estimates are more imprecise but similar in magnitudes to the OLS estimates using the cousin sample (columns 2 and 4). The results for both type of experience are still statistically significant except for the case of externalizing behaviors.

To address the endogeneity of parenting experience, we exploit the fact that the CNLSY sample all the children born to the focal mother and estimate models. We rely on comparisons of siblings born at different maternal ages, which controls for unobserved children's shared family background characteristics that are time invariant. For the case of math test scores, our sibling-based family fixed effects coefficient for parenting experience decline and it is no longer statistically significant (Column 3 vs. 5 in Table 3). Corresponding regressions for reading achievement show that the associations for the second experience segment are as large as for the first and do not fall much in the presence of sibling fixed effect controls (Column 3 vs. 5 in Table 4). Coefficients (negative in this case reflecting the negative nature of the dependent variable) are similar in magnitude for early teenage behavior problems (Column 3 vs. 5 in Table 5).

Mediators:

The overall ability of our collection of mediators to account for the associations between maternal experience and child outcomes is indicated by a comparison between columns 1, 4, and 5 and columns 6-8 in Tables 3-5. In the case of our math outcome, the coefficient on years between age 16 and first birth (general experience) fall by about one-third (from .036 to .023 OLS full sample) when the mediators are added in. Both reading and behavior problems follow a similar pattern and the coefficient also falls about one-third as well. The coefficients for general life experience also decline when we add the mediators to the cousin fixed effects models and are no longer statistically significant. These patterns of results indicate that the mediators play some role in accounting for the associations between life experience and children human capital. In the case of years between the first and given birth (parenting experience), the mediators account for considerably less of the associations.

Many of the mediators themselves are significant predictors of our early teen outcomes (results shown in Tables 3-5 columns 6-8). In the non-fixed effects models involving achievement outcomes, maternal education, home environment scores, and birth weight are all significant predictors. For behavior problems, family structure following the birth and prenatal cigarette and alcohol use are significant as well. Many fewer of these measures retain statistical significance in the sibling fixed effects models, in part because the limited or perhaps error-

inducing sibling differencing drives up standard errors.

[Insert Table 6 here]

Mediation is a joint product of the association between mediators and outcomes shown in Columns 6-8 in Tables 3-5 and the associations between our maternal experience measures and the mediators, which are shown in Table 6 and Appendix tables 4-9. Mediators are treated as dependent variables in Table 6 and Appendix tables 4-9. Independent variables include our two maternal experience variables, demographic controls and, in the case of mediators other than maternal education, maternal education itself. This reflects a recursive model in which the maternal schooling mediator is considered to be causally prior to the others.

By far the strongest relationship between years prior to the first birth and the mediators is with years of maternal schooling (shown in Table 6); each year of postponing a first birth is associated with nearly one-fifth (.194) years of completed schooling (Column 1 Table 6). When this coefficient is multiplied by the .038 coefficient on maternal schooling in the math OLS regression in Column 6 of Table 3, it can be seen that increases in maternal schooling account for about one-fifth of the estimated payoff to delaying a first birth (found in Column 1 Table 3). Generally similar results are found for the reading and behavior problems outcomes. Other mediators account for less of these associations, in part because of weak association with one or both of the mediational paths. Particularly surprising were the weak associations between the two maternal experience segments and both birth weight and scores from the assessment of the quality of the home environment.

V. Future directions

Although our analyses are preliminary at this stage, they demonstrate that maternal age at birth involves much more than just whether a first birth occurs prior to age 20. In fact, it appears that children benefit from both a delay in first birth and from maternal experience acquired between the first birth and birth of the child whose outcomes are under study.

Our sibling fixed effects approach helped us account for observable and unobservable characteristics shared between siblings of the same family that are invariant—in particular, the general experience or years between age 16 and the mother's first child that was constant between siblings. This sibling fixed approach helps us take steps towards a causal explanation of understanding the effects of an additional year of parenting experience or years between the first and a given child.

For the case of an additional year of general life experience in order to have a causal understanding, we attempted an instrumental variable approach using both age of menarche and miscarriages before the first birth as instruments for years between age 16 and first child. We found age of menarche to produce a very weak first stage, which resulted in a poor instrument for the purposes of this analysis. In regards to miscarriages, we found miscarriages to produce a strong first stage equation but the small number of miscarriages before the first birth resulted in standard errors that were too large to detect significance given the size of the coefficients in our OLS results (Tables 3-5). Additionally, we will also attempt to improve our instrumental variable approach for age of maternal general experience by using the timing of changes in abortion laws from 1970 to 1998 as instruments. We will use three types of changes: Medicaid funding restrictions, parental notification or consent laws and mandatory waiting periods (Bitler and Zavodny, 2001). The timing of those changes fit particularly well with the year of birth of the

first born children in our sample.

