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A REANALYSIS OF *THE BELL CURVE*

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ABSTRACT

In *The Bell Curve* Herrnstein and Murray argue that a youth's intelligence (IQ) is a more important determinant of social and economic success in adulthood than is the socioeconomic status (SES) of his or her parents. Herrnstein and Murray base this conclusion on comparisons of effects of IQ score (measures at ages 15 and 23) and the effects of an index of parents' SES from models of economic status, marriage, welfare use, involvement in crime, as well as several outcomes for young children. Reviewers of *The Bell Curve* have questioned whether Herrnstein and Murray's estimates of the effects of IQ are overstated by their use of a rather crude measure of parents' SES.

Comparisons of siblings in the Herrnstein and Murray sample, a more complete and accurate way to control for family background, reveal little evidence that Herrnstein and Murray's estimates of the effects of IQ score are biased by omitted family background characteristics (with the possible exception of outcomes for young children). However, there is evidence of substantial bias due to measurement error in their estimates of the effects of parents' socioeconomic status. In addition, Herrnstein and Murray's measure of parental SES fails to capture the effects of important elements of family background (such as single-parent family structure at age 14). As a result, their analysis gives an exaggerated impression of the importance of IQ relative to parents' SES, and relative to family background more generally. Estimates based on a variety of methods, including analyses of siblings, suggest that parental family background is at least as important, and may be much more important than IQ in determining social and economic success in adulthood.

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Introduction

Since its publication at the beginning of October 1994, *The Bell Curve* by the late Richard Herrnstein and Charles Murray has been discussed in over one thousand articles in the public and academic press. Initial commentary focused primarily on the book's treatment of race. The majority of these essays were negative, with many denouncing the book as racist. More recent reviews (e.g., Heckman 1995; Hunt 1995; Goldberger and Manski 1995) have focussed on the disjunction between the evidence presented and the strong conclusions drawn by the authors.

Herrnstein and Murray argue in *The Bell Curve* that IQ is the most important determinant of social and economic success in present day America. Herrnstein and Murray support this conclusion with statistical analyses that suggest that a youth's intelligence or IQ [measured at ages 15 to 23 by the Armed Forces Qualifications Test (AFQT)] is considerably more important than his or her parents' social and economic status (SES) in determining social and economic status in adulthood, the well- being of her children (in the case of females), and the avoidance of anti-social behaviors. In their analyses, the effect of IQ is more than twice as large as the effect of parents' SES in predicting whether, at ages 25 to 32, someone (1) is poor, (2) dropped out of high school, (3) had been unemployed four weeks or more, (4) had a child out of wedlock, (5) had been on welfare, (6) had a low birth weight birth, or (7) had a child with low IQ.[1] In this paper, we reanalyze Herrnstein and Murray's data in order to assess whether their principal conclusions are warranted.

Our analyses address three questions. The first two are related to whether Herrnstein and Murray's estimates of the effects of IQ and parents' SES are biased by measurement error (especially in parents' SES) or by unmeasured or omitted family background characteristics that may be correlated with AFQT, parents' SES, and economic and social success.

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[1] See also Goldberger and Manski pp. 765-766 for a succinct summary of Herrnstein and Murray's conclusions regarding the importance of IQ relative to parents' SES.

(1) Is Herrnstein and Murray's index of parents' socioeconomic status adequate for isolating the effects of measured IQ on economic and social success in adulthood?

Ideally, in order to isolate the effects of IQ on adult outcomes, one would like to hold constant--with perfect measures--all aspects of family background that influence both adult outcomes and IQ scores. Herrnstein and Murray employ a narrowly conceived and poorly measured index of parental SES. As Heckman notes:

> The statistical methods used by Herrnstein and Murray are vulnerable to measurement error. It would be incredible if 15 to 23 years of environmental influences, including the nurturing of parents, the resources they spent on a child, their cultural environment, their interactions with their children and the influence of the larger community on the children could be summarized by a single measure of education, occupation and family income in one year. If environment is poorly measured but affects the test score--and there is solid evidence of environmental impacts on test scores--the Murray and Herrnstein finding that IQ has a stronger impact on socioeconomic outcomes than measured environment may simply arise from the poor quality of their measure of the environment. Their measure of IQ proxies the mismeasured environmental variable (p. 21).

In the first part of our analysis we use comparisons of siblings in order to control more completely and broadly for differences in family background characteristics that may influence IQ and adult outcomes. We estimate the effects of IQ (AFQT score) net of family background by relating differences between siblings in adult outcomes to differences in their IQ tests scores (controlling for age and gender). In effect, a youth's sibling(s) acts as his "control group." Incredible as it may seem, our sibling analyses suggest that, even though Herrnstein and Murray's parental SES index is poorly measured and narrowly conceived, it appears in most cases to be adequate for producing unbiased estimates of the effects of AFQT score on socioeconomic outcomes.

(2) Is Herrnstein and Murray's measure of parents' socioeconomic status adequate for estimating the effects of parental SES or family background on social and economic success in adulthood?

Because Herrnstein and Murray's index of parental SES is highly correlated (0.55) with IQ score, and because parental SES is measured with more error than is IQ score, Herrnstein and Murray's estimates may substantially understate the effects of parents' SES and overstate the effects of IQ score on adult outcomes. This point is easily demonstrated for a subset of Herrnstein and Murray's adult outcomes that are continuous (as opposed to binary) variables. For these outcomes, we adjust estimates for measurement error using a range of values for the reliability of AFQT score and parents' SES. We find evidence of substantial downward bias in their estimates of the effects of parents' SES.

Next, we investigate more directly the consequences of Herrnstein and Murray's narrow conceptualization of family background. We argue that Herrnstein and Murray's index of parental SES covers an important but limited range of parental family characteristics. As Goldberger and Manski (pp. 768-769) remark[2]:

> In practice they simply take it for granted that their SES index--a rather ad hoc concoction of information on parental attributes--adequately captures the socioeconomic environment within which a child grows up. This single variable carries the burden of expressing all aspects of the child's upbringing from family structure to sibling relationships to neighborhood characteristics.

We find evidence that Herrnstein and Murray's index of parents' SES yields substantially misleading estimates of the effects of parental family background on socioeconomic outcomes. Herrnstein and Murray's index of parents' SES fails to capture components of family background that are demonstrably important determinants of adult outcomes. We illustrate this point in two ways that, together, form upper and lower bounds for the effects of family background.

