MATERNAL EDUCATION, HOME ENVIRONMENTS AND THE DEVELOPMENT OF CHILDREN AND ADOLESCENTS

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Abstract

We study the intergenerational effects of maternal education on children's cognitive achievement, behavioral problems, grade repetition and obesity. We address endogeneity of maternal schooling by instrumenting with variation in schooling costs when the mother grew up. Using matched data from the female participants of the National Longitudinal Survey of Youth 1979 (NLSY79) and their children, we can control for mother's ability and family background factors. Our results show substantial intergenerational returns to education. For children aged 7-8, for example, our IV results indicate that an additional year of mother's schooling increases the child's performance on a standardized math test by almost 0.1 of a standard deviation, and reduces the incidence of behavioral problems. Our data set allows us to study a large array of channels which may transmit the effect of maternal education to the child, including family environment and parental investments at different ages of the child. We find that income effects, delayed childbearing, and assortative mating are likely to be important, and we show that maternal education leads to substantial differences in maternal labor supply. We investigate heterogeneity in returns, and we present results focusing both on very early stages in the child's life as well as adolescent outcomes. We present a falsification exercise to support the validity of our instruments, and our results are found to be robust in a sensitivity analysis. We discuss policy implications and relate our findings to intergenerational mobility.

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1 Introduction

"... the forces that are driving the transition are leading to two different trajectories for women - with different implications for children. One trajectory - the one associated with delays in childbearing and increases in maternal employment - reflect gains in resources, while the other - the one associated with divorce and nonmarital childbearing - reflects losses. Moreover, the women with the most opportunities and resources are following the first trajectory, whereas the women with the fewest opportunities and resources are following the second." (McLanahan, 2004)

The above quote is from Sara McLanahan's presidential address to the Population Association of America, in which she documents a striking increase in inequality in children's home environments (over the last 50 years) across families where mothers have different levels of education.[1] The trends documented in these and other papers, starting with Coleman et al. (1966), are cause for great concern because the home environment is probably the best candidate for explaining inequality in child development.[2]

To address this problem, McLanahan (2004) ends her paper by proposing a set of changes to the welfare system. The effectiveness of such proposals is still to be assessed. However, given that home environments are rooted in the experiences of each family, they are probably difficult to change if we rely only the welfare system, while more direct interventions require invading family autonomy and privacy and are notoriously difficult to enforce. Therefore, one possible alternative is to target future parents in their youth, by affecting their education, before they start forming a family. In this paper we assess the potential for such a policy, by estimating the impact of maternal

[1]She examines six dimensions of home environments: age of mothers of young children (below 5), maternal employment, single motherhood, divorce during the first 10 years of marriage, father's involvement, and family income. In this paper we consider a more detailed set of measures.

[2]For example, Jencks and Phillips (1998), Cameron and Heckman (2001), Fryer and Levitt (2004, 2006, 2007), Carneiro, Heckman, and Masterov (2005), Todd and Wolpin (2006) and many others show how differences in family environments account for a large proportion of the black-white test score gap.

education on home environments and on child outomes.

Our analysis is based on the Children of the National Longitudinal Survey of Youth 1979, a dataset with very detailed information on maternal characteristics, home environments, and child outcomes. Since the data covers mothers and children over several years it allows a unified treatment of different aspects of child development across ages, including cognitive, noncognitive, and health outcomes.[3] Furthermore, using this single dataset it is possible to estimate the impact of maternal education not only on parental characteristics like employment, income, marital status, spouse's education, age at first birth, but also on several aspects of parenting practices. Our paper provides a detailed analysis of the possible mechanisms mediating the relationship between parental education and child outcomes. The novelty of our work is precisely in the systematic treatment of a very large range of inputs and outputs to the child development process, at different ages of the child, in a unified framework and dataset. We also compare the relative roles of maternal education and ability,[4] and we show how the role of maternal education varies with the gender and race of the child, and with the cognitive ability of the mother.

We show that maternal education has positive impacts both on cognitive skills and behavioral problems of children, but the latter are more sustained than the former. This is perhaps because behavior is more malleable than cognition (e.g., Carneiro and Heckman (2003)). Especially among whites, there is considerable heterogeneity in these impacts, which are larger for girls, and for mothers with higher cognition.

More educated mothers are more likely to work and work for longer hours, especially among blacks. This is true independently of the child being in its infancy, childhood,

[3]The dynamic aspect of cognitive and noncognitive skill formation is emphasized in the recent literature on child development, such as Carneiro and Heckman (2003), Cunha, Heckman, Lochner, and Masterov (2005), Cunha and Heckman (2007), and Todd and Wolpin (2003).

[4]Maternal cognitive ability is a central determinant of child's cognitive achievement. According to Todd and Wolpin (2006), racial differences in mother's cognition account for half of the minority-white test score gap among children.

and adolescence. Nevertheless, there is no evidence that more educated mothers do less breastfeeding, spend much less time reading to their children, or even taking them on outings. This is important because some studies suggest that maternal employment may be detrimental for child outcomes if it leads to reduced (quality) time with children.

Due to the nature of the data, this paper focuses on the effect of maternal, but not paternal, schooling. Due to assortative mating, part of the effects we find may be driven by the father's schooling through a mating effect. However, unless the effect of partner's schooling is incredibly large, assortative mating cannot fully explain our main results, as suggested in some of the literature.

The key empirical problem we face is controlling for the endogeneity of mother's schooling: factors that influence the mother's decision to obtain schooling may also affect her ability to bring up children or may relate to other environmental and genetic factors relevant to child outcomes. To deal with this issue we exploit differential changes in the direct and opportunity costs of schooling across counties and cohorts of mothers, while controlling both for permanent differences and aggregate trends as well as numerous observed characteristics such as mother's ability. The variables we use to measure the costs of education include local labor market conditions, the presence of a four year college, and college tuition at age 17, in the county where the mother resided when she was 14 years of age. These variables have previously been used as instruments for schooling by Card (1993), Kane and Rouse (1993), Currie and Moretti (2003), Cameron and Taber (2004), and Carneiro, Heckman, and Vytlacil (2006), among others. We also control for county fixed effects, to allow for permanent differences in area characteristics and in the quality of offered education, as well as for mother's cohort effects, to allow for common trends, thus leaving only the differential changes in local costs of education between counties and cohorts to drive the results. To provide evidence in favor of our exclusion restrictions we show that our instruments cannot predict early measures of mother's personality and health limitations.

Recently, several papers have appeared on this topic dealing with the endogeneity issue in different ways. Behrman and Rosenzweig (2002) compare the schooling attainment of children of twin mothers and twin fathers (with different levels of schooling). They find that the effect of father's education is strong and large in magnitude, but the effect of maternal education on child schooling is insignificant (see also Antonovics and Goldberger (2005); Behrman and Rosenzweig (2005)).

Black, Devereux, and Salvanes (2005), Oreopoulos, Page, and Stevens (2003), Chevalier (2004), Chevalier, Harmon, O'Sullivan, and Walker (2005), Maurin and McNally (2005), and Galindo-Rueda (2003) use an instrumental variables strategies to estimate the effect of parental education on child outcomes, exploring changes in compulsory schooling or in examination standards. Each paper focuses on different outcomes, but child's education is common across papers.

Currie and Moretti (2003) find that maternal education has significant effects on birthweight and gestational age. Maternal education also affects potential channels by which birth outcomes are improved such as maternal smoking, the use of prenatal care, marital status, and spouse's education.

Related studies by Plug (2004), Sacerdote (2002) and Bjoerklund, Lindahl, and Plug (2006), which are based on adoptions data, compare the correlation between parental schooling and the outcomes of biological children, with the correlation between foster parents' schooling and adopted children's schooling. Adoption studies inform the debate by separating the effect of environmental and genetic factors (although their standard design can be problematic if there are substantial interactions between genes and environments), but they do not tell us directly about the causal effect of parental schooling on child outcomes. These studies cannot distinguish between the role of parental schooling and ability in the provision of better environments. Plug (2004) finds weak effects of adoptive mother's schooling on child's schooling but large effects of father's schooling, and Bjoerklund, Lindahl, and Plug (2006) find strong effects of both adoptive father and mother's schooling. Sacerdote (2002) argues that a college educated adoptive mother is associated with a 7% increase in the probability that the adopted child graduates from college. The general sense we get from the whole literature is that the results are quite disparate and a consensus has not formed yet (see Holmlund, Lindahl, and Plug (2006)).[5]

The plan of the paper is as follows. In the next section we describe the data, followed by an explanation of our empirical strategy. Then we discuss our results on the impact of mother's schooling on child outcomes, followed by results on the possible mechanisms through which schooling may operate. Finally, we present a sensitivity analysis and a concluding section.

2 Data

We use data from the National Longitudinal Survey of Youth (NLSY79). This is a panel which follows 12,686 young men and women, aged between 15 and 22 years old in the first survey year of 1979. Surveys are conducted annually from 1979 until 1994, and every two years from 1994 onwards. We use data up to 2002.

Apart from the main cross-sectional sample representative of the population, the NLSY79 contains an over-sample representative of blacks and hispanics, an over-sample of economically disadvantaged whites, and a sample of members of the military. In our analysis we exclude the over-sample of economically disadvantaged whites and the sample of the military. Attrition rates are very low (see CHRR (2002)). As we describe below, for our purpose only the females of the NLSY79 are of interest.

We measure mother's schooling as completed years of schooling. Since we observe mothers over a number of years, we have multiple observations of years of schooling.

[5]Holmlund, Lindahl, and Plug (2006) replicate the differing findings based on twin studies, adoptions, and instrumental variables within one Swedish data set, suggesting that the differences cannot be fully explained by country specifics or sample characteristics.

We are interested in the mother's schooling at the time when the outcome is measured.[6]

The data contains detailed information on family background of the mother, namely her parents' schooling, and whether she was raised by both her biological parents. Furthermore, we know the mother's score in the Armed Forces Qualification Test (AFQT), administered in 1980, which we use as a measure of mother's cognitive ability. The original AFQT score may be influenced by the amount of schooling taking up to the test date, but it is possible to estimate the effect of schooling on the test score (see Hansen, Heckman, and Mullen (2004)), and then construct a separate measure of ability (we apply the same procedure as in Carneiro, Heckman, and Vytlacil (2005)). Throughout the paper, we refer to the AFQT score as this schooling-corrected ability measure, normalized to have mean zero and standard deviation one.

In 1986, when the females of the NLSY79 are between 22 and 29 years old, another data set, the Children of the NLSY79, is initiated. It follows the children of the female members of the NLSY79 over time and surveys each child throughout childhood and adolescence. Questionnaires are tailored to the age of the child, and information is collected from both the mother and the child. We match the information on each child of the NLSY79 to the data of the mother. Even though the NLSY79 surveys a random sample of potential mothers, the design of the children's sample leads to an initial oversample of children of younger mothers, until all women are old enough and have completed their child-bearing period. In 2000, the women of the NLSY79 have completed an average of 90% of their expected childbearing (CHRR, 2002).

Table 1 presents an overview of the different outcomes for reference. In order to measure the child's cognitive ability we use the Peabody Individual Achievement Tests (PIAT) in math and reading, which are widely used in the literature. Behavior

[6]Occasionally, sample members do not answer this question in the year of interest. In order to to include these observations, we take as the measure of schooling the maximum number of completed years reported up to the year of interest.

problems are measured using the Behavior Problems Index (BPI).[7] We also construct grade repetition[8] and child obesity indicators.

We also examine potential transmission channels. We look at: mother's age at birth, an indicator variable for whether the mother is married, years of schooling of the mother's spouse, log of total family income (for couples, it includes both husband's and wife's incomes), number of hours the mother worked in a year, maternal aspirations of the child's educational achievement, and number of children. We take the child's age as the relevant reference point for observing the measures of interest.

One unusual feature of the dataset we use is that it contains direct measures of parenting behaviors, which can also be studied as mediating channels. In particular, we look at whether: the child is taken to the museum; there is a musical instrument at home; the child gets special lessons; the mother reads to the child; newspaper and computer are available; there is adult supervision after school, and joint meals with both parents (Table 1).

Finally, we look at children's outcomes very early in life and in adolescent years. Early measures include an indicator function for low birthweight, and the standardized score on the Motor and Social Development scale (MSD), an assessment of early motor, social and cognitive developments. We focus on ages 0 to 2. As early investments, we study smoking during pregnancy, weeks breastfeeding, use of formal child care and hours worked, and indicators for whether the mother reads to the child, how many books and soft toys the child has, and an indicator for whether the child gets out of the house regularly. Adolescent outcomes are measured at ages 18-19 and include school enrollment, criminal convictions and number of own children.