Figure 1

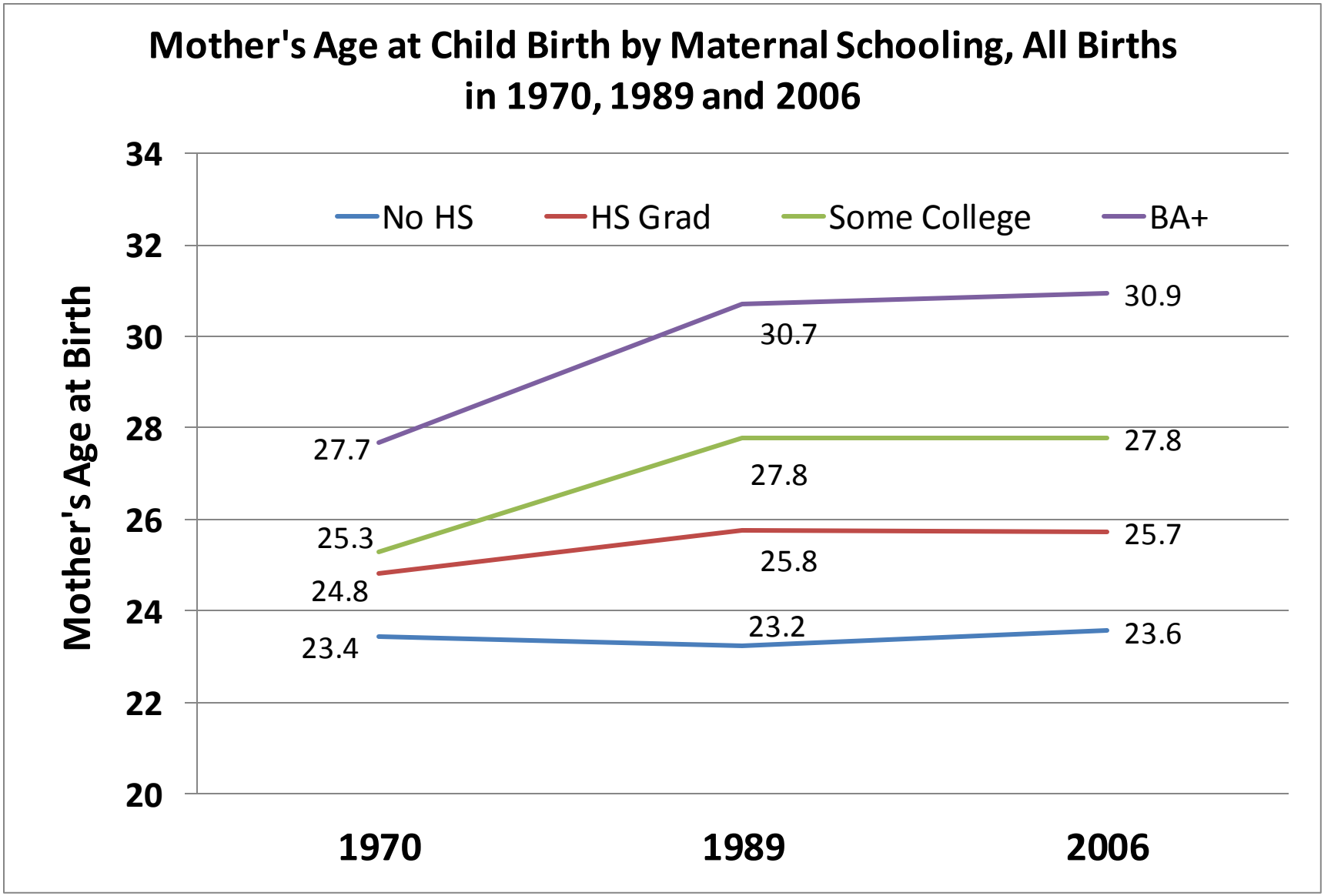
Mother's Age at Child Birth by Maternal Schooling, All Births in 1970, 1989 and 2006
Mother's Age at Birth
34
32
30
28
26
24
22
20
No HS
HS Grad
Some College
BA+
27.7
30.7
30.9
25.3
27.8
27.8
24.8
25.8
25.7
23.4
23.2
23.6
1970
1989
2006

Table 1: Summary Statistics

	Full Sample (N=7729)		Cousin Sample (N=2288)		Sibling Sample (N=6165)	
	Mean or %	Std. Dev.	Mean or %	Std. Dev.	Mean or %	Std. Dev.
Outcome Variables (Ages 10/12 or 11/13)						
Math	102.92	14.34	102.87	14.65	103.11	14.46
Reading	104.35	15.33	103.91	15.44	104.33	15.35
Externalizing Behaviors	102.48	14.00	101.61	13.09	102.20	13.95
Predictor Variables						
Years between Age 16 and first child	8.10	5.18	8.48	5.18	8.07	4.89
Years between first and given child	4.44	4.90	4.28	4.87	4.64	4.93
Number of siblings before birth	1.18	1.22	1.17	1.24	1.30	1.27
Mediators						
Mother's education at birth	12.55	2.48	12.82	2.44	12.61	2.53
Home score at age 2/3	96.61	16.65	96.83	16.84	96.53	16.94
Birth weight	117.28	21.46	117.44	21.51	117.71	21.40
Prenatal cigarette use per day	.18	.41	0.16	0.38	0.17	0.40
Prenatal alcohol use per month	.68	2.36	0.71	2.66	0.66	2.39
Fraction of years between birth and age 12 biological father in household	.70	.38	0.70	0.38	0.73	0.37
Number of siblings between birth and age 13	.70	.92	0.77	0.98	0.88	0.95
Covariates						
Black	25.14%		26.40%		24.54%	
Hispanic	19.72%		18.92%		20.79%	
Female	49.05%		49.78%		49.28%	
Mother's AFQT Score	39.09	28.23	38.99	28.75	39.57	28.57
Mother ever fight	17.66%		17.38%		17.65%	
Mother ever steal	1.98%		2.08%		1.94%	
Mother US born	92.16%		93.92%		91.71%	

