DISCUSSION PAPERS IN ECONOMICS

IQ, Academic Performance, Environment and Earnings

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IQ, Academic Performance, Environment and Earnings

Abstract

This paper explores the effects of peers, friends, family, IQ and academic performance, observed in the last year of high school, on earnings at ages 35 and 53. All significantly affect earnings at both ages. The effects of IQ are much smaller than asserted in, for example, The Bell Curve, and badly overstated in the absence of controls for family, wider context or academic performance. Aspirations appear to be very important. Socialization and role models may be as well, but not ability spillovers. Feasible increases in academic performance and education can compensate for the effects of many cognitive and contextual deficits.

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Economic success depends both on an individual's internal resources and the context in which the individual develops them. Internal resources consist of innate human capital, the capacity to augment any such 'endowment' through additional investments and the work effort derived from this capital. 'Context' comprises the family, school and community resources that may contribute to the productivity of these efforts.

There is a vast literature examining the relationship between wages or earnings and personal characteristics that can serve as proxies for the accumulation of human capital, such as age, education, labor market experience, gender and race. However, there are perhaps no more than a dozen papers that examine the relationship between earnings and pre-labor market measures of intellectual capacity.

Similarly, relatively little is known about the relationship between contextual effects and subsequent wages or earnings. Two recent reviews together identify only eight papers that address this issue (Haveman and Wolfe (1995), Jencks and Mayer (1990)). Collectively, they demonstrate that income as a young adult is related to characteristics measured during childhood and adolescence. However, they offer little conclusive evidence regarding temporal, social or spatial proximity: the span within the life-cycle during which these effects are important, the degree of personal intimacy necessary to generate them, or the geographic area within which they are concentrated.

Analyses that do not incorporate measures of both individual capacity and context must be interpreted with care because the two are almost surely correlated: more intelligent children are likely to be offered richer environments, at least educationally. Richer environments presumably stimulate the development or realization of intelligence. To the extent that capacity is inherited, more intelligent parents are more likely to be able to afford the inputs that create richer environments, and to have more intelligent children.

However, analyses that include measures of both individual capacity and context require unusually detailed data. In consequence, the intersection of the literatures discussing the effects of cognitive ability and contextual effects on earnings consists, arguably, of only Kiker and Condon (1981). This paper constitutes another member of this intersection. It presents new evidence regarding the contributions of both individual intellectual capacity and adolescent context to earnings. It simultaneously estimates the contributions of IQ, characteristics of family, high school friends, high school peers and their families, and high schools to earnings at ages 35 and 53.

These estimates are noteworthy, first, because an extensive array of covariates minimizes the biases attributable to any omissions. Second, this is one of only a very few papers to examine the magnitudes of these contributions at ages beyond the mid-thirties. Third, the estimates of contextual contributions here are distinctive because they derive from a uniquely exhaustive description of an entire hierarchy of contexts, from family through friends and peers to high schools. Fourth, the estimates here are the first to meaningfully evaluate the contribution of high school academic performance, measured by high school rank, to adult earnings. Lastly, they are the first to control for academic performance in estimating the effects of IQ.

I. IQ and earnings

Previous evidence regarding the relationship between intellectual capacity and earnings is not entirely consistent. Several papers suggest that it is unimportant; Kiker and Condon (1981) and Cohn and Kiker (1986) estimate that the cognitive ability measure in the Panel Study of Income Dynamics (PSID) has negligible effects on log earnings.[1] Murnane, Willett

[1] With cognitive ability scores rescaled to standard deviations of 15, both papers estimate that even statistically significant effects of intelligence on earnings are unimpor-

and Levy (1995, 259) estimate that a difference of approximately one standard deviation in mathematics achievement scores has "a very modest impact" on wages for 24 year-old males in 1978, though a larger effect in 1986. Bound, Griliches and Hall (1986, 94) conclude that, in the National Longitudinal Study of Youth (NLSY), "(t)he role of the [unobserved] 'ability' factor in the wage equation is marginal, both in the sense that its coefficients are not significantly different from zero and in the sense that it contributes little to the explanation of the variance of wages."[2]

However, Crouse (1979) estimates returns of approximately 15 percent to income for each standard deviation of measured intelligence, using several sixth grade tests for 692 individuals enrolled in the Kalamzoo, Michigan school district between the years of 1928 and 1952. Bishop (1989, 181) adopts .190 as his central "estimate of the response of the logarithm of the wage to a one population standard deviation change in adult GIA [general intellectual achievement]" among males in the PSID. Neal and Johnson (1996) estimate a log wage response of .172 to a standard deviation change in Armed Forces Qualification Test (AFQT) scores among males in the NLSY. Cameron and Heckman (1993, tables 2 and 10) imply returns of 7-10% to this change among NLSY respondents.

These estimates suggest that the difference in earnings associated with a one standard deviation difference in measured cognitive ability is equal to that associated with a difference of at least one, and perhaps as many as three years of schooling.[3] Gottfredson, et

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tant.

[2] Blackburn and Neumark (1993) estimate small and often negative wage effects for what they call the "academic test" in the NLSY in the presence of other NLSY test scores.

[3] "(O)n average, an extra year of schooling still increases earnings by at least a substantial 6-8 percent" (Heckman (1995, 1111-2)). However, Ashenfelter and Krueger (1994, 1171) assert that "the returns to schooling in our data are never less than 9 percent per year completed" and appear to be 12-16 percent.

[4] IQ measurements as of late high school are appropriate here because the issue is whether subsequent interventions can compensate for cognitive deficits in the determination of earnings during the peak years. In addition, these measurements can incorporate only limited experience effects. In contrast, Bishop (1989, 180) requires "that GIA [general intellectual achievement] be measured long after the completion of schooling and as close as possible to the date of the wage rate observations" because "the more recent test is by far the more powerful predictor of earnings". Achievement test scores that are contemporaneous with earnings measures must derive some of their predictive power from their relationship with work experience (Bishop (1989, 179) and Neal and Johnson (1996, 873)).

[5] Observations are 24 years old in Murnane, Willett and Levy (1995), between 26 and 29 in Neal and Johnson (1996), between 19 and 32 in Kiker and Condon (1981), between 26 and 38 in Bound, Griliches and Hall (1986) and apparently between the early thirties and

contextual activity and individual behavior. Respectively, these models predict that individuals are more likely to adopt and pursue an objective if this choice is popular among their peers, encouraged by neighborhood adults or external authorities.