To obtain lower-bound estimates we first add to Herrnstein and Murray's models a variety family background controls including indicators of parental family arrangement (e.g., single parent

[2]A similar point is raised by Fischer et al. (1995). They also emphasize the importance of race and gender in the determination of social and economic status in adulthood.

family, step-parent) at age 14, family structure (e.g., number of siblings), urban/rural residence at age 14, as well as other aspects of the home environment at age 14. We combine the effects of Herrnstein and Murray's parental SES index with the effects of this richer set of family background controls to form a single standardized composite effect of family background. The composite effect is dramatically larger than the effect of parental SES alone, and is sometimes larger than the effect of AFQT score. Nonetheless, these composite effects are lower-bounds for the effects of family background because they are based on the limited set of imperfectly measured family background characteristics available in the data set.

Our upper-bound estimates of the effects of family background are based on analyses of siblings. These estimates are upper-bounds because they are derived under the assumption that anything common to siblings other than IQ, age, and gender is attributable to family background. These residual effects of family background are far larger than Herrnstein and Murray's estimated effects of parental SES, and are at times two to four times as large as the effects of IQ.

(3) Are Herrnstein and Murray's estimates sensitive to their treatment of education?

Herrnstein and Murray do not control for a youth's education when estimating the effects of his or her IQ and parental SES on adult outcomes. We agree with Herrnstein and Murray that simply including education controls in the models does not necessarily lead to more accurate estimates of the effect of IQ on adult outcomes if IQ determines, in part, the amount of education one obtains (and, therefore, the estimated effects of education include indirect effects of IQ). However, by the same reasoning, if education and parental SES affect IQ score, then Herrnstein and Murray's IQ effects include indirect effects of education and parents' SES. We intend to develop these ideas more fully in a companion paper (Winship and Korenman, in progress). For the purposes of the present paper we are satisfied to show that the effects of IQ are sensitive to the inclusion of education controls--something that may not be immediately obvious to readers of *The Bell Curve*. Our point is not that one should necessarily prefer the smaller estimates of the effects of IQ from analyses that include education, but, rather, that the sensitivity of the IQ effects underscores the need for a careful and thorough examination of the role of education.

Outline of *The Bell Curve*

The Bell Curve is organized into four sections. In part one, Herrnstein and Murray argue that America is becoming increasingly dominated by a cognitive elite. They discuss the increasing selectivity of elite universities and colleges and the rising educational credentials of top managers. In part two they present an extensive set of original analyses aimed at demonstrating that IQ is the principal determinant of a variety of social and economic outcomes. (We are concerned with this portion of the book.) The third section examines previous work on racial differences in IQ and presents new analyses of the importance of IQ as a determinant of different outcomes across racial/ethnic groups. The final section of the book discusses a variety of policy issues, most notably affirmative action.

Much of *The Bell Curve* reviews and interprets the analyses and data of others. The exceptions are the chapters in section II, and chapters 14 and 16 of section III, in which Herrnstein and Murray present original analyses of the National Longitudinal Survey of Youth.

The analysis methods used by Herrnstein and Murray are those commonly employed in the social sciences, and their approach to the data is straightforward and clearly explained.[3] As noted,

[3] They use linear and logit regression, and estimate the effects of IQ and SES on different outcomes when age is controlled.

Herrnstein and Murray's principal conclusion is that for all racial and ethnic groups and across a variety of social and economic outcomes, an individual's IQ is a more important determinant than is the social and economic status of his parents.

Methods and Data

The analyses in section II of *The Bell Curve* and in chapters 14 and 16 are all of the Department of Labor's National Longitudinal Surveys of Youth (NLSY). The NLSY is an ongoing longitudinal study of approximately 12,000 youths aged 14 to 21 as of January 1, 1979 (Center for Human Resource Research 1994).

In section one of their book, Herrnstein and Murray restrict their analyses to whites. In chapter 14 and appendix 6 they repeat these analyses for blacks and latinos. In our analyses, we estimate models for the entire sample and enter controls for race and ethnicity (and sex). Most of the time we have done so to ensure that we had the largest sample possible. As explained below, sample size becomes an important concern in analyses of sibling differences. We have also repeated the analyses for black, Latino and white subsamples for continuous outcomes (income, wages, and years of schooling) where sample sizes are sufficient to permit analysis of sibling differences. The results of these analyses, which we present in Appendix 1, parallel those for the full sample.

--- Table 1 here ---

Table 1 provides a description of the outcome variables and samples from *The Bell Curve* that we have used in our analysis. Our approach to the analysis is to use Herrnstein and Murray's data (supplied to us by Murray) and estimate models analogous to their models. We then report alternative estimates based on different assumptions or modeling strategies. Because we present some models that include controls for years of schooling completed as of 1990, we have restricted the samples to respondents who have valid information on Herrnstein and Murray's (standardized) educational attainment variable. This restriction results in the loss of about one percent of the sample.

The importance of the NLSY is that in 1980 the Armed Forces Qualifications Test (AFQT) was administered to nearly the entire sample so that the Department of Defense could renorm the AFQT based on a national population. The AFQT score Herrnstein and Murray use as their measure of IQ is a weighted average of four of the ten components of the ASVAB (Armed Services Vocational Aptitude Battery). They provide arguments and evidence that their measure is one of the best available for general intelligence. We leave discussion and evaluation of this claim to future work where we intend to take up issues of endogenous determination of AFQT scores (see also Neal and Johnson 1995; Rogers and Spriggs 1995; Hunt 1995).

The components of AFQT with their factor loadings are (Herrnstein and Murray, p. 583): Word Knowledge (.87), Paragraph Comprehension (.81), Arithmetic Reasoning (.87), and Mathematical Knowledge (.82). Herrnstein and Murray do not discuss whether, net of their measure, other components of the ASVAB might affect the different adult outcomes. For example, Heckman (1995) notes that the numerical operations component is a strong predictor of labor market outcomes. Although the construction and interpretation of the AFQT score is an important issue, it is one that we do not explore.

Herrnstein and Murray's measure of parental social and economic status is a combination of the respondent's father's and mother's education, occupation of parents or other adults in the household (as measured by the highest revised Duncan Index score among the two parents or adults), and the natural log of income of the parental family (the average of available years, 1978 and 1979, for youths who report income of the parental household). The components of SES are each standardized to have variance one. A simple average of the available standardized measures is taken in order to create the SES index. The index is standardized to have variance one.