Table 2: Correlations between Outcome Variables and Key Predictors

	(1)	(2)	(3)	(4)	(5)	(6)
Outcome Variables						
(Ages 10/12 or 11/13)						
Math (1)	1					
Reading (2)	.65***	1.00				
Externalizing Behaviors (3)	-.22***	-.24***	1			
Predictor Variables						
Years between age 16 and first child (4)	.35***	.30***	-.16***	1.00		
Years between first and given child (5)	-.15***	-.15***	.01	-.51***	1.00	
Number of siblings before birth (6)	-.18***	-.21***	.02	-.46***	.76***	1.00

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 3: Math in Early Adolescence Regressed on Maternal Experience (Years before first birth and Years between first and given child) and other controls

	OLS			Fixed Effects		With Mediators		
	Full Sample	Cousin Sample	Sibling Sample	Cousin FE	Sibling FE	OLS	Cousin FE	Sibling FE
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Years between age 16 and first child	.036***	.027***	.040***	.030**		.023***	.018	
	(.004)	(.007)	(.004)	(.010)		(.004)	(.011)	
Years between first and given child	.027***	.028**	.027***	.034**	.013	.019***	.023+	.008
	(.005)	(.009)	(.005)	(.012)	(.008)	(.005)	(.013)	(.009)
Number of siblings before birth	-.074***	-.064+	-.073***	-.072	.005	-.056**	-.095+	.086
	(.019)	(.033)	(.021)	(.047)	(.030)	(.019)	(.049)	(.096)
Mediators								
Mother's education at birth						.038***	.048**	.015
						(.008)	(.018)	(.018)
Home score at age 2/3						.100***	.026	.041+
						(.015)	(.030)	(.021)
Birth weight						.050***	.069*	.085***
						(.014)	(.031)	(.022)
Prenatal cigarette use per day						.012	.060	.011
						(.016)	(.045)	(.031)
Prenatal alcohol use per month						-.008	.021	-.003
						(.013)	(.021)	(.019)
Fraction of years between birth and age 12 biological father in household						.078+	.178	.011
						(.040)	(.115)	(.096)
Number of siblings between birth and age 13						-.025+	-.075*	.084
						(.015)	(.034)	(.092)
Constant	-.528***	-.394**	-.558***	-.481***	.005	-.857***	-1.000***	-.381
	(.080)	(.148)	(.090)	(.130)	(.024)	(.113)	(.255)	(.295)
R^2	.278	.284	.293	.045	.012	.298	.072	.025
Observations	5275	1623	4372	1623	4372	5275	1623	4372

Note. Standard errors in parentheses

+ $p < .10$, * $p < .05$, ** $p < .01$, *** $p < .001$

Age 10 to 13 math scores are standardized values for children with valid values in at least one year

Control variables include: black, Hispanic, female, Mother's AFQT score, mother ever fight, mother ever stole, mother US born

Table 4: Reading in Early Adolescence Regressed on Maternal Experience (Years before first birth and Years between first and given child) and other controls

	OLS			Fixed Effects		With Mediators		
	Full Sample	Cousin Sample	Sibling Sample	Cousin FE	Sibling FE	OLS	Cousin FE	Sibling FE
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Years between age 16 and first child	.026***	.022***	.028***	.022*		.015***	.014	.
	(.003)	(.007)	(.004)	(.010)		(.004)	(.011)	
Years between first and given child	.031***	.031**	.029***	.045***	.032***	.025***	.034**	.029**
	(.005)	(.009)	(.006)	(.012)	(.008)	(.005)	(.012)	(.009)
Number of siblings before birth	-.143***	-.152***	-.137***	-.173***	-.120***	-.125***	-.195***	.050
	(.019)	(.034)	(.021)	(.047)	(.029)	(.019)	(.055)	(.094)
Mediators								
Mother's education at birth						.039***	.030+	-.004
						(.008)	(.017)	(.016)
Home score at age 2/3						.115***	.060+	.062**
						(.017)	(.034)	(.021)
Birth weight						.039**	.045	.055*
						(.014)	(.029)	(.022)
Prenatal cigarette use per day						-.017	.105*	.014
						(.019)	(.041)	(.027)
Prenatal alcohol use per month						-.004	.019	.012
						(.016)	(.031)	(.024)
Fraction of years between birth and age 12 biological father in household						.060	.200+	-.006
						(.044)	(.111)	(.092)
Number of siblings between birth and age 13						-.017	-.081*	.171+
						(.015)	(.038)	(.089)
Constant	-.635***	-.511***	-.675***	-.173	-.060*	-.970***	-.495+	-.377
	(.090)	(.152)	(.103)	(.137)	(.024)	(.120)	(.265)	(.268)
R^2	.219	.217	.226	.034	.017	.240	.056	.028
Observations	5274	1623	4370	1623	4370	5274	1623	4370

Note. Standard errors in parentheses

+ $p < .10$, * $p < .05$, ** $p < .01$, *** $p < .001$

Age 10 to 13 reading scores are standardized values for children with valid values in at least one year

