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Part 3 of 3

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Chapter 3

Effects of Parental Characteristics on the Returns to Education, and Labor Market Experience

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Introduction

This chapter examines whether the education and experience slopes of wages vary systematically with cognitive ability and with family background characteristics that influence the quantity of formal education chosen. This question is of interest for two reasons. First, experience and education are among the two most important determinants of earnings. While there is an enormous literature seeking to measure the relationship between earnings and these two variables, only a few studies have examined the extent to which the return to these variables depends on worker characteristics. In particular, little is known about how family background influences the wage benefits of education and of time spent in the labor market. This is surprising in light of the fact that there is an extensive literature documenting the effects of parental characteristics on both the educational attainment and on the income of children. The literature on parental effects on children's income focusses on the direct effect of inherited ability and family environment on wage levels rather than on the effects of these variables on the rate of return to

education and experience.[1] Some educational attainment studies have examined the influence of parents' education and financial resources on years of schooling and achievement in school, and a smaller number have examined parental effects on school quality.[2] However, there is little evidence on whether parents and the family influence the rate of return to education and experience in the labor market.[3] More generally, little is known about the determinants of the value of a year of school.[4]

Our second reason for being interested in family determinants of education slopes is as a source of family differences in the demand for

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1. For example, all of the studies surveyed in Griliches (1979) assume that the rate of return to education is the same for all individuals.

2. See Siebert (1985) for a discussion of this literature and detailed references.

3. We discuss a parallel study by Altonji (1988) below. Hauser (1973) finds little evidence that father's occupation has much effect on the return to education for men in a cross section analysis that permits the education slope and intercept to vary with father's occupation. Using the Kalamazoo twins data, Olneck (Chapter 6 in Jencks et al., Who Gets Ahead?) finds little evidence that education slopes differ by IQ or by father's education.

4. Altonji (1988) and Morgan and Sirageldin (1968) are examples of studies that examine the relationship between school variables and future earnings and provide references to a small number of other studies. There is a large literature on race and sex differences in the rates of return to education. (See Cain (1986) and Welch (1973).) However, Welch (1973) and a recent paper by Card and Krueger (1990) are among a handful of studies that have looked at the effects of schooling inputs on the returns to education. Card and Krueger find substantial effects of student/teacher ratio, the relative salary of teachers, and the length of the school term on estimates of the rates of return to education. They rely on variation across states and age cohorts in these input measures and do not control for differences in parental inputs. To the extent that differences in the average education of parents raises the demand for school quality in a state and has a positive direct effect on rates of return to education, their results may overstate the effects of school inputs on the return to education. On the other hand, we find little evidence below of a substantial effect of parental education on the return to education.

education. In our data set the correlations of education levels between matched family members are .46 for fathers and sons, .43 for mothers and sons, .40 for fathers and daughters, .41 for mothers and daughters, .58 for brothers, .50 for sisters, and .48 for brothers and sisters. Most studies of educational attainment take the view that family background affects education primarily by influencing the amount of education individuals obtain, holding the rate of return to education constant. However, education choice models such as Willis and Rosen (1979) imply that family background characteristics that raise the rate of return to schooling may induce individuals to stay in school longer. Perhaps the strong parental and sibling correlations in years of education arises in part because there is a correlation across family members in the economic value of education.

In this chapter we take advantage of the NLS data on sibling pairs to estimate a simple model which measures parental effects on the education and experience slopes of children. Consider a standard wage equation in which the log wage is specified to depend upon education, and experience, and a set of control variables. We allow the education and experience coefficients to depend upon on other variables, including father's education and mother's education, and an index of family background variables, school characteristics, and personal characteristics that predict years of education completed. We also examine the interaction of the effect of IQ on the relationship between years of education and the wage. Since education as well as the interaction between education and parent's education are likely to depend upon unobserved family characteristics that have an independent influence on wages, there is a strong possibility that omitted family variables will bias estimates of the return to education. We deal with this

by using a sibling fixed effect to control for unobserved variables that are common to siblings. Of course, controlling for the family does not eliminate idiosyncratic differences among siblings in cognitive ability and motivational factors which have an independent effect on both wages and education. In most of our specifications, we control for a measure of IQ to reduce the possibility that ability differences between siblings will lead to biases in the estimated returns.[5] Our hope is that most of the remaining bias is absorbed by the estimate of the main effect of education on wages rather than by the estimates of the extent to which background variables shift the estimates of education. Below we analyze the potential biases using a simple model of wages and the demand for education.

Our main result is that the effect of the child's IQ, father's education, mother's education, and index of family background, secondary school characteristics, and personal characteristics that predict years of schooling completed have only weak influences on the relationship between education and wages, and between labor market experience and wages. In a number of cases, the family background interactions work in the wrong direction or are statistically insignificant. In view of the results, it seems unlikely to us that the effect of family background on the education slope of wages is responsible for more than a small part of the powerful effect of family background on years of school completed.

The paper is organized as follows. Section I presents the econometric framework for the study. Data issues are addressed in section II. Section III presents the empirical results, and in section IV we summarize the

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5. The basic approach was implemented in Altonji (1988) using a small sample for the Panel Study of Income Dynamics, without a control for IQ. His results are discussed below.

findings and offer some suggestions for future research.

I. Econometric Framework

Consider the following log wage equation for a young woman:

$$(1)\quad W_{dht} = Z_{dht}B_1 + Z_{mh}B_2 + Z_{fh}B_3 + r_{dh}ED_{dh} + \Gamma_{dh}EXP_{dht} + \varepsilon_d + \varepsilon_h + u_{dht}$$

In (1) W_{dht} is the log wage, and Z_{mh} and Z_{fh} are characteristics of the mother and father, respectively. The variable ED_{dht} is education, and EXP_{dht} is labor market experience. The vector Z_{dht} consists of other observed characteristics of the woman that affect her wage rates. For expository convenience, we work with a linear specification of the education and experience profiles. However, in most of our empirical work we include an interaction term between education and experience, a cubic specification in education, and a quadratic in experience. Finally, ε_d and ε_h are individual specific and family specific error components; u_{dht} is a transitory error component that we assume is uncorrelated with the other right hand side variables in the equation.

The education and experience slopes r_{dh} and Γ_{dh} depend on family background characteristics that are related to innate cognitive ability, quality of early childhood development, primary and secondary school quality, the amount of time and energy that children devote to schooling when in primary and secondary school, and the success of parents as aides in the formal schooling process and as informal teachers at home. Specifically,

$$(2)\quad r_{dh} = a_1 X_{fh} + a_2 X_{mh} + r + v_h$$

$$\Gamma_{dh} = b_1 X_{fh} + b_2 X_{mh} + \Gamma + \mu_h$$

where v_h and μ_h are unobserved household specific error components affecting rates of return to education and experience. The variables v_h and μ_h may be correlated. One can easily generalize (2) to include person specific variables such as IQ scores, and we do so in the empirical work below.

Using (2) to substitute for r_{dh} and Γ_{dh} in (1) leads to

$$\begin{aligned}(3)\quad W_{dht} &= Z_{dht}B_1 + Z_{mh}B_2 + Z_{fh}B_3 \\ &\quad + [r + a_1 X_{fh} + a_2 X_{mh}]ED_{dh} + [\Gamma + b_1 X_{fh} + b_2 X_{mh}]EXP_{dht} \\ &\quad + \varepsilon_d + \varepsilon_h + v_h ED_{dh} + \mu_h EXP_{dht} + u_{dht}\end{aligned}$$

Because ED_{dh} is likely to be correlated with the error terms ε_h and v_h, least squares estimation of the above equation will lead to biased parameter estimates. However, by differencing (3) for pairs of siblings one can eliminate the terms involving ε_h from the equation. For siblings indexed by d and d', the differenced equation is

$$\begin{aligned}(4)\quad W_{dht} - W_{d'ht} &= [Z_{dht} - Z_{d'ht}]B_1 \\ &\quad + [r + a_1 X_{fh} + a_2 X_{mh}]\,[ED_{dh} - ED_{d'h}] \\ &\quad + [\Gamma + b_1 X_{fh} + b_2 X_{mh}][EXP_{dht} - EXP_{d'ht}] \\ &\quad + \varepsilon_d - \varepsilon_{d'} + v_h[ED_{dh} - ED_{d'h}] + \mu_h[EXP_{dht} - EXP_{d'ht}] + u_{dht} - u_{d'ht}\end{aligned}$$

The error components v_h and μ_h are constant within the household and so

will be uncorrelated with the explanatory variables in the above equation.