[6] This result is familiar in the tournament literature (Lazear and Rosen (1981), McLaughlin (1988)).

inefficiencies can lead to "the collapse of the productive sector" (pg. 619). Durlauf (1994) describes how contextual effects might be responsible for the formation of persistently disadvantaged communities.

III. Data and method

The Wisconsin Longitudinal Study of Social and Psychological Factors in Aspiration and Attainment (WLS) contains information regarding 10,317 individuals. Together, these individuals constitute approximately one-third of all seniors in Wisconsin high schools in 1957.[7] The WLS includes self-responses from sample members, siblings, and parents, and administrative data, collected in a series of surveys beginning in 1957, and continuing in 1964, 1975 and 1993.[8]

By definition, this data set is restrictive. In particular, Wisconsin high schools in 1957 contained very few black or Hispanic students.[9] Wisconsin was also a relatively wealthy state. It presumably contained few of the severely disadvantaged neighborhoods that are the focus of, for example, Freeman (1986), Case and Katz (1991) and Wilson (1996).[10]

However, these limitations are advantageous, analytically. The possible contextual effects associated with race, segregation and extreme poverty are especially vexed and

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[7] All WLS respondents graduated from high school (Hauser and Sweeney (1997, 542)). School enrollment rates were .880 among 14 through 17 year olds in the East North Central region in 1958 (Goldin (1994)) and .883 among 16 and 17 year olds in Wisconsin in 1960 (U.S. Bureau of the Census (1963b)). The ratio of high school graduates to 17 year olds in the East North Central region in 1958 was .610 (Goldin (1994)).

[8] Robert M. Hauser, William H. Sewell and J. Kenneth Little are the principal investigators for the WLS. The Inter-University Consortium for Social and Political Research distributes it as data set number 6163. Sewell and Hauser (1980) provide a general description. Work based on the WLS has "heavily influenced subsequent work both quantitative sociology and economics" (Haveman and Wolfe (1995, 1840)).

[9] In 1960 only 1.93% of Wisconsin high school students were non-white (U.S. Bureau of the Census (1963b)). Non-whites comprised 2.35% of the Wisconsin population. "Negros" comprised 1.89%. The WLS does not record race, only ancestry. Fewer then ten members of the sample of table 3 below identify their paternal ancestry as "African".

[10] According to the U.S. Bureau of the Census (1963a, 1963b), the 1959 median incomes in current dollars for families and unrelated individuals in Wisconsin and in the U.S. were $5,173 and $4,791, respectively. In Wisconsin, 11.5% of all families and unrelated individuals had 1959 incomes below $1,000, and 20.5% below $2,000. The corresponding proportions for the U.S. were 12.8% and 23.3%.

intricate (Corcoran and Adams (1997), Jencks and Mayer (1990), Wilson (1996)). More typical contextual effects may be easier to discern in their absence.

In addition, the WLS provides extensive data regarding many of these other effects. Table 1 presents averages of the contextual variables used here, for the sample of 2,959 male respondents analyzed in section IV.[11] The public use version of this data set identifies the population category of the town in which each respondent attended high school, but no other population characteristics. Here, these towns are characterized by dummy variables identifying those with less than 10,000 and more than 49,999 in population.[12] The WLS also provides three variables that identify high school auspice and size of graduating class. Sample averages for these variables, which represent the two 'outermost' contextual levels, appear in the first two panels of table 1.

The WLS contains a wealth of unique information regarding four additional, increasingly intimate contextual levels.[13] The public-use version of the WLS does not reveal the actual identity of individual high schools. However, it identifies high school classmates, and samples approximately one-third of them. These classmates, male and female, constitute the 'peers' of this analysis. Their average characteristics and those of their families

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[11] This paper examines men because, arguably, they would almost all have aspired to labor market success. In contrast, family formation would have been a competing and perhaps predominant objective for women of this generation. The analysis for them must therefore treat family structure and labor force participation, as well as income, as outcomes.

[12] Wisconsin cities with 1960 populations in excess of 49,999 were Green Bay, Kenosha, Madison, Milwaukee, Racine, Wauwatosa and West Allis. All but the last two exceeded this threshold in 1950 as well (U.S. Bureau of the Census (1963b)).

[13] Rowe (1997, 145-6) advocates analyses addressing multiple contextual levels: "Analyses of environments should also adopt nested analytical strategies. ... By analyzing hierarchically, one may reveal environmental effects at a particular level of the social system."

Table 1

Summary statistics, contextual variables

Variable	Average	Standard deviation
Community characteristics:		
High school in town <10,000 population	.287	.452
High school in town >49,999 population	.272	.445
School characteristics:		
Private school	.0159	.125
Catholic school	.0997	.300
Size of high school graduating class	174.	133.
Peer household characteristics:		
Average household income ($10,000s)	3.01	1.16
% fathers graduated high school	.315	.120
% fathers graduated college	.0856	.0951
Peer characteristics:		
Average IQ	101.	5.12
% planning college	.752	.125

represent two additional levels of contextual effects.[14]

The third panel of table 1 presents three variables that measure average peer family characteristics. If the two measures of educational attainment among peer fathers are important, they would be consistent with hypotheses based on collective socialization, or 'role models' (Crane (1991), for example). The average peer household income should be a proxy for community wealth and perhaps for the level of material resources available to the school.

The fourth panel of table 1 presents measures of context at one less remove from the individual. These five variables measure characteristics of peers themselves: the percentages reporting that they planned to attend college, pursue a white collar occupation, enter the military or engage in farming[15], and the average IQ.[16]

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[14] Olson and Ackerman (1999) augment the WLS with detailed information describing individual school districts. Case and Katz (1991) disregard the information available in their sample regarding the parents of other children in the same neighborhood because "parent peers may not provide a representative sample of non-familial adult behavior in a youth's neighborhood" (pg. 13). However, 'relatedness' rather than 'representativeness' is the important analytical issue. In Case and Katz (1991), nothing is known about the extent of contact between observed individuals and parents of other 'neighborhood' children. Here, it is plausible that the parents of peers exercise some influence, directly or otherwise, over sample individuals. Therefore, these data provide a useful opportunity to test for both the presence and proximity of adult-based contextual effects.

[15] The "% planning college" is the proportion of respondents from each high school answering "yes" to "Ever plan to attend college?". The three occupational variables represent the proportions choosing among mutually exclusive responses to "Respondent's intended occupational class".