Control variables include: black, Hispanic, female, Mother's AFQT score, mother ever fight, mother ever stole, mother US born

Table 5: Externalizing in Early Adolescence Regressed on Maternal Experience (Years before first birth and Years between first and given child) and other controls

	OLS			Fixed Effects		With Mediators		
	Full Sample	Cousin Sample	Sibling Sample	Cousin FE	Sibling FE	OLS	Cousin FE	Sibling FE
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Years between age 16 and first child	-.038***	-.018**	-.040***	-.013		-.026***	-.013	
	(.004)	(.007)	(.005)	(.010)		(.004)	(.011)	
Years between first and given child	-.021***	-.015	-.024***	.000	-.034***	-.021***	.001	-.039***
	(.006)	(.011)	(.007)	(.011)	(.009)	(.006)	(.011)	(.009)
Number of siblings before birth	-.008	.019	.001	-.063	.022	-.035	-.102*	.084
	(.022)	(.042)	(.025)	(.039)	(.029)	(.022)	(.045)	(.093)
Mediators								
Mother's education at birth						-.042***	-.019	-.024
						(.009)	(.020)	(.017)
Home score at age 2/3						-.170***	-.099**	-.024
						(.018)	(.034)	(.022)
Birth weight						-.020	-.007	-.027
						(.015)	(.029)	(.021)
Prenatal cigarette use per day						.110***	.081+	.016
						(.021)	(.047)	(.030)
Prenatal alcohol use per month						.042**	-.003	-.052*
						(.013)	(.024)	(.022)
Fraction of years between birth and age 12 biological father in household						-.213***	-.159+	.066
						(.047)	(.096)	(.099)
Number of siblings between birth and age 13						-.027	-.041	.059
						(.017)	(.032)	(.091)
Constant	.601***	.299+	.596***	.404**	.217***	1.139***	.812**	.353
	(.096)	(.174)	(.110)	(.147)	(.023)	(.128)	(.279)	(.302)
R^2	.056	.053	.059	.036	.042	.112	.060	.049
Observations	5565	1682	4594	1682	4594	5565	1682	4594

Note. Standard errors in parentheses
+ $p < .10$, * $p < .05$, ** $p < .01$, *** $p < .001$
Age 10 to 13 externalizing scores are standardized values for children with valid values in at least one year
Control variables include: black, Hispanic, female, Mother's AFQT score, mother ever fight, mother ever stole, mother US born

Table 6: Mother's education at birth regressed on maternal experience (Years before first birth and years between first and given child) and controls

	OLS			Fixed Effects	
	Full Sample	Cousin Sample	Sibling Sample	Cousin FE	Sibling FE
	(1)	(2)	(3)	(4)	(5)
Years between age 16 and first child	.194***	.181***	.205***	.116***	
	(.008)	(.014)	(.010)	(.019)	
Years between first and given child	.048***	.036+	.058***	.040+	.044***
	(.010)	(.022)	(.012)	(.021)	(.011)
Number of siblings before birth	-.187***	-.076	-.218***	-.064	-.032
	(.039)	(.072)	(.043)	(.067)	(.031)
Covariates					
Black	1.364***	1.281***	1.299***	.298+	
	(.079)	(.153)	(.096)	(.165)	
Hispanic	.264**	.166	.227*	-2.715***	
	(.100)	(.195)	(.115)	(.411)	
Female	-.033	-.073	-.013	-.033	.001
	(.042)	(.077)	(.047)	(.061)	(.017)
AFQT Score	.046***	.048***	.046***	.029***	
	(.001)	(.003)	(.002)	(.004)	
Mom Ever Fight	-.061	.240	-.044		
	(.080)	(.165)	(.097)		
Mom Ever Steal	-.997**	-2.021*	-1.277**		
	(.321)	(.867)	(.406)		
Mother US Born	.717***	.540	.802***		
	(.193)	(.465)	(.215)		
Constant	8.361***	8.672***	8.282***	11.159***	12.462***
	(.222)	(.544)	(.253)	(.239)	(.017)
R^2	.507	.518	.518	.166	.073
Observations	6700	1963	5311	1963	5311

Note. Standard errors in parentheses
+ $p < .10$, * $p < .05$, ** $p < .01$, *** $p < .001$

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Appendix Table 1: Math in Early Adolescence Regressed on Maternal Experience (Years before first birth and Years between first and given child) and other controls