However, potential simultaneity problems could arise from the term $\varepsilon_d - \varepsilon_{d'}$, if these idiosyncratic components capturing differences in productivity, say, are correlated to the differences in the education levels chosen by siblings d and d'. In a number of the specifications below, we try to mitigate this problem by adding a measure of IQ to (3), which implies that the difference between the IQ scores of d and d' will appear in (4). However, IQ is almost certainly not a perfect control, and in the next few paragraph we use a simplified model of wages and the demand for education to examine whether our estimates of the effects of parental education on returns to education will be subject to bias.

Suppose that a_2 in equation (2) is equal to zero, that there is no experience slope, and theat Z_{dht} is a constant for all siblings. Also, without much loss of generality, suppose we ignore the transitory wage components. Then (4) reduces to

$$(5)\quad W_{dh} - W_{d'h} = [r + a_1 X_{fh}]\,[ED_{dh} - ED_{d'h}] + \varepsilon_d - \varepsilon_{d'} + v_h[ED_{dh} - ED_{d'h}]$$

Let the young woman's demand for education be

$$(6)\quad ED_{dh} = C_1 + C_2 X_{fh} + C_3 \varepsilon_d + C_4 v_h + \omega_d$$

where C_1 is a constant, $C_2 > 0$, $C_3 > 0$, and $C_4 > 0$. One can easily derive (6) from a model in which individuals seek to maximize the present discounted value of lifetime income, and where the education slope in the wage equation

is related to X_{fh}, ε_d, v_h, and ω_d, and the interest rate used to discount future income depends upon one or more of these variables and on the number of years of education chosen.

Finally, assume that X_{fh} takes on only two values, 0 and 1. Suppose one estimates (5) separately for families with $X_{fh}=0$ and $X_{fh}=1$. The probability limit of the estimator of r for the $X_{fh}=0$ sample will be

$$(7)\quad r + \frac{\mathrm{Cov}([ED_{dh} - ED_{d'h}],\ \varepsilon_d - \varepsilon_{d'} + v_h[ED_{dh} - ED_{d'h}] \mid X_{fh}=0)}{\mathrm{Var}(C_3\ [\varepsilon_d - \varepsilon_{d'}] + [\omega_d - \omega_{d'}] \mid X_{fh}=0)}$$

The probability limit of the estimator of $r + a_1$ for the $X_{fh}=1$ sample is

$$(8)\quad r + a_1 + \frac{\mathrm{Cov}([ED_{dh} - ED_{d'h}],\ \varepsilon_d - \varepsilon_{d'} + v_h[ED_{dh} - ED_{d'h}] \mid X_{fh}=1)}{\mathrm{Var}(C_3\ [\varepsilon_d - \varepsilon_{d'}] + [\omega_d - \omega_{d'}] \mid X_{fh}=1)}$$

The difference between (8) and (7) is the probability limit of the OLS estimator of a_1 that one would obtain if one used the pooled sample of families to estimate (5).

It follows that if the conditional variances and covariances in the above expressions are independent of X_{fh}, then the difference in the coefficients from the two separate regressions is a consistent estimator of a_1 even though (7) is an inconsistent estimator of r and (8) is an inconsistent estimator of $r + a_1$. The argument can easily be generalized to the case in which X_{fh} takes on a variety of values.

In practice, our specifications include nonlinear education terms and

other explanatory variables. Some specifications include more than one interaction term with education, and all of our models include a measure of experience, which was omitted from the above discussion entirely. But the above analysis provides some basis for believing that the bias in the estimate of a_1 (the influence of the father's characteristics on the daughter's return to education) will be small even if the bias in the estimate of r is large.

A Fixed Effect Approach

In practice, it is not efficient to work with the differenced equation (4). Our panel data set provides more than one observation on (3) for most individuals in the sample. Furthermore, for some households more than one sibling is in the sample, and for others only one child is in the sample. In these circumstances a more efficient estimation approach is to work with (3) and include a separate intercept for each family (a fixed effect) to eliminate ε_h. This permits us to use the time variation in experience for each individual to identify experience effects and the effects of parental characteristics on the experience slope even in the case of individuals who do not have a sibling in the sample. It is also a convenient way to use all of the data on households with more than two children. Applying OLS to (3) with a separate constant for each household is equivalent to estimating

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\begin{aligned}
(9)\quad W_{dht} - W_h = {} & (Z_{dht} - Z_h)B_1 + \\
& + [r + a_1X_{fh} + a_2X_{mh}](ED_{dh} - ED_h) + v_h(ED_{dh} - ED_h) \\
& + [\Gamma + b_1X_{fh} + b_2X_{mh}](EXP_{dht} - EXP_h) + \mu_h(EXP_{dht} - EXP_h) \\
& + \varepsilon_d - \bar{\varepsilon}_d + u_{dht} - u_h
\end{aligned}
$$

where Z_h are the averages of the characteristics of all the daughters in household h, ED_h is the average education level and EXP_h the average labor market experience of the daughters in household h, $\bar{\varepsilon}_d$ is the average daughter component, and u_h is the average idiosyncratic component of their wages.

When data for only one daughter from household h is available, the terms involving $(ED_{dh} - ED_h)$ drop out of (9), but the experience terms, including the interaction, remain.

We use the same framework to study young men and brothers. When we pool data for young men and young women we permit all of the coefficients involving experience and education, except the interactions between X_{fh} and X_{mh} to vary with gender. We also allow for separate intercepts for males and females. In pooled case we are implicitly assuming that unobserved common family characteristics have the same effect on both young men and young women. If the effects enter differently for males and females, then they will not be eliminated when we add a separate intercept for females to (9).[6] Consequently, we are not sure how much emphasis to place on the fixed effects results based on the pooled sample.

3. Data

The data are based on the Young Men and Young Women cohorts of the NLS. The sample selection criteria and most of the variables are discussed in Chapter 1. The dependent variable in all regressions is the log of the young man's or woman's reported wage for a given year. Note that an individual may

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[6]. In Chapter 2 we find that there do exist gender differences in the effects of parental wage factors and of "sibling" wage factors on the wage rates of young men and young women.

contribute more than one observation to his or her sample.[7] The measures of parental education (DADED and MOMED) are based on young men and young women's survey reports, since the use of information provided by the parents themselves would limit the sample to only those young men and young women whose parents are found in the mature women and older men's cohorts. Missing data on IQ scores and on mother's and father's education poses a problem for the study. When IQ is missing, (31 percent of the sample for young men and 30.5 percent for young women) we code all variables that depend on IQ as zero. All of our equations that involve IQ also include a dummy variable that is one if data on the IQ score are missing and is zero otherwise. Missing data for DADED (25.1 percent for young men, and 26.9 for women) and MOMED (13.3 percent for young men, and 10.9 for women) are handled in the same way. Since missing data on DADED are likely to be related to whether the individual's father was present in the household while he or she was growing up, we feel that it is inappropriate to simply eliminate cases with missing data from the analysis.[8]

In addition to IQ, DADED, and MOMED, we constructed a predicted educational attainment variable called EDINDEX. EDINDEX is a measure of the deviation of a child's "expected" highest grade completed from his or her group's mean expected highest grade completed. It was constructed as the predicted value from a regression of the child's highest grade completed on a set of parental and school quality variables that predict education, and perhaps influence the child's potential wages. Specifically, the parental

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7. In fact, the average number of observations per young man is 4.66; 3.66 for young women. See this chapter's Appendix for summary statistics and more detailed descriptions of the young men's and women's data sets.