[7]Based on data from the UK National Child Development Survey, Currie and Thomas (2001) and Carneiro, Crawford, and Goodman (2007) show that early test scores and early measures of behavioral problems are strongly associated with adolescent and adult labor market outcomes, health, and engagement in risky behaviors.

[8]In the NLSY79, mothers are asked whether their child ever repeated a grade in school and which grade the child repeated. We set observations to missing if the mother's set of answers to grade repetition is not consistent.

Table 1: Outcome variables

Name	Definition
	Child outcomes (ages 7-8 and 12-14)
PIAT math	Peabody Individual Achievement Test Mathematics. Age-specific score with population mean 0 and variance 1.
PIAT read.	Peabody Individual Achievement Test Reading Comprehension. Age-specific score with population mean 0 and variance 1.
BPI	Behavior Problem Index. Gender-age specific score with population mean 0 and variance 1.
Grade repetition	Indicator for whether child has ever repeated a grade
Overweight	Indicator for whether child is overweight: Takes value 1 if child's Body Mass Index (BMI) is larger than the 95th percentile of age-gender specific distribution.
	Family environment (ages 7-8)
Maternal age⋆	Age of the mother at birth of the child (in years)
Number of children⋆	Total number of children ever reported by the mother.
Marital status	Indicator for whether the mother is married
Spouse's schooling	Years of schooling of mother's spouse.
Hours worked	Number of hours mother worked in past year
Log family income	Log of total annual family income
Maternal aspirations	Indicator for whether mother believes that child will go to college
	Parental investment measures (ages 7-8 and 12-14)
Museum	Indicator for whether child is taken to museum several times or more in last year
Musical instrument	Indicator for whether there is a musical instrument child can use at home
Special lessons	Indicator for whether child gets special lessons
Mother reads	Indicator for whether mother reads to child at least three times a week
Newspaper	Indicator for whether family gets a daily newspaper
Computer	Indicator for whether child has a computer in his/her home
Adult home	Indicator: takes the value 1 if adult is present when child comes home after school, and 0 if no adult is present or if child goes somewhere else.
Joint meals	Indicator for whether child eats with both parents at least once per day.
	Early child outcomes (ages 0-1)
Low birthweight	Indicator for whether child's birthweight is 5.5 lbs or less
Motor skills	Motor and social development scale (MSD), gender-age specific score standardized to mean 0 and variance 1.
	Early investments (ages 0-1)
Smoking during pregnancy⋆	Indicator for whether mother smoked in the year prior the child's birth
Weeks breastfeeding⋆	Number of weeks mother was breastfeeding
Formal child care	Indicator for whether formal childcare arrangements were in place for at least six months over past year
Hours worked	Number of hours mother worked in past year
Mother reads	Indicator for whether mother reads at least three times a week to the child
Books	Number of books child has
Soft toys	Number of cuddly, soft or role-playing toys child has
Outings	Indicator for whether the child gets out of the house at least four times a week
	Adolescent outcomes (ages 18-19)
Enrollment	Indicator for enrollment status of the young adult
Conviction	Indicator for whether the young adult has been convicted up to the age of interest
Number of own children	Total number of own children born to the young adult up to the age of interest
	Falsification exercise (ages 7-8)
Mother's sociability⋆	Indicator for maternal sociability at age 6.
Mother's early health problems⋆	Indicator for whether the mother had health limitations before age 5

Note: Age ranges (in italics) refer to the child and define at which child age this outcome is included in the outcome regression. Not all variables vary across time, but we follow the same sample selection principle for consistency. Variables which do not vary across time are indicated by a star (⋆).

In the next section we discuss in detail our instrumental variable strategy, its justification and validity. Before we do so, we explain how the instruments are constructed. The instruments for mother's schooling are average tuition in public four-year colleges (in prices of 1993), distance to four-year colleges (an indicator whether there is a college in the county of residence), local log wage and local unemployment rate. When assigning the instruments to mothers, our general approach is the following: we assign values that correspond to the year when the mother was 17, in order to be relevant for educational choices towards the end of highschool; in order to avoid any potentially endogenous re-location around that period, we use maternal location at age 14. The local wage variable is local log wages in the county of residence where the mother resided at 14, but measured in the year when the mother is aged 17 (based on county data from the Bureau of Economic Analysis, Regional Economic Accounts, and adjusted to 2000 prices using the CPI). The state unemployment rate data comes from the BLS.[9] The unemployment variable is again assigned to state of residence at 14, and measured at age 17. The distance variable, which is from Kling (2001), is an indicator variable whether in 1977 there is a four-year college in the county of residence. Annual records on tuition, enrollment, and location of all public two- and four year colleges in the United States were constructed from the Department of Education's annual Higher Education General Information Survey and Integrated Postsecondary Education Data System 'Institutional Characteristics' surveys. By matching location with county of residence, we determined the presence of two-year and four-year colleges. Tuition measures are enrollment weighted averages of all public four-year colleges in a person's county of residence, or at the state level if there is no college in the county.

The data set, limited to the subsamples of interest for which all maternal variables

[9]State unemployment data is available for all states from 1976 on, and it is available for 29 states for 1973, 1974 and 1975, and therefore for some of the individuals we have to use the unemployment rate in the state of residence in 1976 (which will correspond to age 19 for those born in 1957 and age 18 for those born in 1958).

are observed, contains information on a total of 4,379 white children from 1,948 white mothers, and 3,051 children from 1,211 black mothers. For some children, we observe the outcome more than once during the age range of interest. To increase precision of our estimates, we pool all available observations within the age range of interest. We cluster all standard errors by cohort and county of mother's residence at age 14, thus allowing for arbitrary dependence between repeat observations from a particular child, and between outcomes of several children from one mother, and more generally for arbitrary dependence within county-cohort cells.

To give a sense of what our sample looks like, the following Table 2 shows summary statistics for the covariates based on the sample used for the PIAT math regression. There are some strong differences between the black and the white sample. Average years of schooling are 0.6 years higher for whites. Also, note the strong difference in the corrected AFQT score: since this variable is normed to have a standard deviation of 1 in the population, the means of these two groups are more than 0.8 of a standard deviation apart. The 'broken home' status is an indicator for whether the mother grew up with both biological parents status; it is more than twice as prevalent in the black sample compared to the white.

3 Empirical Strategy

We assume that child outcomes (y_i) are determined by mother's years of schooling (S_i) as well as a set of observable (X_i) and unobservable factors. Schooling is determined by the same factors as child outcomes, and by a set of instruments (Z_i) that reflect the measured direct and indirect costs of schooling. In interpreting the results we assume that the effects of schooling on outcomes depends on unobservables and that the IV estimates will represent Local Average Treatment Effects (LATE).[10]

We also allow the coefficient on maternal schooling to depend on observable charac-

[10]see Imbens and Angrist (1994).

Table 2: Descriptive sample statistics

	Whites (1)	Blacks (2)
Mother's yrs. of schooling	13.236	12.670
	[2.185]	[1.919]
Mother's AFQT (corrected)	0.367	-0.458
	[0.882]	[0.774]
Grandmother's yrs. of schooling	11.719	10.541
	[2.278]	[2.677]
Grandfather's yrs. of schooling	11.813	9.798
	[3.114]	[3.612]
'Broken home' status	0.207	0.437
	[0.406]	[0.496]
Child age (months)	95.166	95.821
	[6.979]	[6.937]
Child female	0.495	0.498
	[0.500]	[0.500]
College availability	0.519	0.598
	[0.500]	[0.491]
Local tuition	2.133	1.964
	[0.851]	[0.830]
Local unemployment	7.161	6.928
	[1.752]	[1.521]
Local wages	10.270	10.245
	[0.186]	[0.213]
Observations	2492	1271

Note: The table reports sample means and (in brackets) standard deviations for covariates and instruments, based on the sample of our PIAT math outcome regression for children aged 7 to 8 (see Tables 5 and 7).

teristics. We define four groups depending on the sex of the child and on whether the mother is characterized by high or low ability based on her AFQT score. These four group indicators will be denoted by D_{ij}, and take the value 1 if observation i belongs to group j ($j = 1...4$). A_i denotes child age. Thus our estimating equation is

$$\begin{aligned} y_i \;&=\; \sum_j \beta_j D_{ij}\, S_i \;+\; \sum_j \gamma_{1j} D_{ij}\, X_{mi} \;+\; \sum_j \gamma_{2j} D_{ij} \;+\; \sum_j \gamma_{3j} D_{ij}\, A_i \\ &\quad+\; \gamma_4\,(\text{county FE}) \;+\; \gamma_5\,(\text{cohort FE}) \;+\; u_i \end{aligned} \tag{1}$$

where X_{mi} (indexed by m for maternal characteristics) include corrected AFQT score, grandmother's schooling, grandfather's schooling, and an indicator for mother's broken home status. The corresponding first stage regressions ($k = 1...4$) are:

$$\begin{aligned} S_i D_{ik} \;=\; & \sum_j \delta_{1j} D_{ij}\, Z_i \;+\; \sum_j \delta_{2j} D_{ij}\, (X_{mi} * Z_i) \;+\; \sum_j \delta_{3j} D_{ij} ((\text{cohort FE}) * Z_i) \\ & + \sum_j \delta_{4j} D_{ij}\, X_{mi} \;+\; \sum_j \delta_{5j} D_{ij} \;+\; \sum_j \gamma_{6j} D_{ij}\, A_i \\ & + \delta_7\, (\text{county FE}) \;+\; \delta_8\, (\text{cohort FE}) \;+\; \epsilon_i \end{aligned} \tag{2}$$

where the asterisk ($*$) denotes the Kronecker product. Note that in the first term we leave out the variable 'distance to college', because in our data set this variable does not vary over time. To estimate average effects across groups, we apply the Minimum Distance procedure (Rothenberg, 1971; Chamberlain, 1984) using as weights the covariance matrix of the unrestricted coefficients.

One part of the direct cost of schooling is the amount of tuition fees a student faces and how far she has to travel to attend college. These variables have frequently been used as instruments (e.g. Kane and Rouse (1993), Card (1993), Currie and Moretti (2003), Cameron and Taber (2004), Carneiro, Heckman, and Vytlacil (2006)). Another major cost of acquiring higher education is foregone earnings. We proxy these variables by using the local unemployment rate, reflecting the speed with which someone can find work, and the local wages, as a direct measure of foregone earnings and as a determinant of expectations about future conditions. Both these variable also capture temporary shocks to family income. Therefore, it is not possible to determine a priori whether these variables have a positive or negative effect on maternal schooling, and the effect may well vary across individuals.[11] A key element of our approach is that we include both cohort and county fixed effects, thus relying on the way the instruments change across counties and cohorts to identify our effects.

As is well known, the instruments must be correlated with mother's schooling, but must not have an independent effect on the outcome equation except through mother's schooling. We discuss these conditions in turn.

[11] See Cameron and Taber (2004) and Arkes (2005).

Underlying the use of geographical variation in schooling costs is the presumption that *local* variables matter for the schooling choice of the individual. In principle, individuals might move to a different location for their studies, e.g. in order to avoid high tuition costs. Still, it seems reasonable to believe that local variation matters: Moving is costly for a variety of reasons: the student is prevented from the option of living at home. Furthermore, movers may be disadvantaged in the form of higher out-of-state tuition. Currie and Moretti (2002) report evidence that the majority of students do not move to a different state to go to college (see also Hoxby (1997)).

Table 3 shows the effect of schooling cost variables on maternal schooling, where for consistency the sample of interest are white children aged 7 and 8. Similar results hold for other ages. We do not yet interact with the four group indicators as we do in the main results below. The table reports marginal effects of each regressor.[12] Mother's ability level and grandparents' schooling are important determinants of maternal education. The instruments are jointly significant at the 1% level although they are not all individually significant.

We have allowed the instruments to interact with a number of covariates reflecting maternal background to help improve the overall predictive ability of the instruments. In our sensitivity analysis we show that our results are robust to very flexible specification of the outcome equations by including polynomials in maternal covariates as well as interactions between them; thus the interactions in the instrument set are not picking up non-linearities left out of the outcome equations, but allow better predictions by modeling better the heterogeneity in the schooling choice.

The second requirement for our instruments is that they should not have an independent effect on the outcome, conditional on other covariates. Thus the differential changes in the costs of schooling should not predict child outcomes, conditional on

[12]The main effect of living near a college is not identified because it does not vary with time and we include county fixed effects. However we do interact it with a number of maternal background characteristics as described above.