[16] Wisconsin administrative records provide IQ scores from the Henmon-Nelson Test of Mental Ability, administered to eleventh graders. Robert Hauser "estimates the reliability of this test to be between 0.92 and 0.95" (Crouse (1979, 93)), excellent by conventional standards. Herrnstein and Murray (1994, 584) report a correlation of .71 between scores on this test and on the AFQT for 152 NLSY respondents. Christopher Jencks asserts (private communication) that, for unknown reasons, the Henmon-Nelson test "yields lower correlations with both its causal antecedents ... and respondents' later attainments than most other reliable cognitive tests". This may imply a downward bias in the IQ effects estimated here. At the same time, this test is clearly superior to the index of cognitive ability in the PSID, which is not derived from a true IQ test.

These variables provide opportunities to distinguish between hypotheses regarding the sources of contextual effects. As examples, the estimated effects of average peer IQ test the assumption that peer intelligence is an input into the educational production function. Those of peer-reported ambitions test the importance of the epidemic or 'contagion' effects.

'Friends' represent a level of context that is both more intimate and, presumably, more influential than peers. Measures of their characteristics provide the opportunity to assess this presumption. The last panel of table 1 reports the percentage of friends planning to attend college, as reported by each respondent.[17]

Measures of the characteristics of high school classmates are rare, and of friends appear to be unique in the literature examining contextual effects. The WLS also includes a full complement of the variables ordinarily employed in this literature to measure family characteristics, representing the most intimate contextual level.

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[17] This variable is one response to "Respondent's perception of friends' probable post-high school behavior". Preliminary estimates including additional responses to this question demonstrated that, statistically, the single variable measuring college plans captured the relationship between the attributes of friends and respondent incomes most effectively. The tabulated proportion of friends planning college is smaller than the proportion of peers with the same plans for two reasons. First, the relevant horizon for friends' aspirations is shorter than that for self-reported peer aspirations, as described in footnote 15. Second, the table 1 average for peer college intentions is essentially an average of the proportion of students within a high school planning college attendance at any time in the future, weighted by the number of students in the high school. It is dominated by larger high schools, with higher rates of planned college attendance.

of at least one natural parent.[18] Sibling counts represent the possibility of intra-sibling competition for scarce family resources.[19]

The household income variable in the WLS is unique. It consists of the average of parental incomes reported to the Wisconsin Department of Revenue during the four years beginning in 1957, taken directly from administrative files. It is therefore based on a rigorously consistent definition for all observations. Consequently, it is a more accurate proxy for permanent income than are measures employed by previous analyses of contextual effects.[20]

The last panel of table 2 presents average values for three essential characteristics of the respondents themselves. The first is self-reported labor market earnings in 1974, at approximately age 35. The log of these earnings is the dependent variable in the analyses

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[18] In total, the analysis below accounts for eight household and parental characteristics. The number of associated variables is greater because several require arrays of dummy variables to represent the relevant categories. The complete WLS descriptions of parental education consist of seven dummy variables. Those for parental occupations consist of nine dummy variables. Four dummy variables describe the variations in parental presence. The authors can provide upon request an appendix of extended tables which reproduces the analyses in this paper with these complete descriptions. These tables reveal no substantive differences with those in the text.

[19] The appendix discussed in footnote 18 also employs sibling counts distinguished by sex and birth order. Butcher and Case (1994) claim that sibling effects on educational attainment depend on sex composition for women but not for men. However, Kaestner (1997) asserts that educational attainment for either is independent of sibling sex composition. Kessler (1991) demonstrates that wage levels and growth are independent of childhood family size and birth order for both. Here, disaggregation permits replication of these results, tests of aggregation itself and of hypotheses regarding the source of any role model effects (Haveman and Wolfe (1995, 1834), for example). Stratified sibling counts are individually and collectively insignificant in all analyses. Most analyses of contextual effects aggregate sibling counts into a single sum (Haveman and Wolfe (1995)), as here. The analysis here disregards detailed 1975 WLS data describing a single randomlyselected sib. These data are contemporaneous with the first earnings observations rather than with the high school experience, and not available for the entire sample.

[20] The income variable is based on tax reports for 1954-6 or 1961-4 if none were filed during 1957-60. The sample excludes those families for which no income information was available.

[21] The authors can provide these and all other ancillary estimates upon request. The instruments consist of the average occupational status and prestige scores for peer fathers and mothers and the proportions of high school classmates identifying themselves as Catholic, Protestant and Jewish, who took the National Merit and College Entrance Board

ry variables here are measured in or before the last year of high school, with the partial exception of the household income variables.[22]

At age 35 the individuals examined here were, for the most part, slightly more mature labor force members than those in the papers surveyed in Haveman and Wolfe (1995) and Jencks and Mayer (1990). A subsample of 2,264 individuals also reported earnings in 1992, at approximately age 53. Sections IV and V analyze the relationships between family and contextual variables and earnings in these two years, respectively. Together, these analyses offer a unique opportunity to examine the persistence of individual resources and contextual effects over the life-cycle.

IV. Earnings at age 35

Neal and Johnson (1996, table 1, column 3) regress the log of earnings on IQ, age and race. The latter two are constant in this sample. Therefore, the equivalent specification here contains only IQ.

Model 1 of table 3 presents the estimate of this regression for the log of earnings at age 35. The coefficient on IQ implies that a difference of 15 IQ points, approximately equal to one standard deviation, is associated with an earnings difference of more than eleven percent. This is smaller than the estimate of Neal and Johnson (1996) for cohorts of

[22] Neal and Johnson (1996, 871-2) provide an especially clear justification for this analytical strategy: "The model underlying our empirical results views the amount of human capital youths have attained by their late teens as a predetermined initial condition that constrains the future path of human capital and, hence, future wages. After the late teens, further investments in human capital, work experience, and occupation are endogenous choices that affect wages but are constrained by the initial level of human capital. ... reduced-form wage equations are appropriate because we are primarily interested in the total effect of race [or, here, of personal and contextual characteristics] on wages after age 18, not the partial effect conditioning on endogenous covariates."

roughly similar age, perhaps because of differences in period. However, it is still a substantial effect, and more supportive than not of recent claims that earnings depend heavily on innate ability.

Model 2 of table 3 adds conventional measures of family context to the specification. This model demonstrates, as suggested in the introduction, that the estimated coefficient of IQ is inflated by the omission of contextual variables. Those included here reduce it by nearly one-third.