8. As we note below, most of our results are robust to restricting the sample to individuals with nonmissing data on IQ, DADED, MOMED, and EDINDEX.

variables are race, parents' educational goal for child at age 14, parental encouragement to continue education past high school, and indicators for whether the natural father was present and for whether the natural mother was present in the household when child was 14 years old, for whether the mother worked when child was 14 years old (young men were not asked this question), and for whether there were two parents (including step- parents) in the household when the child was 14 years old. The school quality measures are a normalized school quality index, student-teacher ratio, counsellor-student ratio, mean teacher's salary, expenditure/pupil, average hours of homework/pupil, and indicators for private school, child's subjects most liked and disliked, and curriculum type (college preparatory, commercial, or vocational). We re-code variables that are missing for a particular individual to zero and include missing variable indicators in the equation. The regression equation used to compute EDINDEX was estimated separately for young men and for young women. For each group EDINDEX is normalized to have a mean of zero.

The hypothesis underlying our use of EDINDEX is that variables that influence how much education individuals obtain also influence the response of wages to a year of schooling. There are too many variables that could be related to the quality of schooling to investigate each separately.

We work with cubic specifications for education and IQ and a quadratic for experience. We parameterize the models so that the coefficient on the linear education term is the marginal rate of return to education for an individual with 12 years of education. When interactions between education and any or all of IQ, DADED, MOMED, and EDINDEX are included, the equations are parameterized so that the coefficient on education is the marginal rate of

return to education for an individual with 12 years of education, an IQ of 100, the sample mean of EDINDEX (which is zero), and a mother and father who each have 12 years of education.[9]

Although not shown in the tables, all equations without family fixed effects include dummy variables for the year for which the wage is reported, child's race, residence in an SMSA, residence in the South, two parents in the household when the child was age 14, in addition to number of siblings, experience (more precisely, potential experience, calculated as number of years since last enrolled in school)[10] and experience squared, and the child's education interacted with his or her experience.[11] In the models with family

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9. All specifications that include interactions between education and any or all of IQ, DADED, MOMED, or EDINDEX also include interactions between education and the corresponding missing dummy variable(s).

10. In creating the experience variable we set experience to (age - 14) for those who never enrolled in school or had zero years of schooling. We set it to age minus the school leaving age for other cases. Unfortunately, we did not notice until after the paper was essentially completed that the school leaving age is inconsistent with the data on age and/or the years of schooling in a few cases. As a result, (age - experience) is less than 14 years for 1.0 percent of the young men's observations and 2.6 percent of the young women's observations. This explains the fact that the difference in Table A1 between the maximum of age and the maximum of experience is 11 years for men and 8 years for women.

When we eliminate these observations and re-estimate the young men's wage equation with fixed effects (Table 5, column 1), the effect of the first year of experience for an individual with 12 years of education falls from 2.65 to 2.59. The effect of education for an individual with 12 years falls from 3.27 to 3.08. For young women the effect of the first year of experience falls from .634 to .544 and effect of education falls from 7.48 to 7.19 (Table 7, column 1). We re-estimated all of the models reported in the tables and found that in all cases the interactions of father's education, mother's education, EDINDEX, and IQ with education and with experience are not dramatically different from those reported in the tables.

11. In the models <u>with</u> family fixed effects, race and number of siblings are excluded from the control variables since they should be constant within the family, and therefore their effects are captured by the family fixed effect. For consistency when we work with the young men's data set, we replace each young man's reports of DADED and MOMED in the interaction terms with the average of the reports of all the brothers in the family. Similar

fixed effects, those individuals who do not have siblings in the sample help to identify the effects of experience, the year, and the residence variables.

III. Estimation Results

In section III.1 we discuss the effects of father's education and mother's education on the education slope. In sections III.2 and III.3 we consider the effects on the education slope of IQ and of the index of determinants of education. In section III.4 we discuss the effects of the various interaction terms on the experience slopes of young men and young women.

III.1 The Effects of Father's and Mother's Education on the Education Slope

Table 1 presents a set of wage equations for young men with a fixed effect included for each family. All coefficients and standard errors have been multiplied by 100 to make the tables easier to read.[12] To provide a basis for assessing whether family background has an important influence on education slopes, we first discuss the size of the effect of education on wages for a typical individual with 12 years of education. A base line

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recodings are done for the young women's data set, and the pooled data set when family fixed effects were added. Nearly 96 % of young men who have brothers supply a DADED report that differs by no more than one half year from the average report over all the brothers in the family. For mother's education, the figure is 94%. For young women, the corresponding percentages are 93, and 93. Finally, for the pooled sample of young men and young women, 83% of individuals have a DADED report within one half year of the average over all his or her siblings' reports, 85 % for MOMED.

12. Standard errors have not been corrected to account for the serial correlation across time for a given individual. The standard errors for the equations without fixed effects also ignore correlation among the errors terms of members of the same family.

equation with all background interaction effects excluded is reported in column 1 of the table. The coefficient on education is to be interpreted as the marginal effect of education when education equals 12 years. The estimated coefficient is 3.41 with a standard error of .801.[13] When we add a cubic specification for IQ, the education coefficient falls to 3.27 (column 2).

In column 4 we add the interaction between father's education and the son's education. The coefficient is .039, which has the expected sign, but is small in magnitude relative to the main effect of an additional year of education, and is not significantly different from zero. The interaction between mother's education and the son's education in column 5 has a coefficient (standard error) of .286 (.199). This result is consistent with a modest effect of mother's education on the return to education, but the evidence is weak. However, when we restrict the sample to individuals with nonmissing data on all of DADED, MOMED, IQ, and EDINDEX, the coefficient on the mother's education interaction rises to .730 and is significant. When we allow for both parents' interactions (in column 6 of Table 1) the coefficient on the mother's education interaction increases and the father's becomes negative. Both coefficients are imprecisely estimated, though.

In an effort to get more precise estimates at the cost of possible bias from the omitted family variables that are correlated with the young man's education and his parents' education, we report estimates <u>without</u> family fixed

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13. When fixed effects are included, we estimate the difference in log wages (times 100) associated with increasing education from 10 years to 12, 14, and 16 to be 6.33, 14.10, and 23.25 (respectively). For young women the corresponding estimates are 15.47, 30.18, and 41.87. When fixed effects are excluded, the estimates are 8.82, 18.06, and 27.14 for young men and 11.74, 24.87, and 38.90 for young women.

effects in Table 2. The estimate of the rate of return when only parents' education is controlled for (column 1) is 4.39, which is in the low range of estimates from other studies that do not contain detailed controls for family variables. (Recall that when family fixed effects were controlled for, the education coefficient was 3.41). The interaction between father's education and the son's education has a coefficient of .074 with a standard error .034. The interaction between mother's education and son's education has a coefficient of .080 with a standard error of .036. When we include both parents' interactions, both coefficients fall somewhat.

Taken together, the results with and without family effects imply that parental education has a small positive effect on the relationship between education and wages for young men. A point estimate of .1 implies that 4 additional years of parent education raises the child's rate of return by .4, which is modest relative to an overall return to education of 4 or 5 percent.

Results for Women

Tables 3 and 4 report wage equations for young women that are comparable to Tables 1 and 2 for young men. Table 3 includes fixed effects for each family, while Table 4 does not. The base line specifications in column 1 of each of the two tables indicates that the rate of return to education is higher for young women than for young men, and actually increases from 6.26 to 7.78 when we control for family effects (recall that for young men, the education coefficients are generally lower when we include family fixed effects). Altonji (1988) reports a similar pattern using matched data on sisters from the Panel Study of Income Dynamics. The education slopes with and without fixed effects seem to indicate that unobserved family variables

that raise wages for young women are associated with fewer years of education, while the opposite is true for young men. The asymmetry is surprising and deserves careful investigation in future work. Associated with it is a peculiar pattern in which the effect of IQ (level) actually changes from positive to negative when we control for family effects (compare columns 2 through 7 of Tables 3 and 4). When fixed effects are excluded, the coefficient on IQ is similar for young men and young women, around 0.30.[14]

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[14]. For young men, the main effect of IQ has a positive and statistically significant effect on the log wage in nearly all specifications. When family fixed effects are included, the coefficients on the linear, quadratic, and cubic terms imply that the wages of individual in the 75th percentile of IQ scores are 5.6 % higher than individuals in the 25th percentile. When family fixed effects are excluded, the corresponding differential is 5.5 %. For young women we obtain a differential of 5.2 % when family fixed effects are excluded. However, when we add family fixed effects we obtain a negative IQ differential equal to 5.9 %.