Omitted Variable Bias in the Effects of IQ: Family Fixed-Effect Estimates

Many aspects of family background could conceivably be included in Herrnstein and Murray's models because they may influence AFQT score at age 15 to 23 and adult outcomes, and may not be captured adequately by the parental SES index. For example, growing up in a single parent family has been linked to a variety of social and economic disadvantages (e.g., Garfinkel and McLanahan 1986). The effects of IQ score estimated by Herrnstein and Murray may be exaggerated (biased upward) as a result of omitted family background variables. One approach to this problem is to attempt to measure and include in the models additional family background variables. We pursue this strategy below. Our initial approach is to carry out analyses of siblings. We compare the effect on various outcomes of differences in IQ between (or among) siblings. In the case of continuous outcomes (dependent variables), fixed-effect analysis amounts to entering a dummy variable for each family of origin. For dichotomous (binary) outcomes, we estimate fixed-effect logit models for the oldest pair of siblings from each baseline household. The estimation of fixed-effects logit models necessarily involves a substantial reduction in sample sizes because only sibling pairs that have different values for an outcome (e.g., one graduated from high school and the other did not) contribute to the likelihood function (Chamberlain 1980).

The fixed-effect analyses correct for bias due to both measurement error in the parental SES index and omitted family characteristics (i.e., characteristics that are common to siblings). This is a broad notion of family background that includes, for example, characteristics of the neighborhood and the surrounding geographic area (Griliches 1979). The advantage of this method is that, to the extent that siblings share identical family backgrounds, the fixed-effect approach provides a way of fully controlling (without measurement error) all aspects of family background. The assumption that siblings have identical family backgrounds is most reasonable when they are close in age.

--- Table 2 here ---

Table 2 (four pages) presents OLS and logit estimates along with fixed-effects estimates for twenty-six outcomes studied by Herrnstein and Murray. For each outcome, we present models that both include and exclude education controls. In this section of the paper, we discuss results of models that exclude education controls and postpone discussion of models that include education controls to a later section of the paper.[4]

In the first three columns of the table we present cross-section results for the full sample. These are analogous to (and are very similar to) the models presented by Herrnstein and Murray in *The Bell Curve*. In the fourth through the sixth column we repeat the cross-section analyses for the

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[4] Our treatment of the outcomes for children of NLSY sample women requires additional explanation. Our analyses of outcomes for first-borne children are analogous to Herrnstein and Murray's. However, in our analyses of outcomes for samples that (potentially) include multiple children per woman we study continuous versions of the binary outcomes studied by Herrnstein and Murray. For example, Herrnstein and Murray study a binary variable that indicates whether or not a child's PPVT score was in the bottom decline for his/her age, whereas we study the (continuous) standardized and age-adjusted PPVT score. Qualitatively, our cross-section results are the same as theirs--higher maternal AFQT score is associated with higher child test score, controlling for parents' SES (i.e., maternal grandparents' SES). The use of continuous outcomes greatly facilitates family fixed-effects analysis and enables us to use all available scores for all children of women included in a given analysis. For tests or assessments that were administered at more than one age for a given child, we average the assessment scores available for each child, and we average the child's ages at assessment. We adjust standard errors for nonindependence among child siblings and among first cousins (i.e., children whose mothers are sisters).

pooled subsample of siblings in the NLSY. The purpose of these analyses is to gauge the representativeness of the siblings subsample that we use for analyses of sibling differences. In general, cross-section results for the sibling subsample are similar to those for the full sample. As a result, we can be confident that any differences we might find between cross-section and fixed-effects estimates is not an artifact of the use a different sample (the sibling subsample of NLSY respondents).

In the final two columns of the table we present results from family fixed-effect (sibling difference) analyses. With a few exceptions, the fixed-effects estimates for AFQT are remarkably similar to the standard OLS and logit estimates. The exceptions, where the effect of AFQT is reduced, are family income ($7,296 in column 4, versus $5,558 in column 7), poverty (-.99 versus -.78), years of school completed (.59 versus .45), out-of-wedlock birth (-.65 versus - .10), HOME score (9.2 versus 3.6), motor and social development (2.8 versus -1.1), PPVT (5.8 versus 0.8), PPVT for children older than 6 (9.0 versus 6.8), and the Behavior Problems Index (-2.2 versus -1.4). The reduction in the size of the effects of AFQT most likely reflects the exacerbation of attenuation bias (due to measurement error) when data are differenced as compared to when they are entered in levels. For example, adjusting for measurement error bias in fixed-effects estimates raises the estimated effects of AFQT score from 5,558 to 6,558 for family income, and from 5,317 to 6,228 for annual earnings (see Appendix 3; see also section on Measurement Error below). However, it is unlikely that attenuation bias alone could explain the reduction in the AFQT effects in several of the outcomes for children.[5]

[5]Appendix 1 presents results from analyses of education, wages, and income for subsamples of blacks, Latinos, and whites. The estimates are broadly consistent with those reported in Table 2 for the full sample. However, figures in the table indicate greater family background heterogeneity bias for blacks than whites (i.e., fixed-effects estimates are smaller relative to cross-section estimates for blacks). However, bias from measurement error (attenuation bias) is greater in fixed-effects analyses than in cross-section analyses, and is probably more severe for blacks in the sample. The reliability of differences in test scores is equal to (R-C)/(1-C), where R is the reliability of the test score and C is the intra-family correlation in test scores. The intra-family correlation in AFQT is higher for whites than blacks in the sample, and therefore, given R, the reliability is lower for blacks. When we

The fixed-effect estimator is a powerful method of controlling for family background in that it captures all components that are common to siblings. It is surprising that, for many outcomes, the fixed-effect estimates for AFQT are similar to the standard estimates. However, Herrnstein and Murray's measure of SES is highly loaded on father's and mother's education. A reasonable conjecture is that parents' education might capture well the component of family background most highly correlated with AFQT and thus serve as an adequate control for family background in estimating the effects of AFQT. If so, the case, the fixed-effect estimates of AFQT would not differ greatly from the standard estimates. The one set of outcomes where the fixed-effect estimates of AFQT are substantially smaller than the cross-section estimates is for outcomes involving children. Here AFQT may be proxying other dimensions of the home environment.