Model 3 of table 3 augments model 2 with variables for respondent and parental college aspirations, and the contextual variables as described in the previous section. In consequence, the estimated IQ coefficient declines further. The reduction in its magnitude between models 2 and 3 is identical to that between models 1 and 2. The estimated IQ coefficient in model 3 is barely half of its value in model 1. This suggests that the estimated IQ coefficients in Bishop (1989) and Neal and Johnson (1996), omitting aspirational and

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[23] Quadratic specifications for IQ fail to reveal non-linear effects. The regressions here omit completed education because it is a consequence of high school experience and context, and more likely to be mutually endogenous with income at 35. Illustratively, model 3 of table 3, augmented by a completed education variable, estimates a significant but small return to schooling of approximately 3.0%. The IQ coefficient, while still significant at better than 1%, declines by more than half, to .00280. This is consistent with, though the converse of, Heckman (1995, 1111) "controlling for ability lowers -- but by no means eliminates -- the return to schooling.". However, this result contradicts Herrnstein and Murray (1994, 97), "the correlation between intelligence and income is not much diminished by partialing out the contributions of education, work experience, marital status, and other demographic variables."

Table 3

The determinants of 1974 labor market earnings

Explanatory variables	Model 1	Model 2	Model 3
Respondent characteristics:			
Respondent IQ	.00752	.00577	.00390
	(12.4)	(9.11)	(5.72)
Respondent planning college	-	-	.0795
			(3.44)
Household characteristics:			
Household income ($10,000s)	-	.0399	.0265
		(6.15)	(3.92)
Household income ($10,000s squared)	-	-.000767	-.000475
		(4.52)	(2.74)
Father has white collar job	-	.0647	.0412
		(2.86)	(1.81)
Mother has white collar job	-	.0388	.0277
		(1.55)	(1.11)
One or both natural parents absent	-	.0251	.0230
		(.725)	(.667)
Number of siblings	-	-.00324	.00151
		(.864)	(.399)
Father's education:			
Father's education missing	-	-.0134	-.0163
		(.311)	(.383)
Father graduated high school but not college	-	.00373	-.0102
		(.167)	(.462)
Father graduated college	-	.0367	.00443
		(.932)	(.112)
p-value	-	.785	.940
Mother's education:			
Mother's education missing	-	.0575	.0582
		(1.38)	(1.40)
Mother graduated high school but not college	-	.0184	.00769
		(.852)	(.357)
Mother graduated college	-	.0346	.0234
		(.945)	(.636)
p-value		.471	.537

Table 3, continued

The determinants of 1974 labor market earnings

Explanatory variables	Model 1	Model 2	Model 3
Parental attitude towards college:			
Parents encouraged college attendance	-	-	.0465
			(2.03)
Parents discouraged or did not permit college attendance	-	-	.0214
			(.398)
p-value	-	-	.128
Community characteristics:			
High school in town <10,000 population	-	-	.0151
			(.580)
High school in town >49,999 population	-	-	-.0234
			(.916)
p-value	-	-	.538
School characteristics:			
Private	-	-	-.163
			(1.98)
Catholic	-	-	.0596
			(1.83)
Size of class (100s)	-	-	.0182
			(1.79)
p-value	-	-	.0086
Peer household characteristics:			
Average income ($10,000s)	-	-	.0303
			(2.18)
% of fathers who graduated from high school	-	-	-.124
			(1.33)
% of fathers who graduated from college	-	-	.0116
			(.0776)
p-value			.0483

Table 3, continued

The determinants of 1974 labor market earnings

Explanatory variables	Model 1	Model 2	Model 3
Peer characteristics:			

Other variables in model 3 are arguably as important as IQ. Respondent plans in high school to attend college are associated with earnings increases of approximately eight percent, with better than one percent significance. This increase is nearly one-third greater than that associated with a one standard deviation difference in measured intelligence.

Parental encouragement towards college attendance is also associated with a positive and significant effect on sons' earnings. This increase is more than half as large as that associated with respondent aspirations, and nearly 80% of that associated with a one standard deviation difference in IQ.

The coefficients of other parental and household characteristics indicate smaller relationships. Respondents whose families had higher incomes had significantly but not substantially higher earnings themselves. The difference between $30,000 and $60,000 of parental income, roughly equal to the sample mean income and the income level one standard deviation above the mean, is associated with a difference in sons' earnings of approximately 6.7%.

In other words, a dramatic difference in parental income is associated with a difference in sons' income that is again comparable to that arising out of an additional year of education.[24] Moreover, the effect associated with parental encouragement to attend college is more than two-thirds as large as that associated with a standard deviation increase in parental income. This supports the assertion that the former can be as important as a relatively large increase in the latter.

Variables measuring levels of educational attainment for both father and mother are

[24] Haveman and Wolfe (1995, 1864) and Mayer (1997, 56-57) summarize previous research as estimating that parental incomes have a much larger effect on those of their sons. However, Mayer (1997, 114) presents evidence that the true effects are smaller than previously believed, as demonstrated here.

collectively insignificant. Furthermore, none are individually significant.[25] These results are consistent with Ashenfelter and Krueger (1994, 1166), who conclude that parental education has no reliable effect on children's wage rates.

Jencks and Mayer (1990, 120) assert that, in addition to parental income and educational attainment, proper controls for family socio-economic status must account for parental occupations and household structure. Table 3 demonstrates that log earnings at age 35 are greater, with 10% significance, if the father's occupation is white collar. However, parental presence and sibling counts are both insignificant.[26]

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[25] Haveman and Wolfe (1995, 1864) conclude that "estimates of the effect of parental educational choices on children's labor market attainments are difficult to interpret". They tentatively suggest (pg. 1873) that the problems of data reliability, multicollinearity and endogeneity that characterize analyses of contextual effects may justify adopting lower standards of statistical significance. The presentation here continues to focus on conventional levels of 10% or better, but addresses this problem through additional emphasis on the joint significance of variable arrays.

[26] The absence of sibling count effects contrasts with previous research, where larger sibships are associated with less favorable social outcomes (Haveman and Wolfe (1995, table 3b), for example) and lower incomes for white males (Datcher (1982)). Although Jencks and Mayer (1990, 120 and 176) assert the contrary, omitting these family variables does not alter the peer and friend effects estimated here.

[27] Spuriously significant effects appear at this level of context if more proximate contextual levels are not represented. Model 2 of table 3, augmented by only the two variables measuring size of place, estimates a coefficient of -.0432 for places of less than 10,000 in population, with a t-statistic of 1.95.