We do no have a full explanation for this puzzling result, although it appears to be due in part to an anomaly in the sample of young women who have sisters. We re-estimated our equations without fixed effects on the sample of young women who have sisters in the sample, since this is the sample that identifies the effect of IQ once family fixed effects are added to the equation. In the basic specification in column 2, the effect of IQ is .15 (not significantly different from zero), which is well below value of .30 for the full sample. (In models with family fixed effects, the coefficient estimates are about equal in the two samples.)

We also reestimated the model on a sample that excludes those young women for whom IQ is missing and obtained a negative but statistically insignificant coefficient when fixed effects are included. Years of schooling, wage rates, and EDINDEX are systematically lower for young women for whom IQ is missing. However, the same pattern holds for young men as well. (Since the IQ score was provided by the respondent's high school, it is not surprising that it is more likely to be missing for those who have fewer years of education.) The correlation between IQ and highest grade completed, the time average of the log wage rate, the time average of log hours worked per week (for those who worked positive hours), and EDINDEX are .50, .27, .05, and .48 respectively in the case of young men and .44, .31, -.04, and .46 in the case of young women. Thus, the gender differences in the raw correlations are small.

We also investigated the possibility that part of the return to IQ for young women comes through an effect on the earnings of potential spouses. When we substituted family income for the log wage rate as the dependent variable in the model, we obtained positive IQ coefficients (multiplied by 100) between .01 and .31 when fixed effects are included and a positive coefficient of about .400 without fixed effects.

The coefficient on the interaction of daughter's and father's education (in column 4 of Table 3) implies that a year of father's education past high school increases the daughter's education slope by .116 with a standard error of .187. The corresponding interaction term with mother's education has a coefficient of .547 with a standard error of .212.[15] These results imply a substantially more powerful effect of parental education (especially the mother's) on the education slope for young women than for young men. (Recall, for young men the corresponding estimates were .039 and .286.) In column 6 we again see the mother's education effect becomes stronger and the father's weaker when they enter together in the equation with family fixed effects.

However, both of the parents' education interaction terms become small and negative when family fixed effects are dropped from the analysis; see columns 4 and 5 in Table 4. Although we prefer the estimates with fixed effects included, the imprecision of the estimates in that case preclude us from drawing strong conclusions about the effects of parental education on the education slopes for women. It is also worth noting that Altonji (1988) obtains quantitatively important effects of parental education on the education slopes for young men, but does not find much of an effect for young women. In view of these mixed results, we conclude is that we do not have much evidence that parental education has a strong effect on the return to education for either young men or young women.

III.2 The Effects of IQ on the Education Slope

A number of the specifications include an interaction of the child's

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15. This estimate rises to .820 when the sample is restricted to individuals with nonmissing data on IQ, DADED, MOMED, and EDINDEX.

education with his or her IQ. We are surprised to find that the interaction term is typically negative (and insignificant) with a coefficient of -.015 to .010 for young men. For young women, the IQ interaction coefficient is between .000 and -.057 (and insignificant) when fixed effects are included. When we add fixed effects, the coefficient is -.085 and is highly significant. Thus, we have little evidence that those with higher IQ's benefit more (in percentage terms) from additional years of schooling.

III.3 The Effects of EDINDEX on the Education Slope

Column 7 of Table 1 adds the interaction of education and EDINDEX and the level of EDINDEX to the equation containing cubic specifications of education and IQ, a family fixed effect, and the other standard controls for young men. The main effect of EDINDEX is large and positive (2.81) with a standard error of .734, but the interaction term is negative and insignificant.[16] When the family fixed effects are excluded (Table 2), the coefficient on the education-EDINDEX interaction is .083, but it is not significantly different from zero. (Without fiexed effects, the coefficient on EDINDEX falls from 2.81 to 1.23 with a standard error of .239).[17]

For young women, we obtain EDINDEX interaction coefficient estimates (standard errors) of .086 (.103) when family effects are excluded (Table 4,

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16. Omitting the education-EDINDEX interaction did not have much effect on the coefficients on EDINDEX reported in column 7 of the various tables.

17. Measurement error in reported education might be partially responsible for the positive coefficient on EDINDEX. The decline in the EDINDEX coefficient would be expected if the proportion of the variance in EDINDEX that is across families exceeds the corresponding proportion for education. It might be possible to improve upon our estimates by using the education reports provided by relatives (e.g., parents, brothers or sisters) as instruments for the education reports provided by the respondents.

column 7) and .310 (.310) when family effects are included (Table 3, column 7). The latter indicates that a 3 year difference in predicted education is associated with a difference of almost 1 percentage point in the young woman's rate of return to education. However, the coefficient has a standard error of .310, and is therefore not precisely estimated.

In column 8 of Tables 1 and 2 we simultaneously include the interactions of education with IQ, DADED, MOMED, and EDINDEX in the wage equations for young men. When fixed effects are included (Table 1) the parents' education, IQ, and EDINDEX interactions are all insignificant. When fixed effects are excluded (Table 2) the EDINDEX interaction coefficient increases to .240 with a standard error of .087, while the parents' terms and the IQ interaction remain insignificant. The same general pattern of coefficient changes is observed in the young women's models in Tables 3 and 4.

In summary, we do not have strong evidence that variables that are related to the number of years of education completed have much of an effect on the education slope of wages, although the education-EDINDEX interactions are typically positive and significant in the models that exclude fixed effects and include all of the interaction terms. The level of EDINDEX was found to have a strong positive effect on wages, particularly in the models including fixed effects.

It is also interesting to note that adding EDINDEX reduces the main effect of education. For example, for young men when fixed effects are excluded the education coefficient falls from 3.78 to 3.27 when EDINDEX is added as a control variable (Table 2, columns 2 and 7). The drop is even more dramatic in the models with family fixed effects: from 3.27 to 2.16 (see Table 1). Evidently, variables that are positively related to educational

attainment, and are captured by EDINDEX, have a positive direct effect on wages. This is consistent with evidence that the education slope is biased upward by omitted variables that are correlated with education.[18] However, an alternative explanation is that measurement error in education, which would tend to lower its coefficient, has more of an influence on the education slope once EDINDEX is controlled for. (See footnote 17 for a further discussion.)

III.4 The Effects of IQ and Parental Education on Experience Slopes

Table 5 reports estimates of the interactions between experience and education, IQ, father's education, and mother's education for young men with family fixed effects included in the equations.[19] In column 1, the effect of

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[18]. Screening models emphasize that education has value in the market because it reveals information about worker quality that is difficult for employers to observe directly. Consequently, to the extent that the variables that are included in EDINDEX are hard for employers to observe directly and are indicators of productivity, the decline in the education coefficient is consistent with signalling models that imply that the return to education is in part a return to worker characteristics that are correlated with-- but are not changed by-- secondary and higher education.

However, to the extent that the variables comprising EDINDEX are easily observable, screening models would seem to predict no decrease in the coefficient on education when EDINDEX is added as a regressor. It may be possible to base a test of the screening model on the relative effects on wages of the component of education that can be predicted from information that employers observe and of the component of education that is unpredictable. Clearly, the problem in implementing such a test is uncertainty about what information employers actually can observe.

[19]. In all equations that we report, we include an interaction between education and experience. (The size of the coefficients and associated standard errors of the other interaction terms are only slightly sensitive to the omission or addition of the education-experience interaction term.) The coefficient on this variable is positive, large, and significant for young men-- around .120 with a standard deviation of .030-- indicating that 4 more years of education raises the linear term in the experience slope by .36 to .51, which is large given that the linear term in the experience slope for an individual with 12 years of education is 3.27 when family fixed effects are included. However, we do not find these effects for young women: though the estimated coefficients are all negative, none are significant (see Tables 7 and 8).

one additional year of experience for an individual with no previous experience, 12 years of education, a father and mother each with 12 years of education, and an IQ of 100 is 2.61. The interaction between IQ and experience in column 2 has a coefficient (standard error) of .017 (.005), implying that a 20 point increase in IQ raises the experience slope by .34.[20]

Father's education has a small negative and statistically insignificant interaction with experience and is not very sensitive to whether one controls for the interactions between experience and mother's education and between experience and IQ (see columns 3, 5 and 6). The mother's interaction term is also small, negative, and insignificant in the models with family fixed effects (see columns 4, 5 and 6).