Biases in the Effects of Parents' SES: Measurement Error

Above we briefly discussed the construction of Herrnstein and Murray's measures of IQ (AFQT) and SES. As we noted, parental SES and AFQT score are highly correlated (.55). As a result, separating the effects of these two variables may be difficult and is likely to be sensitive to model specification and other assumptions.

The IQ measure (AFQT) is potentially more comprehensive than their SES measure since it is based on four separate tests each of which contains a large number of items. SES is comprised of four components of parental status measured (essentially) in a single year. Murray (personal

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corrected the fixed-effects estimates for reliability of AFQT score using a value of 0.95 for R and values of C that vary by race, there was no longer any evidence of greater heterogeneity bias for blacks. We do not present these results because a proper reliability correction would require separate estimates of R for blacks, whites and Latinos. We are not aware of the existence of such estimates.

communication) reports that the reliability of their four component measure of AFQT is 0.95, indicating that the measure is highly reliable. This figure is consistent with Bock and Moore's comment (p. 196) that "various composites such as the AFQT composite...have reliabilities in excess of 0.90."

In *The Bell Curve* Herrnstein and Murray report that SES has a reliability of 0.76 (page 574). This reliability, however, is based on Cronbach's Alpha. Cronbach's Alpha is an appropriate measure of reliability under the assumption that one has a set of measures of a single underlying variable. In the case of SES this assumption may not be defensible. Parents' education, the occupation of the head of the household, and parents' income are unlikely to measure a single underlying concept. Rather, we tend to think of these separate variables as combining to determine SES.

The true reliability of Herrnstein and Murray's SES measure is unknown. Ignorance about the reliability of SES does not mean, however, that we should ignore the potential bias induced by measurement error in the estimated effects of SES or AFQT. Because of high correlation between AFQT and SES, measurement error bias in the SES coefficient will be translated to the AFQT coefficient. At present, we have discovered no way of obtaining an independent estimate of the reliability of their SES measure. Jencks (1979) reviews a number of studies with different estimated reliabilities for the components of SES. From these estimates, a reliability of .85 for SES would seem to be conservative if we are concerned with measuring SES in a single year only. If measured SES changes from year to year during childhood, as it surely does, this reliability estimate is most likely too high if we are after a more permanent concept. In fact, the .76 reliability reported by Herrnstein and Murray may even be too high.

Measurement error in the independent variables leads to potentially severely biased and inconsistent estimates of regression parameters. Simple techniques are available to correct for measurement error in linear regression models when the measurement error is purely random. Some popular computer programs such as STATA (Stata corporation, 1993), which we have used for most of our analyses, contain routines for carrying out this correction.

Most of the models estimated by Herrnstein and Murray involve logit analyses. The correction of measurement error in logit analysis is an area of current research. A forthcoming book by Carroll, Ruppert, and Stefanski (1995) provides a detailed discussion. At present no software is available for the general situation for carrying out these corrections. Therefore, at this time we are able to examine the effects of measurement error in only three cases where the dependent variable is continuous.

Table 3 (two pages) reports estimates of the effects of AFQT and SES on family income, annual earnings, and education. We have assumed a reliability of .95 for AFQT and reliabilities of .85 or .76 for SES. (We postpone discussion of the effects of reliability corrections on estimates from models that include education controls to a later section.)

--- Table 3 here ---

As one would expect, given the lower reliabilities for SES than AFQT, correcting for measurement error increases the size of the effect of SES relative to that of AFQT. In the case of income, when a reliability ratio of 0.76 is assumed for SES, SES has a slightly larger effect ($7,036) than AFQT ($6,047). When measurement error is corrected in the earnings equations for all year-round workers (males and females, controlling for sex), the effect of SES increases (to $2,162 assuming a reliability ratio of 0.76) although it is still considerably smaller than the effect of AFQT ($4,855). When the analysis is restricted to men (second page of Table 3) and we assume a reliability of *0.76* for SES, its effect ($3,052) begins to approach that of AFQT ($4,199).

When years of schooling is the dependent variable, correcting for measurement error increases the effect of SES (from .20 to .24 and .29), but it is still considerably smaller than that of AFQT (.62, .64, and .61).

Biases in the Effects of Parents' SES:
Additional Family Background Characteristics

Herrnstein and Murray's SES index may capture only a small part of family background. Therefore, we examine the effects of controlling for several additional family characteristics: family arrangement when the respondent was 14 years old (two-parent, parent and step-parent, single parent, other); whether, at age 14: the respondent lived in an urban area; the respondent's family had a library card, received magazines regularly, received newspapers regularly; whether an adult female in the household worked outside the home; the number of siblings of the respondent (dummy variables for none, two, three, and four or more); the age of the respondent's mother at the time of the respondent's birth (entered as a quadratic); whether the respondent is the eldest child in the family; and whether the respondent was born outside the U.S. Surely, there are also other important omitted parental SES and family background components.

Coefficients and standard errors for the full models are presented in Appendix 2 (six pages). The results of these analyses are summarized in Table 4 (two pages). In the first two columns we repeat the results presented in Table 2. In the third and fourth column we present coefficients and standard errors for the AFQT and SES variables from models that include detailed family background controls. Finally, in the last two columns of the table, we present two "composite" estimates of the effects of family background (both in absolute values). The first is a standardized composite of the

SES effect and the effects of the various family background characteristics described in the previous paragraph. The second composite adds to the first the effect of racial/ethnic identification. Since AFQT score is controlled, the effects of race/ethnicity may reflect, at least in part, additional effects of family background (also see Fischer et al. 1995).

The composite effects we have constructed may be unfamiliar to many readers. This procedure allows us to extend Herrnstein and Murray's methodology for comparing effects of AFQT and SES to compare the effects of AFQT to a single, yet more comprehensive measure of family background. The composite effects are derived as follows. We first estimate a model for each outcome using the different components of family background. Next, using coefficients from these models, we construct (specific to each model) an index of family background as the sum of the family background variables weighted by their effects. We then calculate the effect of this composite family background index assuming that it has standard deviation one. We compare the standardized combined effect of family background to the standardized effect of AFQT and SES.