[28] The magnitude of the Catholic high school effect here is slightly larger than that estimated by Neal (1997, table 9, column a) in the NLSY. The large negative effect of secular private high schools suggests that, in this sample, many may have been remedial.

[29] Jencks and Mayer (1990, 173) assert that "(a) high school's mean SES does not have much effect on its graduates' economic prospects" especially for whites in the northern United States, with controls for other exogenous influences (1990, 130 and 141). To the extent that measured socioeconomic status does not incorporate income, this is not inconsistent with the significance of peer family income here. Furthermore, it is supported by the absence of significant effects from peer paternal educational attainment. Quadratic terms in average peer household income are insignificant and unimportant when entered into model 3 of table 3.

[30] Analogously, Bishop (1989) estimates a reduction of 15% to 16% in weekly earnings associated with the PSID variable BORNFARM, which he does not formally define.

[31] This discussion assumes that table 3 estimates of individual and peer IQ effects are unbiased. Gottfredson, et al. (1997, 13) essentially assert that IQ measures intelligence without error. If measurement error arises, however, it would alter somewhat the interpretations of the results here. Appendix A presents a simple characterization of possible error.

Lastly, the college aspirations of friends are positively and significantly related to respondent's later earnings. The magnitude of this effect is slightly larger than that of parental encouragement to attend college. These two effects, and that of respondent college plans, demonstrate that the overall association between aspirations and future income is quantitatively large. The three together are associated with earnings increases in excess of 18%.[32]

In sum, model 3 of table 3 demonstrates that sons' earnings at age 35 are related to own aspirations and intelligence and some, but by no means all, family characteristics. Earnings are clearly associated with family material resources and parental aspirations. Socialization, through exposure to some parental occupations, may also play a role. However, parental credentials, either educational or, in most cases, occupational, appear to have little influence.

This model also demonstrates that earnings at age 35 are associated with characteristics of the school itself, its students, parents in the school community and the students who affiliate as friends.[33] The magnitudes of many of these associations are readily

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estimates of small but consistently negative peer achievement spillovers in general (Jencks and Mayer (1990, 128)) and in the WLS (Hauser, Sewell and Alwin (1976)). As explained in section III, own and peer household incomes are presumably free of measurement error by construction.

[32] The correlation coefficients for any pair of own, parents' and friends' aspirations regarding college all lie between .408 and .520, significant at better than 1% but indicating substantial orthogonal components. The omission of any one increases the coefficients on the remaining two in model 3 of table 3. However, these increases are almost always less than .02 log points. The sum of the two remaining coefficients is always less, by at least .035 log points, than the sum of the three coefficients in model 3. Therefore, all three are necessary to completely capture the effects of aspirations. Their coefficients are unaffected by the omission of the variable measuring peer aspirations. Parenthetically, a variable measuring respondents' perceptions of their teachers' aspirations for them is also insignificant in all specifications.

[33] As the introduction suggests, the omission of IQ strengthens many of these effects. Jencks and Mayer (1990, 121-4) propose that interactions between individual, family and

apparent because they are estimated by single coefficients. However, peer influences are represented by multiple variables. Table 4 summarizes the net peer and peer household associations in confidence intervals for predicted log earnings based on 'improvements' of

neighborhood characteristics may be important. None prove so here. When added to the specification of table 3, interactions between own and peer IQs, between own and peer household incomes and between IQ and income variables all yield consistently insignificant coefficients.

[34] All confidence intervals assume that values for explanatory variables are not stochastic.

Table 4

Predicted 1974 log earnings and 95% confidence intervals

Explanatory variable values	Predicted 1974 log earnings	95% confidence interval for predicted log earnings: Lower bound	Upper bound
Averages for all variables	10.60	10.58	10.62
One standard deviation improvement in peer characteristics	10.65	10.60	10.70
One standard deviation improvement in peer household characteristics	10.65	10.61	10.69

deviation in IQ. This is a dramatic contrast to the general theme of Herrnstein and Murray (1994, Part II). They assert that variations in IQ are much more important than are 'equivalent' variations in socioeconomic status in the determination of social and economic experiences.[35]

With the exception of place of residence, all high school contextual levels represented in model 3 of table 3 have at least one significant association with future earnings for the sample as a whole. Stratified regressions available from the authors demonstrate, however, that the magnitudes and significances of these associations can differ for subsamples with different personal or contextual 'endowments'.

For example, stratifications of the sample at the IQ value of 101, the approximate median, yield subsamples of 1,460 men with equal or lower scores and 1,499 with higher. Regressions on these subsamples demonstrate that the association between IQ and earnings exhibits diminishing returns. The coefficient for IQ among the former is .00451, but only .00325 among the latter. Wealth in the adolescent household also, in general, has a stronger association with future earnings for those with lower IQ scores. The linear coefficients for parental income are .0348 and .0203 in the two subsamples.[36]

At the same time, these regressions suggest that the relationship between contextual and especially aspirational influences and earnings is stronger for individuals with higher

[35] Interpretations of the comparisons in Herrnstein and Murray (1994) are problematic, as discussed in Goldberger and Manski (1995) and Heckman (1995).

[36] An F-test rejects the null hypothesis that the specification of model 3, table 3 is superior to the stratification discussed here at better than 5% significance. Virtually identical comparisons arise if the sample is partitioned into the 1,375 men with IQ scores of 100 or less, and the 1,584 men with IQ scores in excess of 100. All coefficients cited in this and the following four paragraphs are significant at 5% or better unless otherwise stated. The quadratic term for household income is insignicant in the regression for the subsample with IQ scores in excess of 101, negative and significant in the regression for the subsample with scores of 101 or less.

[37] An F-test rejects the null hypothesis that the specification of model 3, table 3 is superior to the stratification by number of friends at better than 5% significance. Slightly fewer than half of the sample identified friends who also appear in the WLS. Experimental regressions with this subsample yield inconsistent evidence regarding the additional predictive value of friend-reported variables.

In sum, the earnings of those with more close high school relationships are not related to those relationships or almost any other element of high school context. The earnings of those with fewer relationships are associated with many of those elements. This apparent paradox suggests, if anything, that the number of friends may have been driven more by "supply" than by "demand"; peers may have been more attracted to those with high levels of self-reliance than to those whose characters were more responsive to their surroundings.[38]

V. Earnings at age 53

Of the 2,959 men analyzed in section IV, 2,264 remain in the sample in 1992, at age 53. The first model of table 5 reproduces model 1 of table 3 for this subsample. It demonstrates that the estimated coefficients on IQ at age 35, ignoring contextual and aspirational variables, are essentially identical in this subsample and in the sample of section IV.