When we do not control for family fixed effects (Table 6) the IQ interaction coefficient rises to .029 with a standard error of .005, and the father's education interaction term rises to .028 with a standard error of .019. However, the coefficient on the interaction between experience and mother's education remains negative and insignificant.

Tables 7 and 8 report a parallel set of results for young women. The coefficients on the IQ-experience interaction are small in magnitude and statistically insignificant whether or not family fixed effects are included. Similarly, the father's and mother's education interaction terms are statistically insignificant and small in magnitude.

In summary, we do not find a strong positive effect of parental education on the experience slopes. In most cases, the point estimates are small, and in some cases, negative. Evidently, the relationship between parental

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[20]. In our sample of young men the 25th and 75th percentiles of the IQ measure are 92 and 112 while the mean is 101.6 and the standard deviation is 15.9. For young women, the corresponding figures are 93, 112, 102.2 and 15.2.

education and general human capital obtained prior to entering the labor market is not strong enough, given the strength of the link between general human capital and investment in on-the-job training, to influence the experience slope. It is interesting to note that IQ has only a small effect on the experience slope. Also, while the experience slope is steeper for more highly educated men, it is (if anything) slightly flatter for more highly educated women.[21] Consequently, the weak relationship between parental education and experience slopes is consistent with the lack of a strong, consistent relationship between the child's own education and ability and his or her experience slope.

IV. Discussion and Conclusion

It should be kept in mind that these results do not rule out the possibility that family characteristics, school characteristics, and individual characteristics that affect expected schooling alter the ex ante return to education. When the effect of education on wages is nonlinear, the

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21. When we pool the young men's and young women's samples and add family fixed effects we find that the experience slope is more than 3 points lower for females than males. It should be kept in mind that our experience measure is a measure of potential experience subsequent to completion of schooling, which may partially explain the smaller coefficient for females.

We also find that coefficients on the interaction between education and experience is typically .085, suggesting a substantial effect of education on the experience slope. This qualitative result and the empirical magnitude is consistent with most of the evidence of which we are aware.

The IQ-experience interaction has a coefficient of .013 (with a standard error of .004) when we use the pooled sample and include family effects, indicating that a 10 point increase in IQ will raise the experience slope by between .05 and .08. The estimate is .021 with a standard error of .004 when family effects are excluded.

Finally, the coefficients on the experience-father's education, and experience-mother's education interactions, which are a main focus of our analysis, are small in magnitude and never statistically significant when we pool the young men's and young women's data.

ex ante return must take account of the fact that educational outcomes are uncertain. Variables that affect years of schooling may raise the ex ante return even if they have no effect or a small negative effect on the response of wages to a given number of years of schooling. To see this, note that if most of the return to college is associated with graduation, then variables that lower the value of a college degree but increase the probability of graduation conditional on starting college may raise the ex ante rate of return to starting college.[22]

A simple way to investigate these issues is to estimate wage equations which do not include education squared and cubed as regressors. In this case, the interaction terms should "get credit" for differences in the average return to education associated with different education levels. Tables 9 and 10 report the results of wage regressions which included linear specifications of education. The results are basically similar to the estimates discussed above.[23]

In this paper we have explored the possibility that education and experience slopes of wage equations are influenced by IQ, parental education, and an index of family background variables, school characteristics, and personal characteristics that predict years of education completed. Our main result is that the effect of the child's IQ, father's education, mother's

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[22] See Weisbrod (1962) for the initial discussion of this distinction and Altonji (1989) for an empirical analysis of ex ante rates of return using data from the High School Class of 1972. He finds that favorable family background and individual characteristics raise the ex ante rate of return to starting college even though his methodology assumes that wage response to education is the same for all individuals.

[23] These results are only suggestive, since variables that have only small effects on average returns may have large effects on marginal returns. To address these issues, it would be necessary to adopt the methodology of Altonji (1989), which is beyond the scope of this paper.

education, and index of family background, secondary school characteristics, and personal characteristics that predict years of schooling completed have only weak influences on the relationship between education and wages, and between labor market experience and wages. In a number of cases, the family background interactions work in the wrong direction or are statistically insignificant. In view of the results, it seems unlikely to us that the effect of family background on the education slope of wages is responsible for more than a small part of the powerful affect of family background on years of school completed.

A substantial research agenda remains. First, we wish to emphasize that in a number of cases, particularly when family fixed effects are included, our estimates are imprecise. Furthermore, the findings for young men are at variance with results in Altonji (1988) using a sample of young men from the PSID. We plan to replicate our analysis using the most recent data from the PSID, which contains large samples of siblings. The recent results of Card and Krueger suggest that educational inputs can have large effects on education slopes. On the other hand, the literature of schooling achievement suggests that family background and peer characteristics are the most important variables in measured educational achievement. There is strong evidence that parental characteristics in particular have a strong relationship to the level of earnings and to the number of years of schooling. It remains to be the seen whether they have a substantial effect on education and experience slopes in wage equations.

Table 1

The Effects of IQ and Parental Education on Wage Levels and Education Slopes

Dependent Variable: Log Real Hourly Wage (1967 Dollars)

Explanatory Variables	Young Men							
	Equations with Family Fixed Effects[1] (Coefficients and Standard Errors Have Been Multiplied by 100)							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Education[2] (based on a cubic specification)	3.41 (.801)	3.27 (.834)	2.27 (.990)	2.69 (1.08)	4.63 (1.03)	3.86 (1.12)	2.16 (.889)	1.84 (1.26)
Education × Experience	.117 (.028)	.117 (.028)	.117 (.028)	.118 (.028)	.119 (.028)	.120 (.028)	.117 (.028)	.121 (.028)
Education × IQ	--	--	.000 (.040)	--	--	--	--	.010 (.040)
Education × DADED[2]	--	--	--	.039 (.164)	--	-.180 (.187)	--	-.216 (.189)
Education × MOMED[2]	--	--	--	--	.286 (.199)	.438 (.229)	--	.406 (.232)
Education × EDINDEX	--	--	--	--	--	--	-.367 (.238)	-.355 (.265)
IQ[3] (based on a cubic specification)	--	.269 (.115)	.315 (.132)	.277 (.115)	.216 (.116)	.226 (.116)	.255 (.116)	.226 (.133)
EDINDEX[4]	--	--	--	--	--	--	2.81 (.734)	2.75 (.754)

NOTES:

1. In addition to the variables reported, all regressions contain the following control variables: year dummies, experience (defined as the number of years since last enrolled in school), experience squared, and indicators for residence in an SMSA and in the South, two parents in the household when the child was 14 years old, and indicators representing missing variable reports.

2. Education is defined as highest grade completed minus 12, so its coefficient is read as the additional wage accruing to a year of education past high school. DADED is the average report over all brothers in the family, rather than the individual young man's report, of father's education minus 12; mother's education (MOMED) is constructed similarly.