The composite family background measures differ across dependent variables. Our procedure constructs the index for each model so as to maximize the effect of measured family background. This strategy is appropriate if one wishes to isolate the direct effects of measured IQ and measured family background. Our procedure differs from Herrnstein and Murray's because they use a fixed index of IQ (AFQT score) and a fixed index of parents' SES across all models. Given their position that AFQT measures a single underlying construct of intelligence, their treatment of the AFQT score is appropriate (although an area of future research is to investigate whether different components of AFQT differentially affect different measures of social and economic success.) However, Herrnstein and Murray do not defend the use of a single index of parents' SES across all models, and we know of no theoretical or evidentiary basis for doing so.

--- Table 4 here ---

Generally speaking, when family arrangement and the other family background variables are included in the models, the effect of AFQT is virtually unchanged and the effect of SES falls modestly (compare column 1 to column 3 and column 2 to column 4). However, in most cases the effects of many of the other FB (family background) variables are substantial (see Appendix 2), and the combined effects of SES and FB typically far exceed those of SES alone (compare column 2 to column 5 or 6). For example, the effect of FB + SES reported in column 5 is at least 50% larger than the effect of SES alone (column 2) for the following outcomes: poverty, annual earnings, high school dropout, high IQ occupation, out of the labor force, unemployment, married by age 30, middle class values index, ever in jail, as well as nearly all the child outcomes. There are several instances in which the SES index has no discernable effect on an outcome, yet the composite FB effect is substantial (e.g., jail, marriage, out of labor force, and low birth weight).

Comparing the relative size of the AFQT and composite FB effects, it appears that the more closely related the outcome is to schooling attainment, the larger is the effect of AFQT relative to the FB composite. The strength of AFQT in predicting education and education-related outcomes further underscores the need to model carefully the joint determination of education, AFQT score, and the various adult outcomes. Other than schooling outcomes, the magnitude of the composite FB effect tends to be in the neighborhood of the AFQT effect, and the point estimate of the composite FB effect is larger than the AFQT effect for seven outcomes (out of the labor force, marriage, illegitimate birth, early AFDC use, foster care, HOME score, motor and social development score) when race/ethnicity is excluded from the composite effect. The composite FB effect is larger than the AFQT effect for three other outcomes (divorce, low birth weight, PPVT score for all children) when the effects of race/ethnicity are included in the composite.

Biases in the Effects of Parents' SES:

Residual Family Background Effects

We saw in Table 4 that the combined family background effect was considerably larger than the effect of SES alone. It is also possible to derive an omnibus estimate of the family background effect implied by the fixed-effect models. This effect captures the effects of all characteristics siblings have in common that are not included in the model (such as AFQT, age and gender). Thus, for example, it includes not only the effect of having grown up in the same household, but also the effect of having grown up in the same neighborhood and broader geographical area. Potentially, personality similarities, similarities in motivation and effort, etc., are also included in this effect.

With continuous variables it is possible to estimate directly the effect of the latent family background variable by doing a one-way ANOVA analysis (by household) of the residual from the fixed-effect model. Here the residual is constructed to include all variance in the dependent variable not due to the observed independent variables. That is, it includes both the individual and family-specific components of the dependent variable, once we have removed the effects of AFQT and other observed variables that may differ among siblings. If we assume that the latent variable has variance one, then its coefficient is equal to the standard deviation of the household effect. These results are shown in Table 5a.

With discrete outcomes the same methodology is not available. It is possible, however, to estimate a bivariate probit model. This is not as powerful a model since it is a random effects model and as such assumes that any unobserved family component is uncorrelated with observed variables such as AFQT. However, we noted in our discussion of the fixed-effect models that SES appeared to be an adequate control for family background for the purpose of estimating the effects of AFQT. (The exceptions to this finding were outcomes for the children of NLSY respondents. However, we do not examine child outcomes here.) As in the fixed-effect model, if we assume that the latent variable has variance one, then its effect is the square root of the inter-sibling correlation. The results of the bivariate probit analyses are report in Table 5b.

--- Table 5a here ---

The top panel of Table 5a shows the imputed effect of family background for earnings. This effect ($5,364) is considerably larger than that of SES alone ($1,169) and is of the same magnitude as both estimates of AFQT's effect (OLS: $5,548 and FE: $5,403). The implied effect of family background on income ($12,505) is considerably larger than that of SES ($4,487) or either AFQT effect (OLS: $7,296 and FE: $5,130). Finally the implied effect of family background on education (.508) is far larger than the OLS estimate of SES's effect (.180), and is somewhat larger than the AFQT fixed-effect estimate (.453).

--- Table 5b here ---

Table 5b reports the results from the bivariate probit analyses. Results are similar to those for income in Table 5a in that in almost all cases the effect of the latent variable and the combined effect of SES and the latent variable are larger than the effect of AFQT, often considerably so. The sole exception is with the probability of receiving a BA degree, where the effects are of nearly equal size. The results in Table 5b suggest there is a very large latent family background component that is orthogonal to the parental SES index, but has substantial effects on many outcomes.

Again, considerable caution should be used in interpreting the estimates in Tables 5a and 5b. These estimates of the total effect of family effects are of the "kitchen sink" variety. That is, they attribute to family background all common variance between siblings in the outcome variables net of the effect of AFQT. For example, if siblings share common genetic traits that are orthogonal to IQ, the effects of these traits have been lumped into the total family background effects. Similarly, if siblings live or have lived in the same geographical location and location affects outcomes, these effects will be included in our estimates of the effect of family background.

The Role of Education

Herrnstein and Murray's models contain few control variables. Appendices 6 and 8 of *The Bell Curve* explore the consequences of adding some variables to their equations predicting various outcomes. Of particular interest is Herrnstein and Murray's treatment of education which other reviewers have noted is uneven and at times inconsistent (e.g., Heckman 1995). In appendices 6 and 8 Herrnstein and Murray present models estimated within education groups. In general, however, it is difficult to assess the effects of controlling for education on their estimates of AFQT. This information may be useful because AFQT and schooling are correlated 0.64.

Table 2 reports estimates for different outcomes when education is included as an independent variable for both standard OLS and logit models and for fixed-effect models. In eleven of 23 cases the inclusion of education reduces the effect of AFQT by more than 25%. In many cases the effect of education is larger than that of AFQT. In the OLS and standard logit analyses, education has a larger effect than AFQT for family income, annual earnings, high-IQ occupations, the middle class values index, whether the mother smoked during pregnancy, HOME index, and child's motor and social development index. Parallel changes are found in the fixed-effect models.[6]

The inclusion of education also substantially changes the effect of parents' SES. This is hardly surprising since it is known that much of the effect of SES on status attainment works through education. In six of twenty-three cases the effect of SES is reduced by more than 25%. It is notable that including education has little impact on the estimates of the effects of SES on the outcomes associated with the children of NLSY respondents.