The second model of table 5 demonstrates that, with the same specification, the

[38] The WLS reports residence state in 1975. Model 3 of table 3, stratified by whether or not the respondent resided in Wisconsin in 1975, is superior to model 3 itself at better than 1% significance. It suggests that migrants experience higher returns to individual characteristics but no friend or peer effects. These latter effects appear only among those remaining in Wisconsin. This contrast may indicate that migration occurs disproportionately among individuals who are not responsive to the influences of peers and friends. It may also indicate that these influences arise only through continued exposure. These suggestions are only tentative because out-of-state residence is probably endogenous with income in 1974.

The IQ effect of Neal and Johnson (1996) lies between those estimated in the two models of table 5. This suggests that the WLS and the NLSY yield broadly similar results under equivalent specifications. Table 6 explores the question of whether the expanded specification of model 3 in table 3, including contextual and aspirational variables, reduces the apparent effects of IQ on income at age 53 as well as at 35.

The first column of table 6 presents this specification for 1974 earnings in the subsample of observations with reported 1992 earnings. The determinants of 1974 earnings in this subsample are largely similar to those in the entire sample of section III, with one partial exception. The collective significance levels of peer and peer household effects are similar, but individual effects are no longer significant.[39]

The second column of table 6 employs the same specification to explain the log of earnings in 1992. The explanatory variables, though measuring characteristics as of 1957,

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[39] This result and that of footnote 21 suggest that the true extents and magnitudes of peer effects remain uncertain.

[40] The average and standard deviation for 1992 earnings are $54,658 and $54,735. The WLS documentation describes the data item for 1992 earnings as "wages, salary, commissions, and tips". It describes the item for 1974 earnings as "wages and salaries". "Commissions and tips" do not appear in the description for any 1974 data item.

Table 7

Predicted 1974 and 1992 log earnings and 95% confidence intervals

Explanatory variable values	Predicted log earnings	95% confidence interval for predicted log earnings: Lower bound	Upper bound
1974:			
Averages for all variables	10.61	10.59	10.63
One standard deviation improvement in peer characteristics	10.67	10.61	10.73
One standard deviation improvement in peer household characteristics	10.66	10.62	10.71
1992:			
Averages for all variables	10.65	10.62	10.68
One standard deviation improvement in peer characteristics	10.71	10.63	10.79
One standard deviation improvement in peer household characteristics	10.70	10.61	10.78

high school increases between the two ages, with essentially constant significance. The earnings premium associated with Catholic school attendance is of similar magnitude at the two ages, but significant only at the first.[43]

These results suggest that labor market performance is associated with high school contextual levels through most of the working life.[44] Table 7 suggests that the magnitudes of the net associations between peer and peer households and log earnings are approximately equivalent at ages 35 and 53. As in table 4, one standard deviation improvements in peer and peer household variables are associated with increases in log earnings at both ages that are approximately equal to lower estimates of the returns to a year of schooling.

VI. High school fixed effects and high school class rank

The analyses of sections IV and V include an exhaustive array of explicit contextual measures in order to identify all sources of contextual associations with adult earnings as precisely as possible. The results demonstrate that these effects occur at a variety of levels.

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[43] This subsample, stratified by IQ or numbers of high school friends, yields results that are roughly similar to those at the end of section IV for both years. However, they are generally weaker, especially, as with table 6, in regards to peer effects. F-tests indicate that the stratifications by IQ are not superior to the models of table 6 for either year. The stratification by number of friends is superior to those models only for 1992. The stratification by whether or not the respondent resided in Wisconsin in 1974 yields estimates that are superior, at better than 1% significance, to either of the models of table 6. The stratified estimates for 1974 are essentially identical to those for the full sample, discussed in footnote 38. Those for 1992 yield weaker contrasts, with one significant peer effect for those who had left the State.

[44] Haveman and Wolfe (1995, 1874) suggest that "individuals appear to follow quite different trajectories as they move toward their ultimate attainments in life." This may be consistent with the experiences of WLS respondents: The correlations between earnings and log earnings at ages 35 and 53 are only .531 and .470, respectively. These correlations would presumably be larger if the effects of individual high school characteristics at these ages differed less.

However, they are not overwhelming in magnitude. Furthermore, the regressions in these sections exhibit R^2 values that do not greatly exceed those typically obtained in log earnings regressions on data containing few or no contextual variables.

These considerations suggest either that a large fraction of adult incomes are orthogonal to high school contextual effects, or that these analyses still omit important contextual characteristics. Dummy variables for each high school allow for a partial test of this latter possibility. These controls will absorb any contextual effects that are constant across classmates. Their inclusion should therefore give some indication of the maximum explanatory power that can be attributed to these effects, regardless of source.

This strategy has some disadvantages; any significant high school effects will not have obvious behavioral interpretations. Furthermore, these effects preempt some of the behavioral interpretations suggested above because they are perfectly collinear with, and therefore replace, the variables describing school, peer and peer household characteristics.

At the same time, this strategy has a collateral advantage. The WLS reports rank in high school graduating class by percentiles. Comparisons of this variable across high schools are meaningless. However, in regressions that include high school fixed effects, it captures differences in academic performance within the same high school class.[45]

The use of this variable is consistent with the posture adopted by this paper. It would be available at age 17 for the purpose of predicting economic success subsequent to high school graduation. Furthermore, it is clearly predetermined with regard to earnings at ages 35 and 53, and therefore an appropriate explanatory variable in the regressions here.

[45] Hauser and Sweeney (1997) also present a regression of 1992 income with IQ and class rank among the explanatory variables. However, they omit high school fixed effects.

this analysis. This raises the possibility that it is only an intervening variable between its precursors and later incomes.

However, more than half of the variation in class rank comes from sources other than

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[46] In the sample of table 3, the regressions of class rank on IQ alone and on all of the explanatory variables in model 3 yield R^2 values of .347 and .450, respectively. Section VII discusses the factors that might be responsible for the influence of class rank.

[47] Greene (1997, 245-7) presents a representative proof of this result.

[48] The public-use versions of the NLSY and PSID do not allow this treatment of class rank because neither identifies high school. Both are based on national samples from multiple years. Whether either contains enough classmates to support estimates of high school performance effects analogous to those here is unknown.