3. IQ is defined as the individual's reported IQ score minus 100.

4. EDINDEX is an index of parental influence and school quality factors which predict number of years of education.

5. The typical regression had N= 19298, R^2= .74, and RMSE= .263.

Table 2

The Effects of IQ and Parental Education on Wage Levels and Education Slopes

Dependent Variable: Log Real Hourly Wage (1967 Dollars)

Explanatory Variables	Young Men							
	Equations without Family Fixed Effects[1] (Coefficients and Standard Errors Have Been Multiplied by 100)							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Education[2] (based on a cubic specification)	4.39	3.78	2.95	3.94	3.98	4.02	3.27	2.68
	(.409)	(.415)	(.458)	(.450)	(.435)	(.454)	(.439)	(.496)
Education × Experience	.173	.172	.174	.173	.173	.174	.168	.171
	(.032)	(.032)	(.032)	(.032)	(.032)	(.032)	(.032)	(.032)
Education × IQ	--	--	-.007	--	--	--	--	-.015
			(.013)					(.013)
Education × DADED	--	--	--	.074	--	.050	--	.054
				(.034)		(.037)		(.037)
Education × MOMED	--	--	--	--	.080	.064	--	.064
					(.036)	(.040)		(.040)
Education × EDINDEX	--	--	--	--	--	--	.083	.240
							(.079)	(.087)
IQ[3] (based on a cubic specification)	--	.274	.334	.275	.272	.273	.248	.319
		(.038)	(.044)	(.039)	(.039)	(.039)	(.039)	(.044)
DADED[2]	-.256	-.285	-.267	-.335	-.312	-.319	-.346	-.372
	(.108)	(.108)	(.108)	(.123)	(.109)	(.124)	(.109)	(.124)
MOMED[2]	.607	.553	.537	.535	.492	.477	.513	.421
	(.118)	(.118)	(.118)	(.118)	(.124)	(.126)	(.118)	(.126)
EDINDEX[4]	--	--	--	--	--	--	1.23	.986
							(.239)	(.244)

NOTES:

1. In addition to the variables reported, all regressions contain the following control variables: year dummies, experience (defined as the number of years since last enrolled in school), experience squared, number of siblings, and indicators for race, residence in an SMSA and in the South, two parents in the household when the child was 14 years old, and indicators representing missing variable reports.

2. Education is defined as highest grade completed minus 12, so its coefficient is read as the additional wage accruing to a year of education past high school. A similar interpretation holds for father's education (DADED) and mother's education (MOMED) coefficients.

3. IQ is defined as the individual's reported IQ score minus 100.

4. EDINDEX is an index of parental influence and school quality factors which predict number of years of education.

5. The typical regression had N= 19298, R^2= .29, and RMSE= .386.

Table 3

The Effects of IQ and Parental Education on Wage Levels and Education Slopes

Dependent Variable: Log Real Hourly Wage (1967 Dollars)

Explanatory Variables	Young Women							
	Equations with Family Fixed Effects[1] (Coefficients and Standard Errors Have Been Multiplied by 100)							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Education[2] (based on a cubic specification)	7.78 (.962)	7.48 (.974)	6.58 (1.13)	7.00 (1.13)	9.44 (1.15)	8.57 (1.22)	6.78 (1.01)	6.53 (1.37)
Education × Experience	-.049 (.043)	-.047 (.043)	-.045 (.043)	-.046 (.043)	-.047 (.043)	-.046 (.043)	-.047 (.043)	-.044 (.043)
Education × IQ	--	--	-.000 (.046)	--	--	--	--	-.057 (.050)
Education × DADED[2]	--	--	--	.116 (.187)	--	-.099 (.200)	--	.115 (.205)
Education × MOMED[2]	--	--	--	--	.547 (.212)	.633 (.226)	--	.711 (.234)
Education × EDINDEX	--	--	--	--	--	--	.310 (.310)	.480 (.344)
IQ[3] (based on a cubic specification)	--	-.284 (.132)	-.276 (.146)	-.298 (.133)	-.331 (.133)	-.336 (.133)	-.316 (.132)	-.288 (.146)
EDINDEX[4]	--	--	--	--	--	--	2.71 (.820)	2.97 (.832)

NOTES:

1. In addition to the variables reported, all regressions contain the following control variables: year dummies, experience (defined as the number of years since last enrolled in school), experience squared, and indicators for residence in an SMSA and in the South, two parents in the household when the child was 14 years old, and indicators representing missing variable reports.

2. Education is defined as highest grade completed minus 12, so its coefficient is read as the additional wage accruing to a year of education past high school. DADED is the average report over all sisters in the family, rather than the individual young woman's report, of father's education minus 12; mother's education (MOMED) is constructed similarly.

3. IQ is defined as the individual's reported IQ score minus 100.

4. EDINDEX is an index of parental influence and school quality factors which predict number of years of education.

5. The typical regression had N= 14320, R^2= .72, and RMSE= .263.

Table 4

The Effects of IQ and Parental Education on Wage Levels and Education Slopes

Dependent Variable: Log Real Hourly Wage (1967 Dollars)

Explanatory Variables	Young Women							
	Equations without Family Fixed Effects[1] (Coefficients and Standard Errors Have Been Multiplied by 100)							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Education[2] (based on a cubic specification)	6.26	5.78	5.04	5.15	5.37	5.04	5.14	3.73
	(.502)	(.503)	(.551)	(.537)	(.523)	(.541)	(.520)	(.594)
Education × Experience	-.002	-.022	-.015	-.023	-.021	-.021	-.030	-.025
	(.043)	(.042)	(.042)	(.042)	(.042)	(.042)	(.042)	(.042)
Education × IQ	--	--	-.085	--	--	--	--	-.089
			(.015)					(.016)
Education × DADED	--	--	--	-.119	--	-.107	--	-.072
				(.042)		(.047)		(.047)
Education × MOMED	--	--	--	--	-.081	-.027	--	-.023
					(.044)	(.049)		(.050)
Education × EDINDEX	--	--	--	--	--	--	.086	.379
							(.103)	(.111)
IQ[3] (based on a cubic specification)	--	.296	.398	.302	.300	.303	.259	.368
		(.042)	(.045)	(.042)	(.042)	(.042)	(.043)	(.045)
DADED[2]	.007	-.139	-.137	.049	-.100	.028	-.212	-.104
	(.122)	(.122)	(.122)	(.134)	(.123)	(.135)	(.122)	(.135)
MOMED[2]	.307	.260	.290	.258	.344	.316	.187	.259
	(.137)	(.136)	(.136)	(.137)	(.139)	(.141)	(.137)	(.141)
EDINDEX[4]	--	--	--	--	--	--	1.64	1.54
							(.283)	(.283)

NOTES:

1. In addition to the variables reported, all regressions contain the following control variables: year dummies, experience (defined as the number of years since last enrolled in school), experience squared, number of siblings, and indicators for race, residence in an SMSA and in the South, two parents in the household when the child was 14 years old, and indicators representing missing variable reports.

2. Education is defined as highest grade completed minus 12, so its coefficient is read as the additional wage accruing to a year of education past high school. A similar interpretation holds for father's education (DADED) and mother's education (MOMED) coefficients.

3. IQ is defined as the individual's reported IQ score minus 100.

4. EDINDEX is an index of parental influence and school quality factors which predict number of years of education.

5. The typical regression had N= 14320, R^2= .24, and RMSE= .376.

Table 5

The Effects of IQ and Parental Education on Wage Levels and Experience Slopes

Dependent Variable: Log Real Hourly Wage (1967 Dollars)

Explanatory Variables	Young Men					
	Equations with Family Fixed Effects[1] (Coefficients and Standard Errors Have Been Multiplied by 100)					
	(1)	(2)	(3)	(4)	(5)	(6)
Education[2] (based on a cubic specification)	3.27	3.49	3.31	3.21	3.27	3.44
	(.834)	(.841)	(.840)	(.841)	(.843)	(.847)
Experience[3]	2.65	2.66	2.64	2.61	2.62	2.61
	(.299)	(.308)	(.305)	(.304)	(.307)	(.314)
(Experience)^2	-.071	-.070	-.072	-.071	-.072	-.071
	(.010)	(.010)	(.010)	(.010)	(.010)	(.010)
Education × Experience	.117	.091	.123	.126	.127	.105
	(.028)	(.031)	(.030)	(.030)	(.031)	(.033)
Experience × IQ	--	.017	--	--	--	.018
		(.005)				(.005)
Experience × DADED[2]	--	--	-.034	--	-.028	-.033
			(.020)		(.022)	(.023)
Experience × MOMED[2]	--	--	--	-.023	-.013	-.019
				(.021)	(.024)	(.024)
IQ[4] (based on a cubic specification)	.269	.136	.272	.272	.273	.135
	(.115)	(.121)	(.115)	(.115)	(.115)	(.121)

NOTES:

1. In addition to the variables reported, all regressions contain the following control variables: year dummies, and indicators for residence in an SMSA and in the South, two parents in the household when the child was 14 years old, and indicators representing missing variable reports.