One objection to including education in the above models is that education may be determined in part by an individual's IQ. As a result, the effect of education on any outcome may in part be the result of an indirect effect of IQ through education. This objection points to an area of confusion in *The Bell Curve*. Throughout section II of the book, Herrnstein and Murray are unclear about whether, in comparing the effects of AFQT and SES, they are contrasting the direct effects of the variables on an outcome--that is, the effects of AFQT and SES net of the effect of other variables--or the total effects of these two variables (their direct effects and indirect effects through other variables such as education).

As noted, if one wants to contrast total effects and thus worry about the indirect effects of IQ through education, one must also consider the possible indirect effects of SES through IQ on different outcomes. Second, although AFQT certainly affects education, education also most likely affects AFQT. In appendix 3 of *The Bell Curve* Herrnstein and Murray carry out an analysis of the possible effects of education on IQ using earlier measures of IQ as a control variable. They find that

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[6]Appendix 3 presents analyses of family income and annual earnings where we have adjusted fixed-effects estimates for measurement error in AFQT scores and education. In models of family income, the effect of AFQT score falls slightly and the effect of education rises markedly (from 4,305 to 5,627) when we correct for measurement error. Both effects rise slightly in models of annual earnings.

education has only a modest effect. An increase in education of one year increases percentile ranking in the IQ distribution by only 2.2%, or when they use the standardized AFQT score, by .074 of a standard deviation, about one IQ point per year of education.

In recent work with the NLSY, however, Neal and Johnson (1995) have found, using quarter of birth as an instrument for educational attainment, that education increases IQ by more than three points for every year of education (a very large effect). Reanalysis of Herrnstein and Murray's data (Murray, personal communication) also finds that seven observations included in Herrnstein and Murray's analyses had years of schooling equal to -5 (a missing value code in the NLSY). Furthermore, the results presented on page 591 are from analyses that do not include age at first test, although it states on page 590 that age at first test was included. When missing data are treated appropriately and age at first test is included as a control, the effect of education on AFQT more than doubles to 4.9 percentage points, or using the standardized AFQT score, .167 standard deviations or 2.5 IQ points for every year of education.

A considerable modelling effort is needed to sort out the possible mutual effects of education and IQ on each other, and to account for the indirect effects of SES on various outcomes through its effect on AFQT. We intend to develop such models in a future paper. Nonetheless, from the analyses reported here we learn that estimates of the direct effects of AFQT, where we control for education, are in most cases much smaller than the effects of AFQT reported in *The Bell Curve*.

Conclusions

The purpose of section II of *The Bell Curve* and chapter 14 is to demonstrate the importance of IQ in determining a variety of outcomes. Herrnstein and Murray summarize their results in the following way: "If a white child of the next generation could be given a choice between being disadvantaged in socioeconomic status or disadvantaged in intelligence, there is no question about the right choice" (p.135). Herrnstein and Murray are confident that IQ is the principal determinant of economic and social success.

In his 1979 book, *Who Gets Ahead?* Christopher Jencks, using a large number of data sets analyzes the importance of intelligence, education, family background, and non-cognitive abilities in determining various economic outcomes. At the end of the book he concludes that all four sets of factors are important, that no single factor dominates the others, and that their relative importance differs across samples and outcomes.

Which conclusion is right? Are Herrnstein and Murray correct in asserting that intelligence is the dominant factor in determining social and economic success? Or, as Jencks asserts, is intelligence just one of several important factors? Although we confirm Herrnstein and Murray's finding that the effects of AFQT are substantial and surprisingly robust, on balance our results appear much closer to Jencks'. Although we have not replicated his analyses, we do find evidence that family background is as important, and in many cases is much more important than IQ in predicting a variety of outcomes.

In reaching this conclusion we have ignored the potentially serious possibility of the endogenous determination of AFQT score. If family socioeconomic background and schooling quality are important determinants of AFQT score at age 15 to 23, then the estimates of AFQT score and parental SES that we have presented may exaggerate the importance of IQ relative to family background in influencing socioeconomic outcomes. This is not to deny the evidence of the importance of IQ, but like Jencks, our results suggest that IQ is an important, but not the dominant factor in predicting economic and social success.

References

Ashenfelter, Orley and Alan B. Krueger. 1994. Estimates of the Economic Return to Schooling from a New Sample of Twins. *American Economic Review* 84(5):1157-73.

Bock, R. Darrell and Elise G.J. Moore. 1986. *Advantage and Disadvantage: A Profile of American Youth*. Hillsdale, NJ: Lawrence Erlbaum Associates.

Carroll, R.J., D. Ruppert, and L.A. Stefanski. Forthcoming. *Nonlinear Measurement Error Models*. Chapman Hall.

Center for Human Resources Research. 1993. *NLS Handbook 1993*. The Ohio State University, Columbus OH.

Chamberlain, Gary. 1980. Analysis of Covariance with Qualitative Data. *Review of Economic Studies*. XLVII: 225-38.

Fischer, Claude S., Michael Hout, Martin Sanchez Jankowski, Samuel R. Lucas, Ann Swidler, and Kim Voss. 1995. *Which Curve? Understanding Inequality in America*. Draft Manuscript, Department of Sociology, University of California, Berkeley, March 6.

Garfinkel, Irwin and Sara S. McLanahan. 1986. *Single Mothers and their Children: A New American Dilemma*. Washington D.C.: The Urban Institute Press.

Goldberger, Arthur S. and Charles Manski. 1995. Review Article: The Bell Curve by Herrnstein and Murray. *The Journal of Economic Literature* XXXIII (June): 762-776.

Griliches, Zvi. 1979. Sibling Estimates, The Beginnings of a Survey. *Journal of Political Economy* LXXXVII (part I): S37-S64.

Heckman, James J. 1995. A review of The Bell Curve: Intelligence and Class Structure in American Life by Richard Herrnstein and Charles Murray. *REASON* (March). Reprinted in The Harris School Report, University of Chicago, Summer 1995.