Table 8

1974 and 1992 earnings with high school fixed effects

Explanatory variables	1974: 1974 sample	1974: 1992 sample	1992: 1992 sample
Respondent characteristics:			

Table 8, continued

1974 and 1992 earnings with high school fixed effects

Explanatory variables	1974: 1974 sample	1974: 1992 sample	1992: 1992 sample
Parental attitude toward college:			
Encouraged	.0362	.0706	.0455
	(1.47)	(2.47)	(1.11)
Discouraged or did not permit	.0181	.0596	-.169
	(.313)	(.871)	(1.72)
p-value	.340	.0420	.0888
Friends' characteristic:			
Planning college	.0581	.0545	.104
	(2.38)	(1.98)	(2.63)
High school fixed effects:			
p-value	.0306	.923	.649
R^2	.233	.244	.276
Adjusted R^2	.110	.123	.159

Notes: The dependent variables are the natural logarithms of 1974 and 1992 annual wages and salaries, measured in 1992 dollars.

1974 earnings for the complete sample.

These results do not support the suspicion that earlier specifications omit essential

[49] The regressions of table 8, stratified by IQ, number of high school friends, or 1974 migrant status yield inconsistent contrasts regarding the effects of the remaining variables.

estimated effects of IQ. No previous analysis of the relationship between earnings and IQ has adequately controlled for academic performance directly or through proxies. Therefore, all previous estimates of this relationship must be similarly exaggerated.[50]

The 1974 regressions of table 8 imply that a one standard deviation increase in adolescent IQ is associated with an increase of approximately four percent in log earnings at age 35. Again, an equivalent increase could be achieved with as little as a few months, and with no more than three-quarters of a year of additional education. The same difference in IQ is associated with a difference of .104 in log earnings at age 53, equivalent to the effect of an additional .6 to 1.8 years of education.

For Herrnstein and Murray (1994, 96), the difficulty of altering measured IQ implies that low-wage workers would benefit "only modestly" from additional education. This conclusion must rest on the implicit assumption that additional education affects earnings largely through its effect on measured IQ. Four years of education may indeed be necessary to close a gap of one standard deviation in IQ scores (Neal and Johnson (1996)). However, the earnings differences that are associated with that gap at ages 35 and 53 can be erased with less than one and less than two years of additional education, respectively. Even less schooling may be sufficient, if distinguished by better academic performance.[51]

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[50] The complete array of explanatory variables in table 8 reduces the estimated coefficients of IQ on 1974 earnings to no more than 37% of their magnitudes as given in model 1 of table 3 and the 1974 model of table 5. The estimated coefficient of IQ on 1992 earnings in table 8 is half that of the 1992 model of table 5.

[51] Heckman (1995, 1103) criticizes Herrnstein and Murray (1994): "Their implicit assumption of an immutable *g* [basic cognitive faculty] that is all-powerful in determining social outcomes leads them to disregard a lot of evidence that a variety of relevant labor market and social skills can be improved, even though efforts to boost IQ substantially are notoriously unsuccessful." This criticism is entirely consistent with the evidence here. Gottfredson (1997, 9-10), concurs: "The search for a means to raise low intelligence should continue, but more attention might be turned to helping people make better use of the abilities they have. ... When the goal is to equalize outcomes, variation in intelligence is undoubtedly a bigger constraint when intelligence is more functionally important. For

example, it can be expected to be a big constraint on changing variation in educational

$$
\begin{aligned}
\ln Y_i &= \beta_1 IQ_i + \beta_2 CR_i + \;_i \\
&= \beta_1 I_i + \beta_2(\alpha I_i + E_i) + \;_i \\
&= (\beta
\end{aligned}
$$

$$\hat{\beta} = \left(X'X\right)^{-1} X'Y = \left(L'A'AL\right)^{-1} X'Y \ .$$

plans implies that factors other than intelligence probably contribute to their relationship with adult earnings. The example above illustrates the consequences. In regressions which omit CR_i, the expected value of the coefficient estimated for IQ_i is $\beta_1+\alpha\beta_2+\gamma\beta_2$, where $\beta_1+\alpha\beta_2$ is the true return to intelligence and γ is the coefficient for IQ_i in an auxiliary regression for E_i.

This coefficient is almost surely positive; equilibrium effort levels should be greater for more intelligent individuals because their return to effort net of costs is higher.[55] In consequence, the expected value of the IQ coefficient in the absence of class rank exceeds the true return to intelligence in this example. This is also likely to be general; it should hold throughout the previous literature, as well as in model 1 of table 3 and the regressions in table 5.

In sum, the true intelligence effect on earnings at age 35 in the sample examined here almost surely lies between the coefficients on IQ in model 1 of table 3 and the 1974 models in table 8. That for earnings at age 53 almost surely lies between the coefficients on IQ in the 1992 models in table 5 and table 8.

In the example above, the true effect of intelligence cannot be estimated without restrictions on α or direct measurements of E_i. In the regressions here, estimation would require explicit models of the relationships between the explanatory variables and their underlying factors, or measurements of the factors themselves. The first is beyond the scope of the present analysis. The second is beyond the scope of the data analyzed here.

However, some potential factors can be tentatively identified. They may include that of the example here, effort, as well as those factors identified by Gottfredson, et al. (1997) as

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[55] The tournament literature (Lazear and Rosen (1981), McLaughlin (1988)) makes the analogous argument relating effort to 'ability'. The same argument arises in the literature on incentives (MacLeod and Malcomson (1988)).

adult earnings have been overstated in previous literature, and are bounded by the estimates in tables 3, 5 and 8 here.

The orthogonal components of explanatory variables such as class rank and college plans must represent those elements that can be altered at later points. In other words, the coefficients for these variables estimate the effects of the variable components of human capital on adult earnings.[58] It is these effects that have been ignored in the previous literature. The results here suggest that, even if intelligence is relatively fixed, the income advantage conferred by greater ability can be mitigated by investments in more variable components of human capital.

The second interpretational issue addresses the evolution of earnings determinants over time and coefficient similar. /H ci4(fi)-5.5He-5.5He ln. earnin4seen 19 Tw di-5.5H-5.5He-4(e)

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[58] In the example above, where class rank depends on intelligence as well as effort, but IQ depends only on intelligence, the coefficient on class rank is an unbiased estimator of the return to effort.

[59] The standard deviation of ln earnings increases from .488 to .717 between 1974 and 1992. However, there appears to be no simple relationship between mean-preserving changes in the variance of a dependent variable and coefficient estimates.

the cohort in question, or both. However, the increase in returns to 'skill' from 1978 to 1986 identified by Murnane, Willett and Levy (1995) incorporates the effects of time and cohort differences. The similarity between these increases and those in the effects of IQ in table 8 is at least suggestive that the common time effects may be dominant.