	OLS			Fixed Effects		With Mediators		
	Full Sample	Cousin Sample	Sibling Sample	Cousin FE	Sibling FE	OLS	Cousin FE	Sibling FE
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Years between age 16 and first child	.036***	.027***	.040***	.030**		.023***	.018	
	(.004)	(.007)	(.004)	(.010)		(.004)	(.011)	
Years between first and given child	.027***	.028**	.027***	.034**	.013	.019***	.023+	.008
	(.005)	(.009)	(.005)	(.012)	(.008)	(.005)	(.013)	(.009)
Number of siblings before birth	-.074***	-.064+	-.073***	-.072	.005	-.056**	-.095+	.086
	(.019)	(.033)	(.021)	(.047)	(.030)	(.019)	(.049)	(.096)
Covariates								
Black	-.263***	-.294***	-.256***			-.218***		
	(.038)	(.072)	(.043)			(.041)		
Hispanic	-.158***	-.155*	-.136**	-.222***		-.140***	.006	
	(.042)	(.079)	(.047)	(.050)		(.042)	(.086)	
Female	-.094***	-.100*	-.101***	-.144**	-.117***	-.097***	-.124**	-.105***
	(.023)	(.043)	(.026)	(.045)	(.028)	(.023)	(.045)	(.029)
AFQT Score	.012***	.013***	.013***	.008**		.010***	.007*	
	(.001)	(.001)	(.001)	(.003)		(.001)	(.003)	
Mom Ever Fight	-.050	-.004	-.079+	.038		-.039	.032	
	(.039)	(.070)	(.044)	(.108)		(.038)	(.102)	
Mom Ever Steal	-.103	-.014	-.127			-.049		
	(.095)	(.139)	(.104)			(.092)		
Mother US Born	-.090	-.225+	-.090			-.117+		
	(.067)	(.128)	(.075)			(.067)		
Mediators								
Mother's education at birth						.038***	.048**	.015
						(.008)	(.018)	(.018)
Home score at age 2/3						.100***	.026	.041+
						(.015)	(.030)	(.021)
Birth weight						.050***	.069*	.085***
						(.014)	(.031)	(.022)
Prenatal cigarette use per day						.012	.060	.011
						(.016)	(.045)	(.031)
Prenatal alcohol use per month						-.008	.021	-.003

						(.013)	(.021)	(.019)
Fraction of years between birth and age 12 biological father in household						.078^{+}	.178	.011
						(.040)	(.115)	(.096)
Number of siblings between birth and age 13						-.025^{+}	-.075*	.084
						(.015)	(.034)	(.092)
Constant	-.528***	-.394**	-.558***	-.481***	.005	-.857***	-1.000***	-.381
	(.080)	(.148)	(.090)	(.130)	(.024)	(.113)	(.255)	(.295)
R^2	.278	.284	.293	.045	.012	.298	.072	.025
Observations	5275	1623	4372	1623	4372	5275	1623	4372

Note. Standard errors in parentheses

$^{+}$ $p < .10$, * $p < .05$, ** $p < .01$, *** $p < .001$

Age 10 to 13 math scores are standardized values for children with valid values in at least one year

Appendix Table 2: Reading in Early Adolescence Regressed on Maternal Experience (Years before first birth and Years between first and given child) and other controls

	OLS			Fixed Effects		With Mediators		
	Full Sample	Cousin Sample	Sibling Sample	Cousin FE	Sibling FE	OLS	Cousin FE	Sibling FE
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Years between age 16 and first child	.026***	.022***	.028***	.022*		.015***	.014	.
	(.003)	(.007)	(.004)	(.010)		(.004)	(.011)	
Years between first and given child	.031***	.031**	.029***	.045***	.032***	.025***	.034**	.029**
	(.005)	(.009)	(.006)	(.012)	(.008)	(.005)	(.012)	(.009)
Number of siblings before birth	-.143***	-.152***	-.137***	-.173***	-.120***	-.125***	-.195***	.050
	(.019)	(.034)	(.021)	(.047)	(.029)	(.019)	(.055)	(.094)
Covariates								
Black	-.138***	-.132+	-.125**			-.106*		
	(.041)	(.080)	(.047)			(.044)		
Hispanic	.045	.109	.068	-1.044***		.054	-.882***	
	(.046)	(.086)	(.052)	(.049)		(.045)	(.094)	
Female	.142***	.130**	.127***	.069	.136***	.135***	.082+	.143***
	(.024)	(.044)	(.026)	(.048)	(.028)	(.024)	(.048)	(.028)
AFQT Score	.012***	.012***	.012***	.005*		.010***	.004	
	(.001)	(.001)	(.001)	(.002)		(.001)	(.002)	
Mom Ever Fight	.002	.008	.000	-.090		.012	-.096	
	(.043)	(.084)	(.048)	(.115)		(.042)	(.111)	
Mom Ever Steal	-.177+	-.295+	-.278**			-.117		
	(.103)	(.176)	(.107)			(.100)		
Mother US Born	-.051	-.155	-.030			-.078		
	(.072)	(.118)	(.082)			(.072)		
Mediators								
Mother's education at birth						.039***	.030+	-.004
						(.008)	(.017)	(.016)
Home score at age 2/3						.115***	.060+	.062**
						(.017)	(.034)	(.021)
Birth weight						.039**	.045	.055*
						(.014)	(.029)	(.022)
Prenatal cigarette use per day						-.017	.105*	.014
						(.019)	(.041)	(.027)
Prenatal alcohol use per month						-.004	.019	.012

						(.016)	(.031)	(.024)
Fraction of years between birth and age 12 biological father in household						.060	.200^{+}	-.006
						(.044)	(.111)	(.092)
Number of siblings between birth and age 13						-.017	-.081*	.171^{+}
						(.015)	(.038)	(.089)
Constant	-.635***	-.511***	-.675***	-.173	-.060*	-.970***	-.495^{+}	-.377
	(.090)	(.152)	(.103)	(.137)	(.024)	(.120)	(.265)	(.268)
R^2	.219	.217	.226	.034	.017	.240	.056	.028
Observations	5274	1623	4370	1623	4370	5274	1623	4370