Herrnstein, Richard J. and Charles Murray. 1994. *The Bell Curve: Intelligence and Class Structure in American Life*. New York: The Free Press.

Hunt, Earl. 1995. The Role of Intelligence in Modern Society. *American Scientist* July/August: 355-368.

Jencks, Christopher. 1979. *Who Gets Ahead? The Determinants of Economic Success in America*. New York: Basic Books.

Neal, Derek A. and William R. Johnson. 1995. The Role of Pre-Market Factors in Black-White Wage Differences. NBER Working Paper No. 5124, May.

Rodgers, William M. and William E. Spriggs. 1995. What Does AFQT Really Measure: Race, Wages, Schooling and the AFQT Score, mimeo, The College of William and Mary, March.

Stata corporation. 1993. *Stata Reference Manual: Release 3.1*. 6th ed. College Station, TX.

Table 1: Unweighted sample means, (SDs), [analysis sample sizes] and descriptions of analysis variables[1,2]

	Mean (SD) [Obs]	Descriptions of variables and sample
Family income ($1990) in 1989	34,345 (27,080) 7977	Total net family income in 1989, 1990 dollars. Excludes persons not working because of school in 1989 or 1990.
In poverty in 1989	0.15 (0.36) 7977	Total net family income below U.S. Census poverty line. Excludes persons not working because of school in 1989 or 1990.
Annual earnings ($1990) in 1989	24,225 (16,083) 4974	Year-round workers.
Years of schooling completed 1990 (z-score)	-0.1 (1.0) 9885	
HS dropout	0.18 (0.39) 8718	Did not get a HS diploma, including those who later earned a GED.
BA degree	0.18 (0.38) 9588	Obtained a bachelor's degree or higher. Excludes persons enrolled as undergraduates in 1990.
High IQ occ.	0.04 (0.20) 7944	Excludes persons enrolled in college or graduate school in 1990.
Out of LF 1+ mos. in 1989, men	0.15 (0.36) 4144	
Unemployed 1+ mos. in 1989, men	0.10 (0.30) 3225	Excludes persons not working because of school in 1989 or 1990.
Married by age 30	0.72 (0.45) 4221	Excludes persons under 30 at 1990 interview. (H&M exclude age as a control.)
Divorced, first 5 years of marriage	0.20 (0.40) 4684	
Middle class values index	0.37 (0.48) 7692	Men: HS grad + in LF full year + never in jail + married to first wife; Women: HS grad + no out-of-wedlock births + never in jail + married to first hus. Excludes single persons who met other conditions and men who were disabled or enrolled in school.
Ever interviewed in jail, men	0.07 (0.25) 4809	

(table continues)

Table 1 (continued):

	Mean (SD) [Obs]	Descriptions of variables and sample
Child outcomes, first-borne children		
"Illegitimate" (out-of-wedlock) birth	0.36 (0.48) 3448	
Early AFDC use	0.24 (0.43) 2683	Mothers poor in year prior to birth.
Mother smoked during pregnancy	0.30 (0.46) 3333	
Low birth weight	0.06 (0.24) 3325	Below 5.5 pounds. Excludes LBW-premature babies whose weight was appropriate for gestational age.
Ever in foster or relative care?	0.05 (0.23) 3475	Ever lived in foster care or with nonparental relatives
Child outcomes, all children[3]		
HOME score (percentiles)	46.2 (25.9) 6711	Home Observation for Measurement of the Environment (short form). Test year and age-of-child entered as controls.
Motor & social development index (percentiles)	51.1 (26.7) 4246	Children aged 0-4. Test year and age-of-child entered as controls.
PPVT (standardized score)	85.9 (20.7) 4707	Peabody Picture Vocabulary Test. Receptive vocabulary for standard American English. Test year and age-of-child entered as controls.
PPVT, 6+ year olds (standardized score)	87.5 (16.9) 1784	Sample restricted to children age 6 years and over.
Behavior problems index (standardized score)	107.5 (13.2) 4645	Children 4 to 12. Maternal reports of behavior probs. Test year and age-of-child entered as controls. Higher score indicates more problems.

Notes:

1. Source: Herrnstein and Murray, p. 646 and elsewhere.
2. In addition to sample restrictions listed in the table, all samples are restricted to observations with non-missing values for: AFQT score, parents' SES score, age, and 1990 education.
3. If an assessment (or test score) is available for a given child in more than one year (1986, 1988, or 1990), then the outcome is the average (across years) of the assessments for that child.

Table 2: Estimated effects from models of socioeconomic status and child development, all races combined[1]

	OLS or Logit Coefficients (SEs)							
	Full Sample[2]			Siblings XSEC[2]			Siblings F-E[3]	
	zAFQT	zSES	zED	zAFQT	zSES	zED	zAFQT	zED
Family income ($1990) in 1989	6,975 (354)	4,580 (324)		7,296 (622)	4,487 (577)		5,558 (975)	
	4,134 (421)	3,627 (330)	4,612 (379)	4,607 (733)	3,717 (575)	4,422 (699)	3,610 (1044)	4,305 (963)
Number of obs.		7977			3316		3316	
In poverty in 1989	-0.95 (.05)	-0.33 (.04)		-0.99 (.08)	-0.31 (.07)		-0.78 (.17)	
	-0.67 (.06)	-0.25 (.04)	-0.50 (.05)	-0.68 (.09)	-0.23 (.07)	-0.59 (.09)	-0.60 (.18)	-0.48 (.17)
Number of obs.		7977			2926		284	
Annual earnings ($1990), YR workers, in 1989	4,866 (270)	1,531 (246)		5,548 (603)	1,169 (459)		5,317 (852)	
	3,040 (291)	910 (240)	3,092 (300)	3,879 (617)	803 (451)	2,667 (592)	4,023 (821)	2,341 (856)
Number of obs.		4974			1579		1579	
Yrs. schooling completed (z-score)	0.62 (.01)	0.20 (.01)		0.59 (.02)	0.18 (.02)		0.45 (.02)	
Number of obs		9885			4758		4,578	
HS dropout	-1.82 (.06)	-0.48 (.04)		-1.75 (.10)	-0.48 (.07)		-1.63 (.26)	
Number of obs.		8739			3468		263	
BA degree	1.76 (.06)	0.70 (.05)		1.76 (.09)	0.66 (.08)		1.87 (.23)	
Number of obs.		9588			3884		309	
High IQ occ.	1.36 (.08)	0.39 (.07)		1.39 (.14)	0.45 (.11)		1.72 (.43)	
	0.78 (.09)	0.14 (.07)	1.12 (.08)	0.83 (.17)	0.23 (.10)	1.07 (.15)	1.15 (.50)	0.92 (.37)
Number of obs.		7944			2946		94	