The literature on earnings inequality interprets these time effects as representing increased return to cognitive ability, driven by skill-biased technical change (Bound and Johnson (1992), Herrnstein and Murray (1994), Juhn, Murphy and Pierce (1993) and Katz and Murphy (1992)). However, holding constant IQ, tables 6 and 8 demonstrate increased returns to many elements of 'ability' or 'capacity' that are not related to intelligence.

At the very least, this implies that the "skills" favored by technical change should be defined more thoughtfully. It also suggests that some of the changes in coefficient magnitudes may derive from increases in labor productivity that are not skill-biased. If so, these labor market trends deserve greater attention. They may include, for example, improvements in human resource management practices (Ichniowski, Shaw and Prennushi (1997)).[60]

VIII. Conclusion

The results here distinguish between several sociological explanations of contextual effects.

[60] Joseph Altonji suggests that these increases could also arise if employer estimates of the productive value of worker characteristics become more precise over time. If employers discount payments for these characteristics to compensate for uncertainty regarding their value, these discounts should diminish with age. The introduction of high school fixed effects into the equation for 1992 earnings reduces the coefficient on own college aspirations by half, to insignificance. The coefficients for parents' aspirations also become algebraically smaller. The apparent increase in the returns to friends' college aspirations may be attributable, in part, to these changes and the correlations between the aspirational variables, which range between .41 and .52 for the sample with 1992 earnings. In the absence of the variable for friends' college aspirations, the coefficient on own aspirations is nearly 50% larger and significant at better than 10%.

The strong influences of friends' college plans and parental aspirations regarding respondent college attendance could represent the effects of contagion or collective socialization. However, 'role models' in the form of adult occupational or educational experiences, or of older siblings, have little influence.

The results here also distinguish between several of the economic theories describing the role of contextual effects in the production of human capital. The significance of peer household average incomes in table 3 suggests that community wealth affects individual economic success.

However, these results provide little support for models of inter-community inequalities. Intelligence spillovers are unimportant. Economic success does not depend on the community's 'stock' of adult human capital during adolescence. Moreover, the link between externalities as experienced by individuals and the evolution of community welfare may be altered by migration, as mentioned in footnote 38.

In sum, adult economic performance is related to several different adolescent contextual levels. The true effects of context almost surely arise from complicated and subtle social interactions that are only crudely approximated by the contextual measures available here. From this perspective, this analysis may still understate them.

At the same time, previous analyses have overstated the role of intelligence in economic success. Controls for family and high school context dramatically reduce the estimated that at age 53, is orthogonal to everything measured as of age 18. Even with a generous allowance for measurement error and transitory income components in the variance that remains, there is plenty of opportunity for individuals to rise above or fall below the level to which their endowments and environment might direct them.

Appendix: Measurement error in intelligence

Assumptions:

1. IQ_i measures intelligence I_i with a random error $_i$ that is uncorrelated with IQ_i, all other explanatory variables and $_j$: I_i=IQ_i+ $_i$, COV(IQ_i, $_i$)=0, COV($_i$, $_j$)=0.
2. Average peer IQ, IQ_P, measures average peer intelligence I_P approximately without error because E($_i$)=0: COV(IQ_P, $_i$)≈0 and IQ_P≈IA_P.
3. Individual and peer intelligence tends to be similar, IQ_i+ $_i$=I_i≈I_P≈IQ_P. Therefore, IQ + i≈IQ and IQ -IQ ≈- , on average. This implies COV(IQ -IQ ,)<0.

$$
\begin{aligned}
\ln Y_i &= \beta_1 I_i + \beta_2 I_P + \nu_i \\
&\approx \beta_1 (IQ_i + {}_i) + \beta_2 IQ_P + \nu_i \\
&= \beta_1 (IQ_i - IQ_P) + (\beta_1 + \beta_2) IQ_P + \nu_i + \beta_1 {}_i \ .
\end{aligned}
$$

Lazear, Edward P. and Sherwin Rosen (1981) "Rank-order tournaments as optimum labor contracts" Journal of Political Economy, Vol. 89, October, 841-864.

MacLeod, W. Bentley and James M. Malcomson (1988) "Reputation and hierarchy in dynamic models of employment" Journal of Political Economy, Vol. 96, August, 832-854.

Mayer, Susan E. (1997) What Money Can't Buy: Family Incomes and Children's Life Chances, Harvard University Press, Cambridge.

McLaughlin, Kenneth J. (1988) "Aspects of tournament models: A survey" Research in Labor Economics, Vol. 9, 225-256.

Montgomery, James D. (1991) "Social networks and labor-market outcomes: Towards an economic analysis" The American Economic Review, Vol. 81, December, 1408-1418.

Murnane, Richard J, John B. Willett and Frank Levy (1995) "The growing importance of cognitive skills in wage determination" The Review of Economics and Statistics, Vol. 77, May, 251-266.

Neal, Derek (1997) "The effects of Catholic secondary schooling on educational achievement" Journal of Labor Economics, Vol. 15, January, 98-123.

Neal, Derek A. and William R. Johnson (1996) "The role of premarket factors in black--white wage differences" Journal of Political Economy, Vol. 104, October, 869-895.

Neisser, Ulric, ed. (1998) The Rising Curve: Long-Term Gains in IQ and Related Measures, American Psychological Association, Washington, D.C.

Olson, Craig A. and Deena Ackerman (1999) "High school inputs and labor market outcomes for male workers in their mid-thirties: New data and new estimates from Wisconsin", working paper, University of Wisconsin-Madison.

O'Regan, Katherine M. and John M. Quigley (1993) "Family networks and youth access to jobs" Journal of Urban Economics, Vol. 34, September, 230-248.

Prendergast, Canice (1999) "The provision of incentives in firms" Journal of Economic Literature, Vol. 37, 5.2u.8(,)-1.rch, ment" Consequences of Growing Up Poor, Duncan, Greg J. and Jeanne Brooks-Gunn, eds., Russell Sage Foundation, New York, 132-189.

U.S. Bureau of the Census (1963a) U.S. Census of Population: 1960, Vol. I, Characteristics of the Population, Part 1, United States Summary, U.S. Government Printing Office, Washington, D.C.

U.S. Bureau of the Census (1963b) U.S. Census of Population: 1960, Vol. I, Characteristics of the Population