Note. Standard errors in parentheses

$^{+}$ $p < .10$, * $p < .05$, ** $p < .01$, *** $p < .001$

All dependent variables are standardized values of age 10 to 13 scores for children with valid values in at least one year

Age 10 to 13 reading scores are standardized values for children with valid values in at least one year

Appendix Table 3: Externalizing in Early Adolescence Regressed on Maternal Experience (Years before first birth and Years between first and given child) and other controls

	OLS			Fixed Effects		With Mediators		
	Full Sample	Cousin Sample	Sibling Sample	Cousin FE	Sibling FE	OLS	Cousin FE	Sibling FE
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Years between age 16 and first child	-.038***	-.018**	-.040***	-.013		-.026***	-.013	
	(.004)	(.007)	(.005)	(.010)		(.004)	(.011)	
Years between first and given child	-.021***	-.015	-.024***	.000	-.034***	-.021***	.001	-.039***
	(.006)	(.011)	(.007)	(.011)	(.009)	(.006)	(.011)	(.009)
Number of siblings before birth	-.008	.019	.001	-.063	.022	-.035	-.102*	.084
	(.022)	(.042)	(.025)	(.039)	(.029)	(.022)	(.045)	(.093)
Covariates								
Black	-.009	-.095	-.014			-.076+		
	(.048)	(.093)	(.055)			(.046)		
Hispanic	-.060	-.036	-.054	.297		-.045	.172	
	(.049)	(.094)	(.055)	(.383)		(.046)	(.358)	
Female	-.254***	-.280***	-.263***	-.220***	-.222***	-.236***	-.211***	-.224***
	(.026)	(.046)	(.029)	(.042)	(.029)	(.026)	(.043)	(.029)
AFQT Score	-.002**	-.004**	-.002**	-.005**		.001+	-.004+	
	(.001)	(.001)	(.001)	(.002)		(.001)	(.002)	
Mom Ever Fight	.055	.074	.005	-.140		.020	-.138	
	(.047)	(.085)	(.055)	(.109)		(.045)	(.107)	
Mom Ever Steal	.076	-.096	.163			-.009		
	(.106)	(.179)	(.121)			(.108)		
Mother US Born	.024	.173	.053			.020		
	(.075)	(.137)	(.083)			(.070)		
Mediators								
Mother's education at birth						-.042***	-.019	-.024
						(.009)	(.020)	(.017)
Home score at age 2/3						-.170***	-.099**	-.024
						(.018)	(.034)	(.022)
Birth weight						-.020	-.007	-.027
						(.015)	(.029)	(.021)
Prenatal cigarette use per day						.110***	.081+	.016
						(.021)	(.047)	(.030)
Prenatal alcohol use per month						.042**	-.003	-.052*

						(.013)	(.024)	(.022)
Fraction of years between birth and age 12 biological father in household						-.213***	-.159+	.066
						(.047)	(.096)	(.099)
Number of siblings between birth and age 13						-.027	-.041	.059
						(.017)	(.032)	(.091)
Constant	.601***	.299+	.596***	.404**	.217***	1.139***	.812**	.353
	(.096)	(.174)	(.110)	(.147)	(.023)	(.128)	(.279)	(.302)
R^2	.056	.053	.059	.036	.042	.112	.060	.049
Observations	5565	1682	4594	1682	4594	5565	1682	4594
	5274	1623	4370	1623	4370	5274	1623	4370

Note. Standard errors in parentheses

+ $p < .10$, * $p < .05$, ** $p < .01$, *** $p < .001$

All dependent variables are standardized values of age 10 to 13 scores for children with valid values in at least one year

Age 10 to 13 externalizing scores are standardized values for children with valid values in at least one year

Appendix Table 4: Fraction of years between birth and age 12 biological father in household regressed on maternal experience (Years before first birth and years between first and given child) and controls

	OLS			Fixed Effects	
	Full Sample	Cousin Sample	Sibling Sample	Cousin FE	Sibling FE
	(1)	(2)	(3)	(4)	(5)
Years between age 16 and first child	.011***	.011***	.012***	.005	
	(.002)	(.003)	(.002)	(.004)	
Years between first and given child	.001	.006	.001	.021***	.015***
	(.002)	(.004)	(.003)	(.005)	(.003)
Number of siblings before birth	.016+	-.003	.006	-.052***	-.035***
	(.009)	(.015)	(.009)	(.015)	(.009)
Mediator					
Mother's Education at birth	.015***	.018*	.013***	.014+	.008
	(.003)	(.007)	(.004)	(.008)	(.011)
Covariates					
Black	-.295***	-.296***	-.284***	-.349***	
	(.019)	(.036)	(.022)	(.038)	
Hispanic	-.047*	-.083*	-.039+	.045	
	(.019)	(.042)	(.021)	(.092)	
Female	-.010	-.015	-.010	-.008	-.006
	(.009)	(.016)	(.010)	(.014)	(.007)
AFQT Score	.001***	.002**	.002***	.001	
	(.000)	(.001)	(.000)	(.001)	
Mom Ever Fight	-.031+	-.026	-.009		
	(.018)	(.033)	(.021)		
Mom Ever Steal	-.055	.074	-.070		
	(.055)	(.101)	(.065)		
Mother US Born	-.100***	-.117*	-.106***		
	(.027)	(.059)	(.029)		
Constant	.538***	.508***	.572***	.492***	.608***
	(.043)	(.099)	(.048)	(.106)	(.144)
R^2	.239	.262	.259	.044	.028
Observations	5586	1670	4526	1670	4526