Table 3: Maternal schooling choices and schooling costs

Dependent variable: Mother's years of schooling	
Mother's AFQT (corrected)	0.937
	[0.065]***
Grandmother's yrs. of schooling	0.158
	[0.030]***
Grandfather's yrs. of schooling	0.149
	[0.024]***
'Broken home' status	-0.249
	[0.144]*
Local unemployment	-0.134
	[0.071]*
Local wages	-4.883
	[2.120]**
Local tuition/1000	0.376
	[0.365]
Observations	2492
F-statistic	2.01
p-value	0.000***

Note: This table shows the result for a regression of maternal schooling on her characteristics and schooling cost variables, where schooling cost variables are also interacted with AFQT, grandparents' schooling, broken home indicator, and mother's birth cohort dummies. County fixed effects included. The table reports estimated marginal effects of a change in the variable indicated, evaluated at the mean. F-statistic and corresponding p-value refer to the joint test that all of these 47 schooling cost variables are zero. The sample is selected to be identical to the PIAT math regression in our main results, see Table 6. Standard errors, clustered by birth cohort and county are reported in brackets. * indicates significance at 10%, ** indicates significance at 5%, *** indicates significance at 1% level. See text for details.

covariates. By controlling for county fixed effects we avoid biases due to geographical sorting. The latter relates to individuals moving to certain counties in a way which creates a correlation between the characteristics of the region (e.g. local labor market conditions, tuition fees, etc), and outcome relevant variables such as the unobserved human capital of the person moving - the mother in our case. The fact that such sorting takes place is well established.[13]

The second concern relates to college quality as well as local labor market conditions. If higher tuition fees are associated with higher college quality, and if higher college

[13] See Solon (1999), Dahl (2002).

quality makes mothers better at child rearing, then this could bias our results. First, we use tuition from public colleges only; any link between cost and quality can be expected to be weaker in comparison to private colleges. Second, a main determinant of college quality is the quality of the students; this aspect is captured by including an ability measure of the mother, and by including family background variables. But perhaps most importantly we *do not* rely on comparing mothers who faced different tuition levels. We exploit changing tuition, which relies on the trends being common across regions, as in the diff-in-diff context. Therefore, it does not seem likely that, after controlling for mother's ability, mother's family background, and county fixed effects, endogeneity of tuition due to college quality will pose a problem. A similar argument can be made for the local labor market conditions.

Our instruments are designed to relate mainly to late schooling or college choice. They should be unrelated to early background characteristics of the mother. In our data there is a measure of mother's sociability at age 6, and a measure of maternal health limitations before age 5, which can be used to check the validity of our instruments.[14]

We next examine whether these instruments predict early sociability and health conditional on our controls. We regress these two measures on maternal schooling and the controls, instrumenting schooling with the variables described above. As in the rest of the paper, the unit of observation in each regression is the child at age 7 or 8, even though the regression relates to the mother only. Therefore there may be more than one observation per mother, since some mothers have several children.

Table 4 presents OLS and IV results for each early measure. Notice that final maternal schooling is strongly associated with both early sociability and early health limitations of the mother in the OLS regressions, but not in the IV regressions. In the

[14]Maternal sociability is an indicator for whether the mother indicates that at age 6 she was somewhat outgoing or extremely outgoing rather than somewhat shy or extremely shy. Early health limitations is an indicator for whether the mother reported any health limitations that she had either all her life or that began before age 5.

Table 4: Instrument validity

	Falsification exercise			
	Sociability at age 6		Early health limitations	
	OLS	IV	OLS	IV
	(1)	(2)	(3)	(4)
Mother's schooling: All	0.019	0.007	-0.014	-0.010
	[0.009]**	[0.022]	[0.007]*	[0.020]
Mother's schooling: Male child	0.014	0.020	-0.017	0.016
	[0.010]	[0.026]	[0.009]*	[0.024]
Mother's schooling: Female child	0.028	-0.006	-0.012	-0.035
	[0.011]**	[0.026]	[0.008]	[0.023]
Mother's schooling: High AFQT	0.019	0.023	-0.009	0.000
	[0.012]	[0.033]	[0.008]	[0.027]
Mother's schooling: Low AFQT	0.020	-0.008	-0.026	-0.023
	[0.013]	[0.032]	[0.013]**	[0.030]
Mother's AFQT (corrected): All	-0.029	-0.020	-0.033	-0.045
	[0.031]	[0.036]	[0.027]	[0.031]
Observations	4322	4322	4395	4395
Mean	0.390	0.390	0.197	0.197
Standard deviation	0.488	0.488	0.398	0.398

Note: This table reports Minimum Distance estimates for the groups indicated based on equation (1), see text for details. A description of the outcome variables is found in Table 1 on page 8. Standard errors reported in brackets, clustered by county-cohort. * indicates significance at 10%, ** indicates significance at 5%, *** indicates significance at 1% level.

latter the coefficient on schooling is smaller and statistically not different from zero. This is what we would expect if our identification strategy is valid.

4 Results

4.1 Effects on Child Outcomes

Our main outcome variables are the PIAT mathematics and reading test, the BPI, and binary indicators for grade repetition and child obesity. The PIAT tests and the BPI are standardized to have mean zero and variance 1 in a nationally representative sample. We measure these variables at both ages 7-8 and 12-14.

4.1.1 White Children

Tables 5 and 6 present our main results for white children. The first line shows the estimates for the whole sample, while the following four lines show effects for different

Table 5: Child outcomes – OLS results: White children

	OLS estimates: White children									
	PIAT math		PIAT read.		BPI		Grade repetition		Overweight	
	7-8 yrs	12-14 yrs	7-8 yrs	12-14 yrs	7-8 yrs	12-14 yrs	7-8 yrs	12-14 yrs	7-8 yrs	12-14 yrs
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Mother's schooling: All	0.050	0.034	0.029	0.035	-0.087	-0.102	-0.005	-0.023	-0.009	-0.007
	[0.012]***	[0.017]**	[0.012]**	[0.014]**	[0.015]***	[0.018]***	[0.003]*	[0.005]***	[0.004]**	[0.005]
Mother's schooling: Male child	0.040	0.045	0.029	0.044	-0.078	-0.119	-0.007	-0.026	-0.014	-0.007
	[0.015]***	[0.021]**	[0.016]*	[0.019]**	[0.018]***	[0.022]***	[0.004]*	[0.007]***	[0.006]**	[0.008]
Mother's schooling: Female child	0.058	0.023	0.029	0.028	-0.099	-0.082	-0.004	-0.021	-0.005	-0.008
	[0.015]***	[0.021]	[0.015]*	[0.018]	[0.021]***	[0.023]***	[0.004]	[0.007]***	[0.006]	[0.006]
Mother's schooling: High AFQT	0.055	0.044	0.048	0.051	-0.093	-0.110	-0.006	-0.013	-0.009	-0.004
	[0.015]***	[0.022]**	[0.016]***	[0.018]***	[0.019]***	[0.023]***	[0.003]*	[0.006]**	[0.005]*	[0.006]
Mother's schooling: Low AFQT	0.040	0.022	-0.000	0.012	-0.076	-0.091	-0.005	-0.045	-0.010	-0.013
	[0.019]**	[0.024]	[0.020]	[0.021]	[0.026]***	[0.029]***	[0.009]	[0.009]***	[0.008]	[0.008]*
Mother's AFQT (corrected): All	0.145	0.185	0.132	0.250	-0.077	-0.010	-0.019	0.001	-0.014	-0.055
	[0.040]***	[0.050]***	[0.046]***	[0.054]***	[0.060]	[0.063]	[0.012]	[0.018]	[0.018]	[0.020]***
Observations	2492	2113	2353	2095	2565	2264	1191	1958	2533	2271
Mean	0.314	0.254	0.491	0.047	0.293	0.464	0.026	0.111	0.114	0.125
Standard deviation	0.782	0.874	0.805	0.854	0.990	0.986	0.159	0.314	0.318	0.331

Note: This table reports Minimum Distance estimates for the groups indicated based on equation (1), see text for details. A description of the outcome variables is found in Table 1 on page 8. Standard errors reported in brackets, clustered by county-cohort. * indicates significance at 10%, ** indicates significance at 5%, *** indicates significance at 1% level.

Table 6: Child outcomes – IV results: White children

	IV estimates: White children									
	PIAT math		PIAT read.		BPI		Grade repetition		Overweight	
	7-8 yrs	12-14 yrs	7-8 yrs	12-14 yrs	7-8 yrs	12-14 yrs	7-8 yrs	12-14 yrs	7-8 yrs	12-14 yrs
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Mother's schooling: All	0.097	0.024	0.075	0.018	-0.092	-0.116	-0.028	-0.028	-0.015	-0.012
	[0.031]***	[0.033]	[0.033]**	[0.033]	[0.043]**	[0.041]***	[0.008]***	[0.011]**	[0.013]	[0.013]
Mother's schooling: Male child	0.060	0.037	0.053	0.043	-0.052	-0.091	-0.029	-0.016	-0.009	0.004
	[0.042]	[0.044]	[0.047]	[0.053]	[0.054]	[0.056]	[0.009]***	[0.015]	[0.018]	[0.020]
Mother's schooling: Female child	0.125	0.013	0.088	0.007	-0.131	-0.134	-0.026	-0.035	-0.020	-0.019
	[0.038]***	[0.041]	[0.040]**	[0.038]	[0.053]**	[0.049]***	[0.011]**	[0.013]***	[0.016]	[0.015]
Mother's schooling: High AFQT	0.146	0.032	0.107	0.024	-0.100	-0.114	-0.032	-0.020	-0.016	-0.020
	[0.045]***	[0.041]	[0.042]**	[0.043]	[0.057]*	[0.052]**	[0.010]***	[0.014]	[0.017]	[0.018]
Mother's schooling: Low AFQT	0.046	0.013	0.028	0.011	-0.081	-0.118	-0.018	-0.041	-0.014	-0.004
	[0.046]	[0.047]	[0.051]	[0.048]	[0.063]	[0.059]**	[0.013]	[0.017]**	[0.020]	[0.018]
Mother's AFQT (corrected): All	0.086	0.204	0.105	0.266	-0.087	-0.002	0.010	0.002	-0.016	-0.052
	[0.047]*	[0.054]***	[0.052]**	[0.057]***	[0.067]	[0.070]	[0.016]	[0.019]	[0.020]	[0.024]**
Observations	2492	2113	2353	2095	2565	2264	1191	1958	2533	2271
Mean	0.314	0.254	0.491	0.047	0.293	0.464	0.026	0.111	0.114	0.125
Standard deviation	0.782	0.874	0.805	0.854	0.990	0.986	0.159	0.314	0.318	0.331

Note: This table reports Minimum Distance estimates for the groups indicated based on equation (1), see text for details. A description of the outcome variables is found in Table 1 on page 8. Standard errors reported in brackets, clustered by county-cohort. * indicates significance at 10%, ** indicates significance at 5%, *** indicates significance at 1% level.

subgroups of interest. The last line of the table corresponds to the overall effect of the mother's AFQT score on child outcomes. This variable is a very strong predictor of children's test scores and it is useful to compare the role of maternal schooling and ability in our results. Each estimate is computed as Minimum Distance estimates based on equation (1). Standard errors are clustered at the county-cohort level.

OLS results indicate that one year of additional mother's education increases mathematics standardized scores by 5% of a standard deviation at ages 7 and 8, while the IV coefficient is 10% (the difference between OLS and IV is significant at the 8% level). The results for the reading score at ages 7 and 8 are similar are similar to those for the math score, but somewhat smaller. However, at ages 12 to 14 the effect of mother's schooling on both math and reading become small and insignificant in the IV results.

Mother's education also has strong effects on child behavioral problems (BPI) at both ages. There is an interesting pattern in these results: the effects on math and reading decline with the age of the child, while the effect on behavior is increasing. At face value it seems that a better educated mother may be able to help accelerate academic achievement, an effect that is not sustained in the long run. However, the impact on behavior is sustained and possibly reinforced with time. The difference across ages for the effect on the math test is significant at the 11% level.

The results in columns (7) and (8) of Tables 5 and 6 examine grade repetition. A one year increase in mother's education reduces the probability of grade repetition by 2.8 percentage points for both age groups (IV). Child obesity is not influenced significantly by maternal schooling based on the IV results. This is surprising, given the consensus that child obesity is largely affected by eating habits and physical exercise. However, the coefficient is larger than the OLS one and less precise.