2. Education is defined as highest grade completed minus 12, so its coefficient is read as the additional wage accruing to a year of education past high school. DADED is the average report over all brothers in the family, rather than the individual young man's report, of father's education minus 12; mother's education (MOMED) is constructed similarly.

3. Experience is measured as potential experience, that is, number of years since last enrolled in school.

4. IQ is defined as the individual's reported IQ score minus 100.

5. The typical regression had N = 19298, R^2 = .74, and RMSE = .263.

Table 6

The Effects of IQ and Parental Education on Wage Levels and Experience Slopes

Dependent Variable: Log Real Hourly Wage (1967 Dollars)

Explanatory Variables	Young Men					
	Equations without Family Fixed Effects[1] (Coefficients and Standard Errors Have Been Multiplied by 100)					
	(1)	(2)	(3)	(4)	(5)	(6)
Education[2] (based on a cubic specification)	3.78	4.27	3.96	3.78	3.89	4.28
	(.415)	(.428)	(.423)	(.423)	(.426)	(.435)
Experience[3]	1.35	1.48	1.49	1.35	1.45	1.51
	(.260)	(.268)	(.267)	(.264)	(.268)	(.274)
(Experience)^2	.002	.002	.003	.003	.004	.003
	(.012)	(.012)	(.012)	(.012)	(.012)	(.012)
Education × Experience	.172	.110	.152	.173	.160	.110
	(.032)	(.035)	(.033)	(.033)	(.034)	(.036)
Experience × IQ	--	.029	--	--	--	.028
		(.005)				(.005)
Experience × DADED	--	--	.028	--	.047	.035
			(.019)		(.021)	(.021)
Experience × MOMED	--	--	--	-.026	-.049	-.056
				(.020)	(.022)	(.022)
IQ[4] (based on a cubic specification)	.274	.039	.277	.273	.275	.043
	(.038)	(.058)	(.038)	(.038)	(.038)	(.058)
DADED[2]	-.285	-.274	-.488	-.289	-.678	-.578
	(.108)	(.108)	(.193)	(.109)	(.211)	(.212)
MOMED[2]	.553	.546	.552	.820	1.02	1.08
	(.118)	(.118)	(.118)	(.217)	(.235)	(.235)

NOTES:

1. In addition to the variables reported, all regressions contain the following control variables: year dummies, number of siblings, and indicators for race, residence in an SMSA and in the South, two parents in the household when the child was 14 years old, and indicators representing missing variable reports.

2. Education is defined as highest grade completed minus 12, so its coefficient is read as the additional wage accruing to a year of education past high school. A similar interpretation holds for fatther's education (DADED) and mother's education (MOMED).

3. Experience is measured as potential experience, that is, number of years since last enrolled in school.

4. IQ is defined as the individual's reported IQ score minus 100.

5. The typical regression had N = 19298, R^2 = .29, and RMSE = .384.

Table 7

The Effects of IQ and Parental Education on Wage Levels and Experience Slopes

Dependent Variable: Log Real Hourly Wage (1967 Dollars)

Explanatory Variables	Young Women					
	Equations with Family Fixed Effects[1] (Coefficients and Standard Errors Have Been Multiplied by 100)					
	(1)	(2)	(3)	(4)	(5)	(6)
Education[2] (based on a cubic specification)	7.48	7.31	7.63	7.60	7.66	7.47
	(.974)	(.986)	(.980)	(.983)	(.985)	(.993)
Experience[3]	.634	.509	.726	.672	.715	.593
	(.410)	(.415)	(.415)	(.416)	(.418)	(.422)
(Experience)[2]	.006	.006	.007	.006	.007	.008
	(.014)	(.014)	(.014)	(.014)	(.014)	(.014)
Education × Experience	-.047	-.023	-.065	-.061	-.067	-.040
	(.043)	(.048)	(.045)	(.047)	(.047)	(.050)
Experience × IQ	--	.003	--	--	--	.001
		(.007)				(.007)
Experience × DADED[2]	--	--	.031	--	.023	.027
			(.026)		(.029)	(.030)
Experience × MOMED[2]	--	--	--	.037	.021	.019
				(.029)	(.033)	(.033)
IQ[4] (based on a cubic specification)	-.284	-.315	-.282	-.280	-.280	-.293
	(.132)	(.143)	(.132)	(.132)	(.132)	(.144)

NOTES:

1. In addition to the variables reported, all regressions contain the following control variables: year dummies, and indicators for residence in an SMSA and in the South, two parents in the household when the child was 14 years old, and indicators representing missing variable reports.

2. Education is defined as highest grade completed minus 12, so its coefficient is read as the additional wage accruing to a year of education past high school. DADED is the average report over all brothers in the family, rather than the individual young man's report, of father's education minus 12; mother's education (MOMED) is constructed similarly.

3. Experience is measured as potential experience, that is, number of years since last enrolled in school.

4. IQ is defined as the individual's reported IQ minus 100.

5. The typical regression had N = 14320, R^2 = .72, and RMSE = .263.

Table 8

The Effects of IQ and Parental Education on Wage Levels and Experience Slopes

Dependent Variable: Log Real Hourly Wage (1967 Dollars)

Explanatory Variables	Young Women					
	Equations without Family Fixed Effects[1] (Coefficients and Standard Errors Have Been Multiplied by 100)					
	(1)	(2)	(3)	(4)	(5)	(6)
Education[2] (based on a cubic specification)	5.78	5.79	5.85	5.87	5.89	5.87
	(.503)	(.521)	(.515)	(.523)	(.525)	(.536)
Experience[3]	-.640	-.733	-.588	-.615	-.579	-.684
	(.349)	(.356)	(.355)	(.354)	(.357)	(.362)
(Experience)^2	.030	.030	.031	.030	.030	.030
	(.016)	(.016)	(.016)	(.016)	(.016)	(.016)
Education × Experience	-.022	-.021	-.029	-.032	-.034	-.029
	(.042)	(.046)	(.044)	(.045)	(.045)	(.047)
Experience × IQ	--	.012	--	--	--	.012
		(.006)				(.007)
Experience × DADED	--	--	.006	--	-.004	-.009
			(.023)		(.026)	(.027)
Experience × MOMED	--	--	--	.029	.027	.024
				(.026)	(.029)	(.029)
IQ[4] (based on a cubic specification)	.296	.175	.297	.297	.298	.178
	(.042)	(.074)	(.042)	(.042)	(.042)	(.075)
DADED[2]	-.139	-.137	-.182	-.130	-.074	-.027
	(.122)	(.122)	(.246)	(.122)	(.273)	(.276)
MOMED[2]	.260	.264	.255	-.036	-.031	.008
	(.136)	(.137)	(.137)	(.283)	(.312)	(.313)

NOTES:

1. In addition to the variables reported, all regressions contain the following control variables: year dummies, number of siblings, and indicators for race, residence in an SMSA and in the South, two parents in the household when the child was 14 years old, and indicators representing missing variable reports.

2. Education is defined as highest grade completed minus 12, so its coefficient is read as the additional wage accruing to a year of education past high school. A similar interpretation holds for father's education (DADED) and mother's education (MOMED).