Note. Standard errors in parentheses
+ $p < .10$, * $p < .05$, ** $p < .01$, *** $p < .001$
Dependent variable is standardized

Appendix Table 5: Number of siblings between birth and age 13 regressed on maternal experience (Years before first birth and years between first and given child) and controls

	OLS			Fixed Effects	
	Full Sample	Cousin Sample	Sibling Sample	Cousin FE	Sibling FE
	(1)	(2)	(3)	(4)	(5)
Years between age 16 and first child	-.046***	-.047***	-.059***	-.070***	
	(.003)	(.007)	(.004)	(.010)	
Years between first and given child	-.071***	-.079***	-.074***	-.052**	.032***
	(.006)	(.011)	(.008)	(.016)	(.004)
Number of siblings before birth	-.003	.046	-.096*	-.380***	-1.038***
	(.032)	(.065)	(.039)	(.067)	(.018)
Mediator					
Mother's Education at birth	.001	-.009	-.016	-.024	.002
	(.008)	(.017)	(.010)	(.021)	(.011)
Covariates					
Black	.180***	.108	.232***	-.006	
	(.052)	(.123)	(.064)	(.113)	
Hispanic	.199***	.151	.170**	.562	
	(.048)	(.110)	(.057)	(.414)	
Female	-.014	-.028	-.022	.003	-.005
	(.022)	(.047)	(.024)	(.043)	(.007)
AFQT Score	.002*	.003	.002*	.002	
	(.001)	(.002)	(.001)	(.003)	
Mom Ever Fight	.066	.046	.081		
	(.056)	(.124)	(.068)		
Mom Ever Steal	-.048	.173	-.040		
	(.103)	(.233)	(.118)		
Mother US Born	-.105+	.020	-.094		
	(.063)	(.112)	(.073)		
Constant	1.313***	1.340***	1.914***	2.118***	2.076***
	(.099)	(.189)	(.112)	(.283)	(.129)
R^2	.093	.080	.160	.333	.963
Observations	6700	1963	5311	1963	5311

Note. Standard errors in parentheses
+ $p < .10$, * $p < .05$, ** $p < .01$, *** $p < .001$
Dependent variable is standardized

Appendix Table 6: Birth Weight regressed on maternal experience (Years before first birth and years between first and given child) and controls

	OLS			Fixed Effects	
	Full Sample	Cousin Sample	Sibling Sample	Cousin FE	Sibling FE
	(1)	(2)	(3)	(4)	(5)
Years between age 16 and first child	-.010*	-.010	-.008	-.025*	
	(.004)	(.008)	(.005)	(.010)	
Years between first and given child	-.010	-.001	-.009	-.015	-.007
	(.006)	(.014)	(.007)	(.015)	(.009)
Number of siblings before birth	.070**	.052	.064*	.082	.093**
	(.023)	(.051)	(.026)	(.056)	(.034)
Mediator					
Mother's Education at birth	.023**	.015	.021*	.025	.011
	(.008)	(.016)	(.009)	(.021)	(.030)
Covariates					
Black	-.312***	-.298***	-.330***	-1.102***	
	(.045)	(.090)	(.053)	(.100)	
Hispanic	-.012	-.080	.003	-.071	
	(.043)	(.077)	(.049)	(.294)	
Female	-.187***	-.170***	-.180***	-.208***	-.183***
	(.025)	(.046)	(.029)	(.050)	(.030)
AFQT Score	.002**	.003*	.003**	-.002	
	(.001)	(.002)	(.001)	(.002)	
Mom Ever Fight	-.058	-.085	-.083		
	(.043)	(.077)	(.052)		
Mom Ever Steal	-.018	.414*	.040		
	(.124)	(.195)	(.150)		
Mother US Born	-.153**	-.027	-.165**		
	(.057)	(.113)	(.063)		
Constant	.035	.018	.060	.394	-.060
	(.103)	(.200)	(.116)	(.286)	(.378)
R^2	.047	.054	.051	.028	.024
Observations	5959	1759	4659	1759	4659

Note. Standard errors in parentheses
$^{+}$ $p < .10$, * $p < .05$, ** $p < .01$, *** $p < .001$
Standardized birth weight after truncating to the .5 and 99.5 percentiles

Appendix Table 7: Prenatal cigarette use regressed on maternal experience (Years before first birth and years between first and given child) and controls