At the bottom of each table we report the impact of the maternal AFQT score on child outcomes. As expected and shown in other papers, the cognitive ability of the mother is a strong predictor of the cognitive ability of the child. The IV results show that the effect of mother's AFQT on child's performance in math and reading is larger at 12-14 than at 7 to 8. At ages 7 to 8, each year of maternal education produces a slightly larger increase in the math score of the child than a one standard deviation in maternal AFQT, so that (very roughly) a 4 year college degree produces the same increase in math at 7 and 8 as a 4 standard deviation increase in mother's cognition (a large effect). Equally striking is the result that mother's AFQT does not predict either child's behavior or child's grade repetition, although mother's schooling is a strong determinant of both.

These results resemble the findings of Cunha and Heckman (2006), who estimate that parental background has a strong effect on the child's cognitive skill at early ages which disappears later on, and a weaker initial effect on her non-cognitive skill which becomes stronger as the child ages. In their model, cognitive and non-cognitive skills are not equally plastic across ages and they estimate that cognitive skills are less malleable than non-cognitive skills. This result has been argued to be true in other papers (e.g., Knudsen, Heckman, Cameron, and Shonkoff (2006)). Our estimates would be consistent with such a model if we interpret maternal schooling as reflecting mostly environmental effects, and maternal cognition as being at least partly related with the heritability of cognitive ability. We would expect the environment to strongly affect child behavior at all ages, but to decrease its influence on cognition as the child grows, while the role of AFQT becomes stronger with child's age. Unless there is a strong environmental component to AFQT after controlling for maternal schooling, maternal AFQT may not be strongly related with the behavior of the child (unless cognitive and non-cognitive innate traits are positively correlated in the population[15]).

We also present estimates for four different subsamples, defined according to the gender of the child and the AFQT of the mother. We divide white mothers into two

[15] Heckman, Stixrud, and Urzua (2006) as well as Duckworth and Seligman (2005) argue that there is little correlation between cognitive and non-cognitive traits of children and adolescents. That is not the case in the data analyzed in Carneiro, Crawford, and Goodman (2007).

groups: white high AFQT mothers have a score above or equal to 0.4, while white low AFQT mothers have a score below 0.4. For blacks, we set the cutoff point at -0.25.[16]

When we break down the results by gender and (separately) by AFQT we find that our estimates are highest for female children and for high AFQT mothers (except for grade repetition at ages 12-14). The decline in the effect of mother's schooling on the math score can be attributed to the impact on girls, which is very strong at age 7-8 but virtually vanishes later. A similar decline can be observed for high AFQT mothers: they achieve a large improvement in the performance of their kids, but the impact vanishes by ages 12-14. In contrast, the effect on the behavioral problems index does not decline with age and the impact is substantial and significant. The lowest impact is on male children (not significant in the IV regression). The impact of mother's education on grade repetition is also persistent across ages. Overall, at ages 7-8, results are almost always stronger for mother's with high AFQT. At 12-14, however, for BPI and grade repetition the results are stronger for low AFQT mothers.

Generally, the IV results for white children are higher than the OLS ones. This may seem surprising because an ability bias intuition would tell us otherwise. However, this result is common in the returns to schooling literature (Card, 1999), and also emerges in the papers by Currie and Moretti (2003) and Oreopoulos, Page, and Stevens (2003). Part of the difference can be explained by measurement error in maternal education (Card, 1999), which could bias downwards the OLS results. Beyond these common arguments the standard intuition that is valid in the fixed coefficient model no longer

[16]This is done to account for the different distributions of AFQT between whites and blacks. There are two reasons why the effect of maternal education on child outcomes can vary across these two groups of mothers. First, this parameter can be a function of AFQT. Second, even within AFQT cells, this parameter can vary across observationally similar mothers. In that case the instrumental variables estimate will be an average of the effects of maternal education for the set of mothers affected by the instrument, and this set can be very different in the high and low AFQT groups, since AFQT and unobservable ability both determine the schooling decision of mothers. Unfortunately, our procedure confounds the two phenomena, but it is still of great interest especially if we can interpret it as (within each AFQT group) the effect of schooling for those mothers most likely to change schooling in response to a decrease in the costs of attending university (measured by our set of instrumental variables).

applies when the impacts are heterogeneous. In this case IV estimates may well exceed OLS estimates of the effect of maternal schooling on child outcomes. On the one hand, with heterogeneous effects the OLS estimates do not have a clear direction of bias; on the other hand the IV estimates, valid only under a suitable monotonicity assumption (see Imbens and Angrist (1994)), pick up the effect on the marginal individual, which can be larger than the average effect.

4.1.2 Black children

It is now well documented that there are large differences in the processes of human capital accumulation of blacks and whites.[17] Furthermore, ethnic differences in skill formation are an important source of concern for education policies in many countries. Therefore we compare the role of maternal education for white and black children.

Tables 7 and 8 present estimates of the effect of maternal education on outcomes for black children. Results are broadly similar to the ones for white children, with the impacts on math and reading, BPI, and grade repetition being quite large and significant, and the impact on obesity being imprecisely determined. There are, however, some differences. First, estimated impacts are stronger at 12-14 than at 7-8, and we do not observe the tendency of the math (and reading) impact to decline. Second, in the IV estimates the impact on grade repetition for 12-14 year olds is twice as large for black children than for whites, and the p-value for the difference is 5.7%. For children of the low AFQT mothers, a year of education reduces the probability of grade repetition by almost 10 percentage points (which partly mirrors differences in prevalence of grade repetition). Third, maternal AFQT is a stronger predictor of child outcomes for blacks than for whites. Fourth, the role of maternal schooling is larger for males than for females.

[17]See, e.g., Currie and Thomas (1995), Jencks and Phillips (1998), Fryer and Levitt (2004), Carneiro, Heckman, and Masterov (2005), Neal (2005), Todd and Wolpin (2006).

Table 7: Child outcomes – OLS results: Black children

	OLS estimates: Black children									
	PIAT math		PIAT read.		BPI		Grade repetition		Overweight	
	7-8 yrs	12-14 yrs	7-8 yrs	12-14 yrs	7-8 yrs	12-14 yrs	7-8 yrs	12-14 yrs	7-8 yrs	12-14 yrs
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Mother's schooling: All	0.074	0.075	0.062	0.079	-0.064	-0.064	-0.003	-0.032	0.009	0.015
	[0.020]***	[0.020]***	[0.019]***	[0.018]***	[0.027]**	[0.027]**	[0.009]	[0.009]***	[0.008]	[0.009]
Mother's schooling: Male child	0.068	0.082	0.065	0.095	-0.068	-0.077	0.003	-0.030	0.010	0.020
	[0.027]**	[0.027]***	[0.024]***	[0.023]***	[0.033]**	[0.031]**	[0.011]	[0.012]**	[0.010]	[0.010]*
Mother's schooling: Female child	0.078	0.070	0.060	0.060	-0.060	-0.047	-0.009	-0.034	0.009	0.004
	[0.022]***	[0.024]***	[0.023]***	[0.024]**	[0.032]*	[0.034]	[0.011]	[0.012]***	[0.011]	[0.014]
Mother's schooling: High AFQT	0.111	0.077	0.074	0.081	-0.063	-0.075	-0.004	-0.019	0.014	0.022
	[0.031]***	[0.032]**	[0.028]***	[0.032]**	[0.036]*	[0.038]**	[0.011]	[0.014]	[0.015]	[0.015]
Mother's schooling: Low AFQT	0.056	0.074	0.054	0.078	-0.064	-0.054	-0.001	-0.042	0.008	0.010
	[0.023]**	[0.025]***	[0.025]**	[0.023]***	[0.048]	[0.036]	[0.012]	[0.013]***	[0.009]	[0.012]
Mother's AFQT (corrected): All	0.298	0.326	0.345	0.254	-0.083	0.070	-0.007	-0.045	-0.025	0.036
	[0.070]***	[0.070]***	[0.069]***	[0.071]***	[0.099]	[0.086]	[0.027]	[0.029]	[0.028]	[0.033]
Observations	1271	1391	1181	1381	1233	1399	396	1168	1248	1446
Mean	-0.257	-0.402	0.066	-0.570	0.486	0.496	0.056	0.229	0.183	0.195
Standard deviation	0.833	0.857	0.806	0.845	0.985	0.993	0.229	0.420	0.387	0.396

Note: This table reports Minimum Distance estimates for the groups indicated based on equation (1), see text for details. A description of the outcome variables is found in Table 1 on page 8. Standard errors reported in brackets, clustered by county-cohort. * indicates significance at 10%, ** indicates significance at 5%, *** indicates significance at 1% level.

Table 8: Child outcomes – IV results: Black children

	IV estimates: Black children									
	PIAT math		PIAT read.		BPI		Grade repetition		Overweight	
	7-8 yrs	12-14 yrs	7-8 yrs	12-14 yrs	7-8 yrs	12-14 yrs	7-8 yrs	12-14 yrs	7-8 yrs	12-14 yrs
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Mother's schooling: All	0.066	0.080	0.100	0.119	-0.067	-0.099	-0.000	-0.065	0.011	0.008
	[0.034]*	[0.028]***	[0.031]***	[0.030]***	[0.044]	[0.039]**	[0.009]	[0.016]***	[0.015]	[0.015]
Mother's schooling: Male child	0.081	0.083	0.121	0.126	-0.054	-0.106	0.004	-0.065	0.032	0.026
	[0.041]**	[0.039]**	[0.039]***	[0.043]***	[0.054]	[0.051]**	[0.011]	[0.020]***	[0.021]	[0.021]
Mother's schooling: Female child	0.051	0.077	0.075	0.113	-0.083	-0.092	-0.007	-0.064	-0.004	-0.009
	[0.042]	[0.040]*	[0.042]*	[0.041]***	[0.057]	[0.056]	[0.012]	[0.023]***	[0.018]	[0.021]
Mother's schooling: High AFQT	0.068	0.053	0.077	0.076	-0.118	-0.142	-0.004	-0.032	0.031	0.015
	[0.047]	[0.050]	[0.047]	[0.049]	[0.059]**	[0.053]***	[0.011]	[0.023]	[0.023]	[0.021]
Mother's schooling: Low AFQT	0.064	0.099	0.119	0.153	-0.003	-0.031	0.005	-0.099	-0.005	0.000
	[0.049]	[0.041]**	[0.042]***	[0.042]***	[0.066]	[0.069]	[0.013]	[0.023]***	[0.020]	[0.023]
Mother's AFQT (corrected): All	0.325	0.325	0.322	0.232	-0.091	0.095	-0.009	-0.030	-0.038	0.042
	[0.069]***	[0.070]***	[0.075]***	[0.073]***	[0.105]	[0.089]	[0.027]	[0.031]	[0.028]	[0.034]
Observations	1271	1391	1181	1381	1233	1399	396	1168	1248	1446
Mean	-0.257	-0.402	0.066	-0.570	0.486	0.496	0.056	0.229	0.183	0.195
Standard deviation	0.833	0.857	0.806	0.845	0.985	0.993	0.229	0.420	0.387	0.396

Note: This table reports Minimum Distance estimates for the groups indicated based on equation (1), see text for details. A description of the outcome variables is found in Table 1 on page 8. Standard errors reported in brackets, clustered by county-cohort. * indicates significance at 10%, ** indicates significance at 5%, *** indicates significance at 1% level.

4.2 Home Environments

The impact of mothers education on child is strong in a number of dimensions. Since we do not have an explicit model of child development, we cannot firmly establish the role of these channels. However, our results paint a picture of how they may operate, and their detail makes them especially useful. The results for whites are reported in Table 9. We comment on the IV results, while in the Appendix we also report the OLS results for completeness. The maternal characteristics examined are maternal

Table 9: Family environment – IV results: White children

	IV estimates: White children (7-8 years)						
	Maternal age	Number of children	Marital status	Spouse schooling	Hours worked	Lg family income	Maternal aspirations
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Mother's schooling: All	1.024	-0.017	0.041	0.549	55.633	0.177	0.048
	[0.139]***	[0.057]	[0.018]**	[0.092]***	[38.528]	[0.034]***	[0.018]***
Mother's schooling: Male child	1.074	-0.029	0.053	0.512	55.724	0.196	0.066
	[0.192]***	[0.072]	[0.021]**	[0.121]***	[45.630]	[0.046]***	[0.025]***
Mother's schooling: Female child	0.983	-0.008	0.029	0.572	55.524	0.157	0.039
	[0.176]***	[0.065]	[0.021]	[0.104]***	[48.314]	[0.047]***	[0.020]*
Mother's schooling: High AFQT	0.846	-0.107	0.045	0.486	24.112	0.177	0.057
	[0.200]***	[0.088]	[0.023]**	[0.137]***	[53.715]	[0.047]***	[0.020]***
Mother's schooling: Low AFQT	1.205	0.059	0.034	0.608	86.592	0.176	0.028
	[0.202]***	[0.080]	[0.029]	[0.132]***	[53.253]	[0.050]***	[0.030]
Mother's AFQT (corrected): All	-0.247	0.079	0.015	0.061	148.174	0.191	0.011
	[0.218]	[0.099]	[0.029]	[0.160]	[59.570]**	[0.056]***	[0.039]
Observations	4395	4395	4391	3335	4307	3796	1235
Mean	24.282	2.752	0.770	13.231	1152.305	10.361	0.764
Standard deviation	4.632	1.195	0.421	2.490	950.919	0.970	0.425

Note: This table reports Minimum Distance estimates for the groups indicated based on equation (1), see text for details. A description of the outcome variables is found in Table 1 on page 8. Standard errors reported in brackets, clustered by county-cohort. * indicates significance at 10%, ** indicates significance at 5%, *** indicates significance at 1% level.

age at birth, educational aspirations for the child (does the mother believe whether the child will go to college), marital status, spouse's years of schooling (for those with a spouse), number of children, hours worked, and log family income (which includes spouse's income). All variables are measured when the child is 7 or 8.