3. Experience is measured as potential experience, that is, number of years since last enrolled in school.

4. IQ is defined as the individual's reported IQ score minus 100.

5. The typical regression had N = 14320, R^2 = .24, and RMSE = .377.

Table 9

The Effects of IQ and Parental Education on Wage Levels and Education Slopes

Dependent Variable: Log Real Hourly Wage (1967 Dollars)

Explanatory Variables	Young Men							
	Equations with Linear Specification of Education[1] (Coefficients and Standard Errors Have Been Multiplied by 100)							
	Without Family Fixed Effects				With Family Fixed Effects			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Education[2] (based on a linear specification)	3.86 (.295)	3.99 (.287)	3.97 (.284)	3.22 (.321)	3.26 (.670)	3.57 (.645)	3.66 (.605)	2.95 (.566)
Education × Experience	.115 (.027)	.158 (.027)	.163 (.027)	.166 (.029)	.108 (.027)	.111 (.027)	.112 (.027)	.110 (.028)
Education × IQ	.001 (.012)	--	--	--	.025 (.038)	--	--	--
Education × DADED[3]	--	.085 (.030)	--	--	--	.219 (.134)	--	--
Education × MOMED[3]	--	--	.090 (.033)	--	--	--	.408 (.157)	--
Education × EDINDEX	--	--	--	.092 (.050)	--	--	--	.082 (.158)
IQ[4] (based on a cubic specification)	.318 (.043)	.281 (.038)	.277 (.038)	.249 (.039)	.276 (.129)	.306 (.113)	.313 (.114)	.260 (.115)
DADED[2]	-.270 (.108)	-.355 (.121)	-.315 (.109)	-.347 (.109)	--	--	--	--
MOMED[2]	.546 (.118)	.538 (.118)	.485 (.123)	.514 (.118)	--	--	--	--
EDINDEX[5]	--	--	--	1.23 (.227)	--	--	--	2.35 (.706)

NOTES:

1. For a list of control variables used in each regression, see footnote 1 in Table 3 for the specifications with a family fixed effect, Table 4 for those without.

2. Education, DADED, and MOMED are defined as highest grade completed minus 12, so their coefficients are read as the additional wage accruing to a year of education past high school.

3. The equations with family fixed effects use the averaged brothers' reports of DADED and of MOMED, rather than the individual young man's corresponding reports.

4. IQ is defined as the individual's reported IQ score minus 100.

5. EDINDEX is an index of parental influence and school quality factors which predict number of years of education.

6. The typical regression without fixed effects had N= 19298, R^2= .29, and RMSE= .384. The typical regression with fixed effects had N= 19298, R^2= .74, and RMSE= .263.

Table 10

The Effects of IQ and Parental Education on Wage Levels and Education Slopes

Dependent Variable: Log Real Hourly Wage (1967 Dollars)

Explanatory Variables	Young Women							
	Equations with Linear Specification of Education[1] (Coefficients and Standard Errors Have Been Multiplied by 100)							
	Without Family Fixed Effects				With Family Fixed Effects			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Education[2] (based on a linear specification)	7.07 (.371)	6.49 (.355)	6.52 (.353)	5.46 (.398)	5.71 (.780)	5.78 (.779)	6.85 (.753)	5.20 (.724)
Education × Experience	-.152 (.035)	-.136 (.034)	-.123 (.035)	-.062 (.038)	-.051 (.043)	-.050 (.043)	-.037 (.043)	-.039 (.043)
Education × IQ	-.071 (.015)	--	--	--	-.010 (.044)	--	--	--
Education × DADED[3]	--	-.064 (.039)	--	--	--	.057 (.175)	--	--
Education × MOMED[3]	--	--	-.005 (.040)	--	--	--	.337 (.192)	--
Education × EDINDEX	--	--	--	.229 (.067)	--	--	--	.227 (.198)
IQ[4] (based on a cubic specification)	.382 (.045)	.316 (.042)	.312 (.042)	.259 (.043)	-.270 (.145)	-.300 (.132)	-.342 (.133)	-.337 (.132)
DADED[2]	-.121 (.122)	-.021 (.133)	-.121 (.123)	-.214 (.122)	--	--	--	--
MOMED[2]	.282 (.137)	.261 (.137)	.306 (.139)	.184 (.137)	--	--	--	--
EDINDEX[5]	--	--	--	1.53 (.276)	--	--	--	2.77 (.789)

NOTES:

1. For a list of control variables used in each regression, see footnote 1 in Table 3 for the specifications with a family fixed effect, Table 4 for those without.

2. Education, DADED, and MOMED are defined as highest grade completed minus 12, so their coefficients are read as the additional wage accruing to a year of education past high school.

3. The equations with family fixed effects use the averaged sisters' reports of DADED 12 and of MOMED, rather than the individual young woman's corresponding reports.

4. IQ is defined as the individual's reported IQ score minus 100.

5. EDINDEX is an index of parental influence and school quality factors which predict number of years of education.

6. The typical regression without fixed effects had N= 14320, R^2= .24, and RMSE= .376. The typical regression with fixed effects had N= 14320, R^2= .72, and RMSE= .263.

Appendix Table A1
Summary Statistics for the Young Men's and Young Women's Data Sets

	Young Men					Young Women				
Variable[1]	Mean	Sample Size	Std Dev	Min	Max	Mean	Sample Size	Std Dev	Min	Max
Log Hourly Wage Rate[2]	1.109	19298	0.457	-0.883	5.188	0.659	14320	0.432	-0.914	3.193
Highest Grade Completed	12.958	19298	2.786	0.000	18.000	12.638	14320	2.403	0.000	18.000
IQ Score	101.127	13304	15.442	50.000	158.000	102.312	9948	14.859	46.000	158.000
Father's Education	9.709	14451	3.732	0.000	18.000	9.844	10462	3.855	0.000	18.000
Mother's Education	10.143	16736	3.258	0.000	18.000	10.202	12758	3.176	0.000	18.000
Age	29.057	19298	3.784	24.000	39.000	28.262	14320	3.307	24.000	37.000
Years of Experience[3]	9.085	18877	4.988	0.000	28.000	9.441	14303	4.500	2.000	29.000
EDINDEX[4]	0.219	19298	2.124	-6.164	4.857	0.182	14320	1.766	-5.886	4.133
Number of Siblings	3.317	19164	2.595	0.000	18.000	3.593	14264	2.628	0.000	16.000
Two Parents in Household at Age 14?	0.832	19256	0.374	0.000	1.000	0.821	14319	0.383	0.000	1.000
Black?	0.230	19298	0.421	0.000	1.000	0.292	14320	0.455	0.000	1.000
Residence in South?	0.399	19297	0.490	0.000	1.000	0.427	14314	0.495	0.000	1.000
Residence in SMSA?	0.700	19297	0.458	0.000	1.000	0.719	14314	0.449	0.000	1.000

Notes:

1. Missing values are omitted from all calculations. The potential sample size is 19298 for young men, 14320 for young women.
2. Wage is measured in 1967 dollars.
3. Experience is measured as "potential experience," or number of years since last enrolled in school. For those individuals never enrolled in school or reporting zero years of education, experience equals age minus 14 years.
4. EDINDEX is an index of family background variables, school characteristics, and personal characteristics that predict years of education.

Appendix Table A2
Summary of Distribution of Observations in Young Men's and Young Women's Data Sets

Young Men's Data Set:

There are 19298 observations provided by 4138 individuals in the Young Men's data set, spanning the period from 1966 to 1981. Fifty-two percent of the young men contributed one, two, three or four observations; 27 percent contributed either five or six observations; and 21 percent contributed seven through twelve observations. The average number of observations per young man is 4.66, while the mode is five observations.

There are 3764 brother sets in the young men's data set, including 3423, or 90.9 percent, singletons, 309, or 8.2 percent, sets of two brothers, 31, or 0.8 percent, sets of three brothers, and 1 set of four brothers. The average number of observations per brother set (including singletons) is 5.13, the median and mode are both five observations. The maximum contribution of any brother set is 22 observations.

Young Women's Data Set:

There are 14320 observations provided by 3907 individuals in the Young Women's data set, spanning the period from 1968 to 1982. Fifty-three percent of the young women contributed one, two or three observations; 31 percent contributed either four or five observations; and 16 percent contributed six through eleven observations. The average number of observations per young woman is 3.66, while the mode is two observations.

There are 3571 sister sets in the young women's data set, including 3269, or 91.5 percent, singletons, 269, or 7.5 percent, sets of two sisters, 32, or 0.9 percent, sets of three sisters, and 1 set of four sisters. The average number of observations per sister set (including singletons) is 4.01, the median is four observations, and the mode is two observations. The maximum contribution of any sister set is 19 observations.

Pooled Data Set:

There are 33618 observations in the pooled data set with the distrubution of observations as given in the preceding young men's and young women's summaries.

There are 8039 brother-sister sets in the pooled data set, including 5367, or 81.7 percent singletons. There are 990 sets, or 15.1 percent, of two siblings, 178 sets, or 2.7 percent, of three siblings, 32 sets, or 0.5 percent, of four siblings, and 5 sets of six siblings.

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