	OLS			Fixed Effects	
	Full Sample	Cousin Sample	Sibling Sample	Cousin FE	Sibling FE
	(1)	(2)	(3)	(4)	(5)
Years between age 16 and first child	-.009*	.000	-.012**	-.005	
	(.003)	(.007)	(.004)	(.010)	
Years between first and given child	.023***	.013	.026**	-.009	-.007
	(.007)	(.010)	(.008)	(.012)	(.007)
Number of siblings before birth	-.037+	.025	-.044+	.051	.009
	(.020)	(.039)	(.024)	(.048)	(.026)
Mediator					
Mother's Education at birth	-.078***	-.088***	-.071***	-.059***	.006
	(.009)	(.019)	(.010)	(.017)	(.016)
Covariates					
Black	-.298***	-.237**	-.273***	.012	
	(.047)	(.086)	(.056)	(.082)	
Hispanic	-.495***	-.495***	-.489***	.381+	
	(.046)	(.082)	(.055)	(.202)	
Female	-.048*	-.049	-.012	-.060	-.024
	(.023)	(.040)	(.025)	(.044)	(.021)
AFQT Score	-.002*	-.004**	-.002*	-.002	
	(.001)	(.001)	(.001)	(.002)	
Mom Ever Fight	.114*	.124	.076		
	(.047)	(.077)	(.054)		
Mom Ever Steal	.127	-.106	.132		
	(.107)	(.162)	(.138)		
Mother US Born	.158+	.208*	.129		
	(.081)	(.097)	(.097)		
Constant	1.040***	1.046***	.971***	.697**	-.117
	(.117)	(.251)	(.138)	(.215)	(.193)
R^2	.105	.148	.106	.026	.001
Observations	6055	1784	4745	1784	4745

Note. Standard errors in parentheses
+ $p < .10$, * $p < .05$, ** $p < .01$, *** $p < .001$
Dependent variable is standardized

Appendix Table 8: Prenatal alcohol use regressed on maternal experience (Years before first birth and years between first and given child) and controls

	OLS			Fixed Effects	
	Full Sample	Cousin Sample	Sibling Sample	Cousin FE	Sibling FE
	(1)	(2)	(3)	(4)	(5)
Years between age 16 and first child	.002	.021^{+}	.004	.015	
	(.004)	(.011)	(.006)	(.009)	
Years between first and given child	.016*	.013	.018*	.002	-.020^{+}
	(.007)	(.019)	(.009)	(.024)	(.012)
Number of siblings before birth	-.039	.021	-.040	.027	.043
	(.031)	(.084)	(.038)	(.104)	(.050)
Mediator					
Mother's Education at birth	-.026***	-.041*	-.026**	-.025	.021
	(.007)	(.018)	(.008)	(.028)	(.027)
Covariates					
Black	.115*	.113	.128*	6.065***	
	(.045)	(.097)	(.054)	(.089)	
Hispanic	-.058^{+}	-.068	-.064^{+}	-.414**	
	(.032)	(.070)	(.037)	(.131)	
Female	-.036	-.008	-.027	-.060	-.080*
	(.024)	(.056)	(.028)	(.061)	(.035)
AFQT Score	.002***	.002	.002**	.001	
	(.001)	(.001)	(.001)	(.001)	
Mom Ever Fight	-.016	-.002	-.037		
	(.038)	(.085)	(.045)		
Mom Ever Steal	.099	-.119	.162		
	(.103)	(.134)	(.132)		
Mother US Born	.103**	.151*	.130***		
	(.038)	(.068)	(.038)		
Constant	.097	.090	.027	-1.322***	-.213
	(.086)	(.186)	(.098)	(.367)	(.326)
R^2	.011	.011	.013	.030	.004
Observations	6068	1787	4755	1787	4755

Note. Standard errors in parentheses
$^{+}$ $p < .10$, * $p < .05$, ** $p < .01$, *** $p < .001$
Dependent variable is standardized

Appendix Table 9: HOME score at age 2/3 regressed on maternal experience (Years before first birth and years between first and given child) and controls

	OLS			Fixed Effects	
	Full Sample	Cousin Sample	Sibling Sample	Cousin FE	Sibling FE
	(1)	(2)	(3)	(4)	(5)
Years between age 16 and first child	.006	-.001	.005	-.012	
	(.004)	(.007)	(.005)	(.009)	
Years between first and given child	.007	.011	.010	.015	.012
	(.006)	(.012)	(.007)	(.015)	(.011)
Number of siblings before birth	-.160***	-.167***	-.163***	-.171**	-.129***
	(.024)	(.047)	(.027)	(.060)	(.036)
Mediator					
Mother's Education at birth	.045***	.058***	.048***	.044*	.008
	(.008)	(.016)	(.009)	(.019)	(.032)
Covariates					
Black	-.595***	-.602***	-.609***	.685***	
	(.044)	(.082)	(.051)	(.086)	
Hispanic	-.164***	-.242**	-.159**	-.310	
	(.046)	(.093)	(.053)	(.268)	
Female	.100***	.120**	.084**	.086+	.109***
	(.023)	(.040)	(.026)	(.046)	(.031)
AFQT Score	.005***	.006***	.005***	.005*	
	(.001)	(.001)	(.001)	(.002)	
Mom Ever Fight	-.035	.021	-.017		
	(.043)	(.079)	(.051)		
Mom Ever Steal	.056	.271	.039		
	(.120)	(.190)	(.141)		
Mother US Born	-.007	-.182	-.014		
	(.066)	(.119)	(.074)		
Constant	-.491***	-.505*	-.526***	-.697**	-.060
	(.105)	(.200)	(.120)	(.247)	(.400)
R^2	.234	.257	.239	.042	.022
Observations	5337	1585	4338	1585	4338

Note. Standard errors in parentheses
+ $p < .10$, * $p < .05$, ** $p < .01$, *** $p < .001$
Standardized HOME Score