An increase in mother's schooling by one year leads to increases in: maternal age at birth by one year, family income by 18%, the probability of being married of 4%, spouse's years of schooling by 0.5. The effect on fertility is surprisingly small.[18]

Several economists have argued that it is important to account for the effects of assortative mating because the causal effect of maternal education on child performance may come through her ability to find an educated father for the child. They also argue that maternal education can have ambiguous effects because if on one hand the child benefits from better home environments and perhaps richer investments, she will benefit of less maternal time because more educated mothers spend more time in the labor market. Two examples are Behrman and Rosenzweig (2002) and Plug (2004), who estimate small or no effects of maternal education on child's schooling, while father's education has large and strong effects on this outcome. Unfortunately we do not have good instruments for either of these variables and cannot directly assess the validity of these arguments. However, we can examine the effect of maternal schooling on spouse's schooling and on maternal labor supply.

As pointed out above, column (4) shows that an increase of one year in maternal education leads to an increase of 0.5 years of spouse's education. If we attributed all the effects of maternal education to assortative mating we would need father's schooling to have almost twice as large effects as the ones we estimate for mothers. Therefore, assortative mating effects are unlikely to fully drive our results. Column (5) looks at the effects of maternal education on maternal employment measured in terms of annual hours worked. Annual hours worked increase by 56 hours per additional year of maternal schooling (5% of the mean of 1,152 hours worked per year), or roughly 1.5 weeks of full-time work per year, although the effect is imprecisely estimated. If we compared a mother with a college degree and another without, our estimates suggest that the former would work 6 more weeks per year than the latter. Cumulating over several years of childhood, these will translate into much more family resources for the

[18] Note that we only have incomplete fertility and that more educated mothers delay childbirth.

mother with a college degree, but less time at home. The latter can have an offsetting effect on the former, although it depends on what kind of substitutes educated mothers can find for their time with their child.

Column (7) shows that more educated mothers are 5 percentage points more likely to believe that their offspring will complete college. These expectations may translate into different behavior on the side of the mother and the child.

The estimates presented in Table 9 are fairly similar for boys and girls, and for children of mothers with high and low levels of AFQT. There are only a few cases of interesting differences across groups. In particular, the effect of maternal education on maternal aspirations and marital status are small for low AFQT mothers, which may be the reason why we found weaker effects on child outcomes for this group of mothers.

One feature of the dataset we use is a wealth of information on direct measures of home environments and parental investments, as reported in Table 10. For white children, an increase in mother's schooling by one year leads to increases in the probabilities that: there is a musical instrument in the home by 5.4%; there is a computer in the home by 5.7%; a child takes special lessons by 6.2%. Each extra year of schooling also means that mothers 4.5% more likely to read to their child at least three times a week. There is no evidence that maternal education affects the amount of newspapers in the home, adult supervision out of school, and time spent with the child in a museum or sharing meals. Notice that more educated mothers do not seem to spend less time in activities with their children, even though they spend more time working. This pattern emerges throughout the paper, even much more strongly than here, and we will comment on it with detail when we examine the child's early years.

The results for black mothers are slightly different, and they are shown in Tables 11 and 12. Relatively to white mothers, education not only affects maternal age at birth, aspirations, marital status, spouse's schooling and income, but it also has large effects on fertility and employment. Each additional four years in school (a four year

Table 10: Investments – IV results: White children

	IV estimates: White children							
	Museum 7-8 yrs	Musical Instr. 7-8 yrs	Special lesson 7-8 yrs	Mother reads 7-8 yrs	Newspaper 7-8 yrs	Computer 12-14 yrs	Adult home 12-14 yrs	Joint meals 12-14 yrs
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Mother's schooling: All	0.023	0.054	0.062	0.045	-0.006	0.057	0.018	-0.008
	[0.019]	[0.020]***	[0.017]***	[0.018]**	[0.021]	[0.016]***	[0.020]	[0.021]
Mother's schooling: Male child	0.045	0.075	0.100	0.064	-0.003	0.048	0.034	-0.007
	[0.028]	[0.026]***	[0.024]***	[0.025]**	[0.028]	[0.022]**	[0.026]	[0.028]
Mother's schooling: Female child	0.007	0.037	0.032	0.030	-0.007	0.064	0.004	-0.009
	[0.024]	[0.025]	[0.021]	[0.022]	[0.024]	[0.020]***	[0.025]	[0.026]
Mother's schooling: High AFQT	0.017	0.067	0.054	0.047	-0.008	0.047	0.008	-0.028
	[0.027]	[0.028]**	[0.021]**	[0.025]*	[0.027]	[0.020]**	[0.026]	[0.027]
Mother's schooling: Low AFQT	0.029	0.040	0.079	0.042	-0.002	0.074	0.030	0.015
	[0.028]	[0.029]	[0.030]***	[0.027]	[0.032]	[0.027]***	[0.027]	[0.029]
Mother's AFQT (corrected): All	-0.015	0.021	-0.002	-0.022	0.045	0.025	-0.067	-0.015
	[0.030]	[0.036]	[0.030]	[0.032]	[0.033]	[0.034]	[0.036]*	[0.037]
Observations	2646	2644	2643	2649	2646	1681	2036	2292
Mean	0.424	0.513	0.682	0.492	0.526	0.681	0.671	0.565
Standard deviation	0.494	0.500	0.466	0.500	0.499	0.466	0.470	0.496

Note: This table reports Minimum Distance estimates for the groups indicated based on equation (1), see text for details. A description of the outcome variables is found in Table 1 on page 8. Standard errors reported in brackets, clustered by county-cohort. * indicates significance at 10%, ** indicates significance at 5%, *** indicates significance at 1% level.

Table 11: Family environment – IV results: Black children

	IV estimates: Black children (7-8 years)						
	Maternal age	Number of children	Marital status	Spouse schooling	Hours worked	Lg family income	Maternal aspirations
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Mother's schooling: All	0.896	-0.304	0.061	0.529	182.163	0.190	0.047
	[0.147]***	[0.063]***	[0.020]***	[0.079]***	[33.790]***	[0.033]***	[0.019]**
Mother's schooling: Male child	0.929	-0.326	0.073	0.484	220.602	0.238	0.046
	[0.200]***	[0.079]***	[0.024]***	[0.096]***	[52.013]***	[0.041]***	[0.025]*
Mother's schooling: Female child	0.867	-0.287	0.049	0.564	161.719	0.133	0.048
	[0.187]***	[0.073]***	[0.024]**	[0.089]***	[39.800]***	[0.043]***	[0.025]*
Mother's schooling: High AFQT	0.841	-0.257	0.059	0.484	138.268	0.257	0.036
	[0.225]***	[0.089]***	[0.031]*	[0.130]***	[46.324]***	[0.051]***	[0.028]
Mother's schooling: Low AFQT	0.937	-0.347	0.062	0.559	233.002	0.144	0.054
	[0.195]***	[0.085]***	[0.024]**	[0.105]***	[49.888]***	[0.042]***	[0.023]**
Mother's AFQT (corrected): All	-0.096	0.089	0.077	0.032	131.007	0.197	0.107
	[0.286]	[0.112]	[0.042]*	[0.227]	[79.503]*	[0.077]**	[0.063]*
Observations	2647	2647	2646	943	2624	2129	422
Mean	22.070	3.097	0.375	12.688	1139.074	9.638	0.656
Standard deviation	4.489	1.413	0.484	2.095	991.853	0.930	0.475

Note: This table reports Minimum Distance estimates for the groups indicated based on equation (1), see text for details. A description of the outcome variables is found in Table 1 on page 8. Standard errors reported in brackets, clustered by county-cohort. * indicates significance at 10%, ** indicates significance at 5%, *** indicates significance at 1% level.

university degree) decreases the number of children born to each woman by 1.2, and increase maternal employment by over 730 hours (or roughly 18 weeks) per year. The effects of education on income are especially large for high AFQT mothers, while the effects of education on employment and fertility are stronger for low AFQT mothers.

It is remarkable that each year of maternal schooling among blacks increases the proportion of children going to a museum at least several times per year by 3.2%, and the proportion of children who are read to at least three times a week by 5.4% (these are time intensive activities). Part of this may be due to the fact that more educated black mothers have less children to spend their time with. However, an extra year of maternal education also makes it 5.1% less likely that black children have adult supervision when they arrive home after school, which can have detrimental effects on their behavior (Aizer, 2004). This problem is worse for males than for females. The

Table 12: Investments – IV results: Black children

	IV estimates: Black children							
	Museum 7-8 yrs	Musical Instr. 7-8 yrs	Special lesson 7-8 yrs	Mother reads 7-8 yrs	Newspaper 7-8 yrs	Computer 12-14 yrs	Adult home 12-14 yrs	Joint meals 12-14 yrs
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Mother's schooling: All	0.032	0.017	0.101	0.054	-0.013	0.065	-0.051	0.014
	[0.019]*	[0.020]	[0.020]***	[0.018]***	[0.019]	[0.019]***	[0.017]***	[0.018]
Mother's schooling: Male child	0.021	-0.005	0.087	0.046	-0.014	0.053	-0.057	0.020
	[0.025]	[0.029]	[0.027]***	[0.023]**	[0.026]	[0.026]**	[0.024]**	[0.023]
Mother's schooling: Female child	0.044	0.034	0.112	0.064	-0.012	0.076	-0.047	0.006
	[0.027]	[0.025]	[0.024]***	[0.024]***	[0.027]	[0.026]***	[0.022]**	[0.025]
Mother's schooling: High AFQT	0.016	0.012	0.136	0.057	-0.014	0.088	-0.042	0.033
	[0.030]	[0.034]	[0.027]***	[0.025]**	[0.027]	[0.029]***	[0.026]*	[0.027]
Mother's schooling: Low AFQT	0.042	0.020	0.062	0.052	-0.012	0.047	-0.059	-0.006
	[0.024]*	[0.026]	[0.028]**	[0.024]**	[0.028]	[0.026]*	[0.023]**	[0.027]
Mother's AFQT (corrected): All	0.002	0.026	0.004	-0.070	0.101	0.082	0.024	-0.075
	[0.043]	[0.046]	[0.043]	[0.045]	[0.048]**	[0.049]*	[0.043]	[0.048]
Observations	1306	1305	1304	1308	1306	906	1306	1431
Mean	0.405	0.336	0.447	0.320	0.419	0.352	0.694	0.316
Standard deviation	0.491	0.472	0.497	0.467	0.494	0.478	0.461	0.465

Note: This table reports Minimum Distance estimates for the groups indicated based on equation (1), see text for details. A description of the outcome variables is found in Table 1 on page 8. Standard errors reported in brackets, clustered by county-cohort. * indicates significance at 10%, ** indicates significance at 5%, *** indicates significance at 1% level.

fact that the effects of maternal education on child outcomes are not only strong, but they are especially strong for black males, shows that mothers are able to overcome the problem of low adult supervision through other means. When we examine the remaining home environment variables, we only find statistically significant effects of the presence of a computer in the home and enrollment in special lessons.

In summary, there exists strong evidence that maternal education affects home environments and child outcomes. The size of several of our estimates in this section is large, and suggests that we should seriously look at education policy as a way of improving the home environments of future generations of children. Educated mothers provide better surroundings for their children by postponing and decreasing childbearing, by increasing family resources, and by assortative mating. There is also strong evidence that educated mothers invest more in their children. However, educated mothers also spend longer periods outside the home working and earning. Still, whatever the negative consequences of spending time away from the children may be, they are outweighed by the positive effects. With the exception of adult supervision for black children, more educated mothers do not spend less time with their children, either because they have less children, or less leisure time. If anything, our results indicate that the opposite is true.

At this point it is useful to compare our estimates of the effect of maternal education to those of other childhood interventions. The large class size reduction of the STAR experiment (a reduction from 22 to 15 pupils per class, studied by Krueger (1999)) yielded test score gains of 0.2 standard deviations, an equivalent of two years of maternal schooling. Dahl and Lochner (2006) estimate that a \$1,000 increase in family income improves performance on the math test score by 2.1% of a standard deviation (3.6% for reading). Using mother fixed effects, Currie and Thomas (1995) estimate that participation in Head Start increases performance in the PPVT vocabulary test by almost 6 percentile points. Bernal and Keane (2006) find that additional formal child care does not improve the average child test score performance, but may be beneficial for poorly educated mothers. Aizer (2004) estimates that adult supervision after school reduces the probability of a child engaging in risky behavior by about 7 percentage points. Dustmann and Schönberg (2007) find that increasing paid maternity leave does not significantly improve long-term child outcomes. The point of this argument is that, although the nature of the different interventions differs quite a lot, the effects of maternal education are not small when compared to the other interventions. If the objective is to increase children's outcomes, additional maternal education may be a serious competitor to the other types of interventions, although the beneficial effects of the policy will take longer to become apparent. Of course, in doing this kind of comparison, it is important to keep in mind that each of the interventions have different costs and may affect children along a variety of dimensions, and comparisons become difficult when trade-offs between different objectives are involved.

4.3 Early Childhood and Young Adulthood

In this section we investigate two issues. First, which of these effects are visible at earlier ages of the child? This question is particularly interesting given the recent academic and policy emphasis on the importance of the early years. Second, is there any evidence of effects of maternal schooling on environments and behavior during adolescence and young adulthood, when behavioral anomalies such as engagement in criminal activities, early dropping out of school, or early child bearing, may be the source of long run problems? Ideally, we would like to follow individuals well into their adult lives, but unfortunately this is not yet possible with this sample.

4.3.1 Early Childhood

Here we present estimates of the effect of maternal schooling on the probability of the child having low birthweight (weighing less than 5.5 pounds at birth), and the score on the MSD scale, which assesses the motor and social skills development, both for children up to 24 months. Results are shown for whites and blacks in Table 13.

Table 13: Early outcomes – IV results

	IV estimates: Children 0-1 years			
	Whites		Blacks	
	Low birthweight	MSD	Low birthweight	MSD
	(1)	(2)	(3)	(4)
Mother's schooling: All	-0.004	-0.076	-0.012	0.084
	[0.007]	[0.035]**	[0.013]	[0.049]*
Mother's schooling: Male child	-0.006	-0.080	-0.010	0.060
	[0.010]	[0.045]*	[0.016]	[0.056]
Mother's schooling: Female child	-0.003	-0.072	-0.016	0.138
	[0.011]	[0.047]	[0.020]	[0.079]*
Mother's schooling: High AFQT	-0.010	-0.054	0.008	0.013
	[0.010]	[0.043]	[0.017]	[0.065]
Mother's schooling: Low AFQT	0.002	-0.120	-0.036	0.157
	[0.011]	[0.061]**	[0.018]**	[0.066]**
Mother's AFQT (corrected): All	-0.008	0.025	-0.000	-0.242
	[0.013]	[0.071]	[0.025]	[0.137]*
Observations	5580	2136	2806	781
Mean	0.065	-0.039	0.130	0.184
Standard deviation	0.246	0.994	0.337	1.216

Note: This table reports Minimum Distance estimates for the groups indicated based on equation (1), see text for details. A description of the outcome variables is found in Table 1 on page 8. Standard errors reported in brackets, clustered by county-cohort. * indicates significance at 10%, ** indicates significance at 5%, *** indicates significance at 1% level.

Currie and Moretti (2003) find that one extra year of maternal education reduces the probability that a child is born with low birthweight by 1 percentage point. Our estimates for whites are lower and insignificant, whether we use OLS or IV, although we have a much smaller sample than Currie and Moretti (2003). Results are only statistically strong for black mothers with low AFQT scores, for whome the coefficient is -0.036 (the incidence of low birthweight is of 14.9% for this group).

Looking at the relationship between maternal education and early motor and social skills of the child a new picture emerges. For whites, our estimates are small but negative, especially for low ability mothers. This is the first and only instance where increases in maternal schooling may not be good for their children, perhaps because of increased maternal employment and less time with the child.

Table 14: Early channels – IV results: white children

	IV estimates: White children 0-1 years							
	Smoking d. pregnancy	Weeks breastfeeding	Formal child care	Hours worked	Mother reads	Book	Soft toys	Outings
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Mother's schooling: All	-0.069	2.307	0.013	102.498	0.006	0.071	-0.198	-0.005
	[0.016]***	[0.710]***	[0.007]*	[29.598]***	[0.014]	[0.030]**	[0.421]	[0.016]
Mother's schooling: Male child	-0.064	1.976	0.004	121.941	0.001	0.063	-0.374	-0.011
	[0.021]***	[0.941]**	[0.010]	[40.272]***	[0.020]	[0.045]	[0.525]	[0.022]
Mother's schooling: Female child	-0.074	2.717	0.022	86.187	0.011	0.077	0.059	0.000
	[0.022]***	[1.043]***	[0.010]**	[37.428]**	[0.021]	[0.042]*	[0.624]	[0.022]
Mother's schooling: High AFQT	-0.062	1.059	0.016	109.035	-0.008	0.026	-0.284	0.001
	[0.020]***	[0.968]	[0.011]	[39.213]***	[0.019]	[0.040]	[0.559]	[0.020]
Mother's schooling: Low AFQT	-0.081	3.801	0.011	93.057	0.027	0.139	-0.075	-0.017
	[0.028]***	[1.061]***	[0.009]	[47.500]*	[0.024]	[0.051]***	[0.677]	[0.029]
Mother's AFQT (corrected): All	-0.065	0.763	0.020	81.880	0.053	0.136	2.507	0.021
	[0.031]**	[1.364]	[0.010]*	[42.710]*	[0.030]*	[0.062]**	[0.775]***	[0.030]
Observations	2293	2220	4850	5942	2358	2382	2343	2380
Mean	0.287	15.370	0.066	926.749	0.607	3.240	16.654	0.691
Standard deviation	0.452	22.126	0.248	880.676	0.489	1.062	12.456	0.462

Note: This table reports Minimum Distance estimates for the groups indicated based on equation (1), see text for details. A description of the outcome variables is found in Table 1 on page 8. Standard errors reported in brackets, clustered by county-cohort. * indicates significance at 10%, ** indicates significance at 5%, *** indicates significance at 1% level.

Table 14 presents the results for early home environments of whites, where the following outcomes are considered: smoking in the year prior to the birth of the child, weeks of breastfeeding, use of formal child care arrangements, annual hours worked by the mother, whether the child is read to, how many books and soft toys the child has, and whether the child is taken out on outings regularly.

The two health inputs, non-smoking and breastfeeding, are strongly affected by maternal schooling. Notice also that the effect on maternal hours worked is much larger when measured during the child's early years than later on (as we saw in Table 9). At the same time, the increase in formal child care is modest and only statistically strong for girls. The strong increase in hours worked that results from additional education is not accompanied by a strong increase in formal childcare, raising the question of how these children are cared for. This could be seen as support to the argument that

Table 15: Early channels – IV results: Black children

	IV estimates: Black children 0-1 years							
	Smoking d. pregnancy	Weeks breastfeeding	Formal child care	Hours worked	Mother reads	Book	Soft toys	Outings
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Mother's schooling: All	-0.026	1.422	0.019	194.011	0.050	0.130	-0.115	0.002
	[0.021]	[0.626]**	[0.008]**	[28.539]***	[0.022]**	[0.052]**	[0.456]	[0.019]
Mother's schooling: Male child	-0.005	1.223	0.017	183.880	0.063	0.150	0.395	-0.002
	[0.026]	[0.749]	[0.010]*	[36.948]***	[0.026]**	[0.060]**	[0.584]	[0.026]
Mother's schooling: Female child	-0.048	1.717	0.023	205.266	0.030	0.099	-0.415	0.005
	[0.026]*	[0.871]**	[0.012]*	[38.655]***	[0.031]	[0.070]	[0.504]	[0.026]
Mother's schooling: High AFQT	-0.034	-0.148	0.035	180.036	0.057	0.092	-0.125	-0.025
	[0.027]	[1.014]	[0.015]**	[39.661]***	[0.032]*	[0.067]	[0.527]	[0.023]
Mother's schooling: Low AFQT	-0.017	1.966	0.014	210.150	0.044	0.166	-0.097	0.044
	[0.029]	[0.684]***	[0.009]	[42.733]***	[0.029]	[0.065]**	[0.642]	[0.028]
Mother's AFQT (corrected): All	0.024	0.680	0.009	140.934	0.013	0.208	-1.184	0.024
	[0.048]	[1.249]	[0.015]	[61.143]**	[0.049]	[0.100]**	[0.950]	[0.042]
Observations	861	855	2257	2965	894	897	889	897
Mean	0.278	5.513	0.070	767.310	0.371	2.337	11.227	0.661
Standard deviation	0.448	13.905	0.254	885.509	0.483	1.190	10.086	0.474

Note: This table reports Minimum Distance estimates for the groups indicated based on equation (1), see text for details. A description of the outcome variables is found in Table 1 on page 8. Standard errors reported in brackets, clustered by county-cohort. * indicates significance at 10%, ** indicates significance at 5%, *** indicates significance at 1% level.

more educated mothers spend more time working, with detrimental effects on child development. Still, even if this is true, children seem to recover, so that BPI and grade repetition at 12 and 14 are lower when maternal education is higher. Finally, there is no evidence that, even though they work more, more educated mothers spend less time breastfeeding, reading to the child, or taking her on outings. This is consistent with recent findings from time diary studies summarized in Blau and Currie (2003): mothers who work more do not spend less time with their children; instead, they have less leisure. It is also consistent with the analysis of (large) changes in maternity leave laws in Germany by Dustmann and Schönberg (2007) who find no positive effect on child outcomes. Notice also that young children of educated mothers have more books than other children, especially if their mothers have low cognitive ability.

In summary, it is difficult to make the case that the large increase in employment of white mothers that results from additional education has detrimental effects on children. There may be some delays in their motor and social development, especially for low AFQT mothers, but they do not appear to have any long term undesirable consequences. In fact, it is for low AFQT mothers that maternal education has the largest positive effects on home environments.

For black families this picture is even more evident. The main results are shown in column (3) and (4) of Table 13. The impacts of maternal education on birthweight and motor and social development are positive and large, especially for low ability mothers. An additional year of education leads to about 200 extra hours of work, but also more regular use of formal child care arrangements, prolonged breastfeeding, more time reading to the child, and more children's books in the home (Table 15).

The estimates displayed in Tables 14 and 15 tell a clear and important story: improvements in maternal schooling promote much better home environments during the early years of the child; although more educated mothers work more, they do not spend less quality time with their children, and if anything the opposite is true; it is striking that for many outcomes, for both black and white mothers, it is for low ability mother that education has the largest impact on early home environments.

4.3.2 Young Adulthood

Finally, we examine engagement in some risky behaviors in late adolescence: early dropping out of school, early childbearing, and criminal activity. It is important to keep in mind that many children of the NLSY79 cohort members have not yet reached adulthood. Thus, the children we observe in this age range are mainly from the early cohorts and from mothers with very low birth ages, and the sample size is smaller than for the younger cohorts. Still, at the very least, the following demonstrates that the effect of maternal education follows the children into adulthood.

Table 16 present estimates of the effect of maternal schooling on several outcomes:

Table 16: Young adults – IV results

	IV estimates: Young adults (18-19 years)					
	White			Black		
	Enrollment	Conviction	Own children	Enrollment	Conviction	Own children
	(1)	(2)	(3)	(4)	(5)	(6)
Mother's schooling: All	0.031	-0.002	-0.045	0.010	-0.018	-0.036
	[0.021]	[0.014]	[0.014]***	[0.021]	[0.013]	[0.014]**
Mother's schooling: Male young adult	0.033	-0.004	-0.047	0.005	-0.039	-0.017
	[0.032]	[0.023]	[0.020]**	[0.031]	[0.020]*	[0.018]
Mother's schooling: Female young adult	0.030	-0.001	-0.043	0.016	-0.005	-0.070
	[0.026]	[0.017]	[0.021]**	[0.030]	[0.016]	[0.024]***
Mother's schooling: High AFQT	0.033	-0.012	-0.052	-0.017	-0.040	-0.036
	[0.030]	[0.020]	[0.020]***	[0.033]	[0.018]**	[0.017]**
Mother's schooling: Low AFQT	0.030	0.007	-0.037	0.034	0.007	-0.037
	[0.029]	[0.019]	[0.020]*	[0.030]	[0.020]	[0.023]
Mother's AFQT (corrected): All	0.042	-0.046	0.010	-0.068	-0.049	0.000
	[0.052]	[0.031]	[0.026]	[0.058]	[0.025]*	[0.043]
Observations	935	1047	816	742	889	612
Mean	0.624	0.154	0.091	0.627	0.124	0.157
Standard deviation	0.485	0.361	0.296	0.484	0.329	0.398

Note: This table reports Minimum Distance estimates for the groups indicated based on equation (1), see text for details. A description of the outcome variables is found in Table 1 on page 8. Standard errors reported in brackets, clustered by county-cohort. * indicates significance at 10%, ** indicates significance at 5%, *** indicates significance at 1% level.

a dummy for school enrollment, a dummy for convictions, and the number of own children, all at ages 18 and 19. Among whites, we only observe strong effects on fertility. For blacks, the decrease in the conviction rate is notable for boys and children of high ability mothers, and so is the decrease in fertility, especially for girls.

4.4 Sensitivity Analysis

In this section we examine the sensitivity of our main results, which we presented in section 4.1 above. One possible criticism of our procedure is that, since we are relying on interactions between controls and instruments, if the outcome equation is misspecified then some of our results might be driven by nonlinearities instead of genuine variation in the instruments. Therefore we re-estimate our model with a more flexible specification of the outcome equations, where we add the following variables to the set of controls:

AFQT squared, grandmother's education squared, grandfather's education squared, and all two-way interactions between AFQT, grandmother's education, grandfather's education and whether the mother lived in a broken home at age 14. These additional controls are also interacted with the four group indicators. The IV estimates of the coefficient on maternal schooling are presented in the first row of Panel B of Table 17 (Panel A reproduces our base case result for easy reference). The results are virtually unchanged by this additional set of controls.

All of our results presented included cohort fixed effects. Another specification check is reported in the second row of Panel B, in which we address the possible concern that the four subgroups of interest may follow group-specific trends, by including *group-specific* cohort indicators. Results are essentially unchanged except for PIAT reading at 7-8 and grade repetition at 12-14. Panel C shows results where we vary the set of instruments we use. We show results where we exclude the distance variable and the corresponding interactions, and then both distance and tuition (and corresponding interactions), so that the results rely only on opportunity cost variables. This kind of experiment is interesting as different instruments may affect different subgroups, and this approach has been used to compare returns for different groups (Cameron and Taber, 2004). There is of course a loss of efficiency connected to excluding some of the instruments, so the precision of these estimates is somewhat lower. The return in terms of PIAT scores for ages 7-8 goes up. When we exclude tuition as well, the BPI coefficient goes down and becomes insignificant. But overall, the results are very similar to the base case.

5 Summary and Conclusion

In this paper we study the effect of maternal education on their children's outcomes, including cognitive development as measured by test score performance, behavioral problems, grade repetition, and health outcomes. We also examine home environments

Table 17: Sensitivity (white children)

	Sensitivity analysis (white children)									
	PIAT math		PIAT read.		BPI		Grade repetition		Overweight	
	7-8 yrs	12-14 yrs	7-8 yrs	12-14 yrs	7-8 yrs	12-14 yrs	7-8 yrs	12-14 yrs	7-8 yrs	12-14 yrs
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Panel A: Base case										
IV – Base case	0.097	0.024	0.075	0.018	-0.092	-0.116	-0.028	-0.028	-0.015	-0.012
	[0.031]***	[0.033]	[0.033]**	[0.033]	[0.043]**	[0.041]***	[0.008]***	[0.011]**	[0.013]	[0.013]
	2492	2113	2353	2095	2565	2264	1191	1958	2533	2271
Panel B: Including additional controls										
including polynomials	0.102	0.047	0.080	0.046	-0.093	-0.128	-0.025	-0.030	-0.018	-0.016
and interactions	[0.031]***	[0.034]	[0.033]**	[0.034]	[0.043]**	[0.042]***	[0.009]***	[0.011]***	[0.013]	[0.013]
	2492	2113	2353	2095	2565	2264	1191	1958	2533	2271
including group-specific	0.086	0.018	0.040	0.014	-0.094	-0.112	-0.022	-0.018	-0.012	-0.013
cohort dummies	[0.031]***	[0.034]	[0.033]	[0.032]	[0.044]**	[0.038]***	[0.008]***	[0.012]	[0.013]	[0.012]
	2492	2113	2353	2095	2565	2264	1191	1958	2533	2271
Panel C: Varying the set of instruments										
IV – Excluding distance variable	0.107	0.033	0.109	0.023	-0.104	-0.126	-0.032	-0.021	-0.015	-0.008
	[0.035]***	[0.038]	[0.038]***	[0.035]	[0.045]**	[0.043]***	[0.010]***	[0.012]*	[0.013]	[0.015]
	2492	2113	2353	2095	2565	2264	1191	1958	2533	2271
IV – Excluding distance variable	0.116	-0.006	0.098	0.038	-0.049	-0.081	-0.021	-0.023	-0.022	-0.012
and tuition variable	[0.041]***	[0.044]	[0.045]**	[0.042]	[0.062]	[0.056]	[0.011]**	[0.014]*	[0.017]	[0.018]
	2492	2113	2353	2095	2565	2264	1191	1958	2533	2271

Note: This table reports IV estimates, showing the estimated average effect across all groups using the MD procedure as before. Panel A reproduces the main results for easy reference. Panel B then adds additional controls. 'Polynomials and interactions' includes polynomials of AFQT and grandparents' education, and two-way interactions between AFQT, grandparents' education, and broken home status. All of these additional regressors are also interacted with the four group indicators. 'Group specific cohort dummies' adds interactions of cohort indicators with group indicators to the base specification. Panel C presents IV estimates based on a subset of the instruments, where distance (and corresponding interactions) and distance and tuition (and corresponding interactions) are, respectively, excluded from the analysis. See text for details. * indicates significance at 10%, ** indicates significance at 5%, *** indicates significance at 1% level.

and parental investments. We instrument maternal schooling with local tuition fees, distance to college, and local labor market variables. In the outcome equations we condition on county and time effects, thus removing the impact of permanent differences and aggregate trends. We obtain additional variation in the instruments by allowing the effect to vary with family background of the mother.

Our results show that mother's education increases the child's performance in both math and reading at ages 7-8, but these effects are not seen at ages 12-14. Maternal education also reduces the incidence of behavioral problems and reduces grade repetition, but we find no effect on obesity. More educated mothers delay childbearing, are more likely to be married, have substantially better educated spouses and higher family income. They are more likely to invest in their children through books, providing musical instruments, special lessons, or availability of a computer. Even though they work more, more educated mothers do not spend less time breastfeeding, reading to their children or taking them on outings. Finally, the effect of maternal education persists into adolescence, reducing the number of children born to the young adults at ages 18-19, and the number of criminal convictions for blacks.

A policy implication is that intergenerational transmission is important for understanding long term policy effectiveness. This is important because many programmes are struggling to improve outcomes for poor children. Programmes which manage to increase mothers schooling are likely to be important not only for mothers now but also for their future children, and should be designed and judged with this in mind.

Our interest in understanding the effect of parental education on children's human capital is closely related to the study of intergenerational mobility. Solon (1999) points out that the high correlation between parental income and their offspring's income is well-documented, but that the underlying causes are not very well understood. Our findings suggest that parental educational choices may be an important transmission channel of intergenerational inequality. They imply that an additional year of parental education increases a child's test score performance by about 0.1 of a standard deviation. If a one standard deviation difference in age 7 test scores translates into wage increases of around 4% (Carneiro, Crawford, and Goodman (2007)), then the change in child's earnings due to the additional year of parental education is about 0.4%. If an additional year of parental education increases parental earnings by say 10% (Card, 1999), this mechanism implies that a one percent change in parental income is associated with about a 0.04 percent change in children's earnings. Comparing this to an empirical long-run elasticity between parental and children's earnings of around 0.4 (Solon (1999)), it becomes clear that parental education plays an important role in transmitting inequality. Of course, this is only a rough calculation. Still, it implies that parental education accounts for a substantive part of the intergenerational correlation in earnings, and it supports the view that educational policy can influence intergenerational mobility.

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A Appendix

Table 18: Family environment – OLS results: White children

	OLS estimates: White children (7-8 years)						
	Maternal age	Number of children	Marital status	Spouse schooling	Hours worked	Lg family income	Maternal aspirations
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Mother's schooling: All	0.984	-0.037	0.016	0.533	71.027	0.152	0.047
	[0.053]***	[0.024]	[0.006]***	[0.043]***	[13.050]***	[0.013]***	[0.008]***
Mother's schooling: Male child	0.936	-0.040	0.019	0.557	74.430	0.156	0.046
	[0.064]***	[0.026]	[0.007]***	[0.049]***	[16.365]***	[0.016]***	[0.011]***
Mother's schooling: Female child	1.041	-0.033	0.012	0.509	67.913	0.149	0.048
	[0.069]***	[0.027]	[0.007]	[0.050]***	[15.874]***	[0.015]***	[0.011]***
Mother's schooling: High AFQT	0.959	-0.025	0.015	0.548	53.733	0.155	0.045
	[0.070]***	[0.030]	[0.007]**	[0.059]***	[18.347]***	[0.017]***	[0.010]***
Mother's schooling: Low AFQT	1.016	-0.057	0.017	0.517	91.878	0.148	0.050
	[0.080]***	[0.039]	[0.011]	[0.063]***	[20.300]***	[0.019]***	[0.014]***
Mother's AFQT (corrected): All	-0.231	0.080	0.032	0.043	130.226	0.202	0.003
	[0.183]	[0.089]	[0.023]	[0.146]	[50.983]**	[0.049]***	[0.035]
Observations	4395	4395	4391	3335	4307	3796	1235
Mean	24.282	2.752	0.770	13.231	1152.305	10.361	0.764
Standard deviation	4.632	1.195	0.421	2.490	950.919	0.970	0.425

Note: This table reports Minimum Distance estimates for the groups indicated based on equation (1), see text for details. A description of the outcome variables is found in Table 1 on page 8. Standard errors reported in brackets, clustered by county-cohort. * indicates significance at 10%, ** indicates significance at 5%, *** indicates significance at 1% level.

Table 19: Family environment – OLS results: Black children

	OLS estimates: Black children (7-8 years)						
	Maternal age	Number of children	Marital status	Spouse schooling	Hours worked	Lg family income	Maternal aspirations
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Mother's schooling: All	1.025	-0.190	0.034	0.460	175.560	0.156	0.071
	[0.078]***	[0.032]***	[0.011]***	[0.073]***	[17.140]***	[0.016]***	[0.016]***
Mother's schooling: Male child	1.106	-0.210	0.048	0.446	178.186	0.169	0.081
	[0.098]***	[0.040]***	[0.013]***	[0.084]***	[19.795]***	[0.017]***	[0.018]***
Mother's schooling: Female child	0.941	-0.181	0.023	0.468	171.745	0.122	0.053
	[0.100]***	[0.034]***	[0.012]*	[0.076]***	[22.375]***	[0.022]***	[0.023]**
Mother's schooling: High AFQT	1.154	-0.158	0.021	0.386	93.849	0.163	0.039
	[0.129]***	[0.051]***	[0.019]	[0.115]***	[29.230]***	[0.032]***	[0.027]
Mother's schooling: Low AFQT	0.942	-0.212	0.040	0.510	215.690	0.154	0.083
	[0.102]***	[0.042]***	[0.013]***	[0.094]***	[20.712]***	[0.018]***	[0.018]***
Mother's AFQT (corrected): All	-0.148	0.017	0.095	0.086	154.825	0.208	0.100
	[0.272]	[0.108]	[0.041]**	[0.230]	[77.030]**	[0.073]***	[0.062]
Observations	2647	2647	2646	943	2624	2129	422
Mean	22.070	3.097	0.375	12.688	1139.074	9.638	0.656
Standard deviation	4.489	1.413	0.484	2.095	991.853	0.930	0.475

Note: This table reports Minimum Distance estimates for the groups indicated based on equation (1), see text for details. A description of the outcome variables is found in Table 1 on page 8. Standard errors reported in brackets, clustered by county-cohort. * indicates significance at 10%, ** indicates significance at 5%, *** indicates significance at 1% level.

Table 20: Investments – OLS results: White children

	OLS estimates: White children							
	Museum 7-8 yrs	Musical Instr. 7-8 yrs	Special lesson 7-8 yrs	Mother reads 7-8 yrs	Newspaper 7-8 yrs	Computer 12-14 yrs	Adult home 12-14 yrs	Joint meals 12-14 yrs
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Mother's schooling: All	0.039	0.041	0.050	0.042	0.013	0.056	-0.010	0.004
	[0.008]***	[0.007]***	[0.006]***	[0.007]***	[0.009]	[0.009]***	[0.009]	[0.009]
Mother's schooling: Male child	0.041	0.043	0.047	0.047	0.012	0.058	0.005	0.011
	[0.010]***	[0.009]***	[0.008]***	[0.009]***	[0.010]	[0.012]***	[0.011]	[0.012]
Mother's schooling: Female child	0.037	0.039	0.053	0.036	0.014	0.054	-0.028	-0.003
	[0.010]***	[0.009]***	[0.009]***	[0.010]***	[0.010]	[0.011]***	[0.012]**	[0.012]
Mother's schooling: High AFQT	0.038	0.035	0.048	0.040	0.016	0.040	-0.016	-0.007
	[0.010]***	[0.010]***	[0.008]***	[0.010]***	[0.011]	[0.012]***	[0.012]	[0.013]
Mother's schooling: Low AFQT	0.040	0.049	0.054	0.044	0.009	0.077	-0.004	0.015
	[0.012]***	[0.011]***	[0.011]***	[0.011]***	[0.012]	[0.013]***	[0.012]	[0.013]
Mother's AFQT (corrected): All	-0.023	0.040	0.009	-0.015	0.030	0.025	-0.047	-0.021
	[0.028]	[0.031]	[0.027]	[0.029]	[0.029]	[0.032]	[0.030]	[0.033]
Observations	2646	2644	2643	2649	2646	1681	2036	2292
Mean	0.424	0.513	0.682	0.492	0.526	0.681	0.671	0.565
Standard deviation	0.494	0.500	0.466	0.500	0.499	0.466	0.470	0.496

Note: This table reports Minimum Distance estimates for the groups indicated based on equation (1), see text for details. A description of the outcome variables is found in Table 1 on page 8. Standard errors reported in brackets, clustered by county-cohort. * indicates significance at 10%, ** indicates significance at 5%, *** indicates significance at 1% level.

Table 21: Investments – OLS results: Black children

	OLS estimates: Black children							
	Museum 7-8 yrs	Musical Instr. 7-8 yrs	Special lesson 7-8 yrs	Mother reads 7-8 yrs	Newspaper 7-8 yrs	Computer 12-14 yrs	Adult home 12-14 yrs	Joint meals 12-14 yrs
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Mother's schooling: All	0.029	0.035	0.064	0.060	-0.000	0.049	-0.030	0.004
	[0.010]***	[0.011]***	[0.011]***	[0.011]***	[0.013]	[0.014]***	[0.011]***	[0.011]
Mother's schooling: Male child	0.022	0.029	0.056	0.053	0.009	0.056	-0.023	0.006
	[0.013]*	[0.012]**	[0.015]***	[0.015]***	[0.014]	[0.017]***	[0.014]	[0.015]
Mother's schooling: Female child	0.038	0.047	0.072	0.065	-0.021	0.041	-0.035	0.003
	[0.015]**	[0.017]***	[0.014]***	[0.013]***	[0.018]	[0.019]**	[0.013]***	[0.013]
Mother's schooling: High AFQT	0.027	0.032	0.093	0.061	-0.010	0.056	-0.021	0.011
	[0.019]	[0.022]	[0.019]***	[0.017]***	[0.021]	[0.024]**	[0.018]	[0.016]
Mother's schooling: Low AFQT	0.029	0.036	0.050	0.059	0.006	0.046	-0.033	-0.002
	[0.012]**	[0.012]***	[0.013]***	[0.013]***	[0.017]	[0.017]***	[0.012]***	[0.016]
Mother's AFQT (corrected): All	-0.002	0.007	0.018	-0.070	0.091	0.090	0.009	-0.068
	[0.042]	[0.044]	[0.041]	[0.043]	[0.049]*	[0.048]*	[0.042]	[0.048]
Observations	1306	1305	1304	1308	1306	906	1306	1431
Mean	0.405	0.336	0.447	0.320	0.419	0.352	0.694	0.316
Standard deviation	0.491	0.472	0.497	0.467	0.494	0.478	0.461	0.465

Note: This table reports Minimum Distance estimates for the groups indicated based on equation (1), see text for details. A description of the outcome variables is found in Table 1 on page 8. Standard errors reported in brackets, clustered by county-cohort. * indicates significance at 10%, ** indicates significance at 5%, *** indicates significance at 1% level.

Table 22: Early outcomes – OLS results

	OLS estimates: Children 0-1 years			
	Whites		Blacks	
	Low birthweight	MSD	Low birthweight	MSD
	(1)	(2)	(3)	(4)
Mother's schooling: All	-0.001	-0.044	-0.005	0.011
	[0.003]	[0.016]***	[0.007]	[0.035]
Mother's schooling: Male child	-0.004	-0.041	-0.006	0.019
	[0.004]	[0.018]**	[0.008]	[0.039]
Mother's schooling: Female child	0.004	-0.049	-0.003	-0.007
	[0.005]	[0.023]**	[0.009]	[0.053]
Mother's schooling: High AFQT	-0.003	-0.046	0.004	-0.022
	[0.004]	[0.018]**	[0.009]	[0.058]
Mother's schooling: Low AFQT	0.003	-0.037	-0.014	0.028
	[0.005]	[0.029]	[0.009]	[0.042]
Mother's AFQT (corrected): All	-0.007	-0.032	-0.003	-0.193
	[0.012]	[0.063]	[0.023]	[0.132]
Observations	5580	2136	2806	781
Mean	0.065	-0.039	0.130	0.184
Standard deviation	0.246	0.994	0.337	1.216

Note: This table reports Minimum Distance estimates for the groups indicated based on equation (1), see text for details. A description of the outcome variables is found in Table 1 on page 8. Standard errors reported in brackets, clustered by county-cohort. * indicates significance at 10%, ** indicates significance at 5%, *** indicates significance at 1% level.

Table 23: Early channels – OLS results: white children

	OLS estimates: White children 0-1 years							
	Smoking d. pregnancy	Weeks breastfeeding	Formal child care	Hours worked	Mother reads	Book	Soft toys	Outings
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Mother's schooling: All	-0.062	1.361	0.010	113.796	0.031	0.088	-0.185	-0.002
	[0.006]***	[0.337]***	[0.003]***	[10.507]***	[0.006]***	[0.013]***	[0.173]	[0.007]
Mother's schooling: Male child	-0.065	0.925	0.008	121.788	0.037	0.104	-0.167	-0.008
	[0.008]***	[0.393]**	[0.004]**	[11.946]***	[0.008]***	[0.018]***	[0.205]	[0.009]
Mother's schooling: Female child	-0.056	2.017	0.013	102.060	0.026	0.075	-0.218	0.004
	[0.009]***	[0.454]***	[0.004]***	[13.418]***	[0.008]***	[0.016]***	[0.266]	[0.009]
Mother's schooling: High AFQT	-0.053	1.516	0.013	96.074	0.029	0.084	-0.211	-0.012
	[0.008]***	[0.416]***	[0.004]***	[13.952]***	[0.007]***	[0.016]***	[0.226]	[0.008]
Mother's schooling: Low AFQT	-0.079	1.081	0.008	135.521	0.038	0.098	-0.140	0.015
	[0.011]***	[0.558]*	[0.004]*	[15.396]***	[0.012]***	[0.024]***	[0.301]	[0.011]
Mother's AFQT (corrected): All	-0.072	1.697	0.022	72.402	0.023	0.093	2.333	0.016
	[0.028]**	[1.185]	[0.009]**	[39.045]*	[0.028]	[0.053]*	[0.668]***	[0.026]
Observations	2293	2220	4850	5942	2358	2382	2343	2380
Mean	0.287	15.370	0.066	926.749	0.607	3.240	16.654	0.691
Standard deviation	0.452	22.126	0.248	880.676	0.489	1.062	12.456	0.462

Note: This table reports Minimum Distance estimates for the groups indicated based on equation (1), see text for details. A description of the outcome variables is found in Table 1 on page 8. Standard errors reported in brackets, clustered by county-cohort. * indicates significance at 10%, ** indicates significance at 5%, *** indicates significance at 1% level.

Table 24: Early channels – OLS results: Black children

	OLS estimates: Black children 0-1 years							
	Smoking d. pregnancy	Weeks breastfeeding	Formal child care	Hours worked	Mother reads	Book	Soft toys	Outings
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Mother's schooling: All	-0.044	1.528	0.021	175.101	0.059	0.183	0.324	0.007
	[0.013]***	[0.386]***	[0.005]***	[14.367]***	[0.013]***	[0.030]***	[0.233]	[0.011]
Mother's schooling: Male child	-0.027	1.544	0.017	172.874	0.069	0.189	0.536	0.009
	[0.015]*	[0.447]***	[0.006]***	[17.046]***	[0.015]***	[0.037]***	[0.301]*	[0.016]
Mother's schooling: Female child	-0.066	1.505	0.025	177.183	0.043	0.177	0.162	0.005
	[0.016]***	[0.493]***	[0.006]***	[16.732]***	[0.019]**	[0.038]***	[0.275]	[0.016]
Mother's schooling: High AFQT	-0.054	0.824	0.025	135.635	0.072	0.203	0.521	-0.015
	[0.016]***	[0.936]	[0.008]***	[27.401]***	[0.022]***	[0.042]***	[0.431]	[0.016]
Mother's schooling: Low AFQT	-0.031	1.598	0.019	190.480	0.052	0.170	0.233	0.028
	[0.020]	[0.395]***	[0.005]***	[17.002]***	[0.017]***	[0.036]***	[0.287]	[0.016]*
Mother's AFQT (corrected): All	0.040	0.396	0.007	152.300	0.002	0.133	-1.587	0.020
	[0.045]	[1.209]	[0.015]	[59.588]**	[0.047]	[0.095]	[0.921]*	[0.039]
Observations	861	855	2257	2965	894	897	889	897
Mean	0.278	5.513	0.070	767.310	0.371	2.337	11.227	0.661
Standard deviation	0.448	13.905	0.254	885.509	0.483	1.190	10.086	0.474

Note: This table reports Minimum Distance estimates for the groups indicated based on equation (1), see text for details. A description of the outcome variables is found in Table 1 on page 8. Standard errors reported in brackets, clustered by county-cohort. * indicates significance at 10%, ** indicates significance at 5%, *** indicates significance at 1% level.

Table 25: Young adults – OLS results

	OLS estimates: Young adults (18-19 years)					
	White			Black		
	Enrollment	Conviction	Own children	Enrollment	Conviction	Own children
	(1)	(2)	(3)	(4)	(5)	(6)
Mother's schooling: All	0.025	-0.011	-0.022	0.031	-0.011	-0.042
	[0.013]*	[0.008]	[0.009]***	[0.017]*	[0.009]	[0.011]***
Mother's schooling: Male young adult	0.019	-0.025	-0.008	0.027	-0.043	-0.028
	[0.017]	[0.013]**	[0.013]	[0.023]	[0.014]***	[0.013]**
Mother's schooling: Female young adult	0.031	-0.001	-0.037	0.035	0.002	-0.067
	[0.017]*	[0.010]	[0.013]***	[0.023]	[0.010]	[0.018]***
Mother's schooling: High AFQT	0.020	-0.014	-0.019	0.015	-0.018	-0.037
	[0.017]	[0.012]	[0.014]	[0.029]	[0.015]	[0.016]**
Mother's schooling: Low AFQT	0.031	-0.008	-0.025	0.038	-0.007	-0.045
	[0.018]*	[0.012]	[0.012]**	[0.020]*	[0.011]	[0.014]***
Mother's AFQT (corrected): All	0.047	-0.041	-0.005	-0.073	-0.047	0.007
	[0.046]	[0.031]	[0.023]	[0.059]	[0.026]*	[0.042]
Observations	935	1047	816	742	889	612
Mean	0.624	0.154	0.091	0.627	0.124	0.157
Standard deviation	0.485	0.361	0.296	0.484	0.329	0.398

Note: This table reports Minimum Distance estimates for the groups indicated based on equation (1), see text for details. A description of the outcome variables is found in Table 1 on page 8. Standard errors reported in brackets, clustered by county-cohort. * indicates significance at 10%, ** indicates significance at 5%, *** indicates significance at 1% level.