(table continues)

Table 2 (continued): Estimated effects from models of socioeconomic status and child development, all races combined

	OLS or Logit Coefficients (SEs)							
	Full Sample			Siblings XSEC			Siblings F-E	
	zAFQT	zSES	zED	zAFQT	zSES	zED	zAFQT	zED
Out of LF 1+ mos. in 1989, men	-0.39	-0.02		-0.34	-0.17		-0.30	
	(.06)	(.05)		(.10)	(.11)		(.19)	
	-0.33	-0.01	-0.10	-0.23	-0.13	-0.19	-0.18	-0.26
	(.06)	(.06)	(.06)	(.12)	(.11)	(.12)	(.22)	(.25)
Number of obs.		4144			1096			132
Unemployed 1+ mos. in 1989, men	-0.44	-0.09		-0.52	-0.02		-0.47	
	(.07)	(.07)		(.14)	(.15)		(.29)	
	-0.33	-0.05	-0.19	-0.44	0.01	-0.15	-0.35	-0.23
	(.08)	(.07)	(.09)	(.16)	(.16)	(.19)	(.32)	(.29)
Number of obs.		3225			720			65
Married by age 30	-0.04	-0.07		0.13	-0.10		0.20	
	(.05)	(.04)		(.11)	(.10)		(.18)	
	0.24	.01	-0.42	0.27	-0.07	-0.24	0.39	-0.33
	(.06)	(.04)	(.05)	(.14)	(.10)	(.12)	(.24)	(.21)
Number of obs.		4221			664			136
Divorced, first 5 years of marriage	-0.22	0.18		-0.26	0.28		-0.53	
	(.05)	(.05)		(.12)	(.10)		(.21)	
	-0.19	0.19	-0.05	-0.22	0.29	-0.08	-0.47	-0.11
	(.06)	(.05)	(.05)	(.13)	(.11)	(.13)	(.24)	(.24)
Number of obs.		4684			1046		159	
Middle class values index	0.75	0.23		0.84	0.20		0.67	
	(.04)	(.03)		(.07)	(.06)		(.13)	
	0.27	0.09	0.87	0.28	0.06	1.02	0.31	0.77
	(.04)	(.04)	(.04)	(.08)	(.06)	(.08)	(.14)	(.15)
Number of obs.		7692			2652			430
Ever interviewed in jail, men	-0.91	-0.06		-0.94	0.16		-0.91	
	(.08)	(.07)		(.13)	(.13)		(.26)	
	-0.76	-0.01	-0.29	-0.76	0.21	-0.32	-0.82	-0.16
	(.09)	(.07)	(.07)	(.15)	(.14)	(.14)	(.33)	(.31)
Number of obs.		4809			1422			72

(table continues)

Table 2 (continued): Estimated effects from models of socioeconomic status and child development, all races combined

OLS or Logit Coefficients (SEs)

	Full Sample			Siblings XSEC			Siblings F-E	
	zAFQT	zSES	zED	zAFQT	zSES	zED	zAFQT	zED
Child outcomes, first-borne children								
"Illegitimate" (out-of-wedlock) birth	-0.46	-0.22		-0.65	-0.02		-0.10	
	(.06)	(.05)		(.18)	(.15)		(.36)	
	-0.31	-0.19	-0.22	-0.54	0.01	-0.19	-0.06	-0.19
	(.08)	(.06)	(.06)	(0.20)	(.15)	(.16)	(.40)	(.38)
Number of obs.		3448			658			91
Early AFDC use	-0.54	-0.19		-0.77	-0.13		-0.84	
	(.08)	(.06)		(.18)	(.15)		(.33)	
	-0.38	-0.15	-0.28	-0.62	-0.11	-0.30	-0.72	-0.34
	(.09)	(.06)	(.08)	(.19)	(.15)	(.18)	(.35)	(.37)
Number of obs.		2683			510			75
Mother smoked during pregnancy	-0.52	-0.01		-0.94	0.29		-0.90	
	(.06)	(.05)		(.16)	(.14)		(.31)	
	-0.17	0.11	-0.64	-0.53	0.44	-0.90	-0.49	-0.86
	(.07)	(.05)	(.06)	(.18)	(.14)	(.20)	(.34)	(.41)
Number of obs.		3333			624			85
Low birth weight	-0.35	-0.08		-0.26	-.13		0.46	
	(0.10)	(.09)		(.23)	(.22)		(.53)	
	-0.35	-0.08	-0.00	-0.23	-0.12	-0.06	0.70	-.36
	(.13)	(.09)	(.10)	(.24)	(.22)	(.22)	(.74)	(.71)
Number of obs.		3325			598			37
Ever in foster or relative care?	-0.42	-0.22		-0.71	0.15		-0.84	
	(.10)	(.09)		(.26)	(.23)		(.50)	
	-0.27	-0.23	-0.24	-0.69	0.16	-0.04	-0.54	-0.65
	(.13)	(.07)	(.11)	(.28)	(.23)	(.25)	(.56)	(.44)
Number of obs.		3475			662			39

(table continues)

Table 2 (continued): Estimated effects from models of socioeconomic status and child development, all races combined

	OLS or Logit Coefficients (SEs)							
	Full Sample			Siblings XSEC			Siblings F-E	
	zAFQT	zSES	zED	zAFQT	zSES	zED	zAFQT	zED
Child outcomes, all children[4]								
HOME score (percentiles)	6.9 (0.5)	4.4 (0.5)		9.2 (1.2)	3.9 (1.0)		3.6 (1.3)	
	4.2 (0.6)	3.7 (0.5)	4.8 (0.6)	6.1 (1.4)	3.0 (1.0)	6.3 (1.4)	2.7 (1.3)	2.5 (1.3)
Number of obs.		6711			1342		1342	
Motor & social development index (percentiles)	2.2 (0.6)	1.9 (0.5)		2.8 (1.3)	1.1 (1.3)		-1.1 (1.9)	
	1.1 (0.8)	1.6 (0.5)	2.0 (0.7)	1.3 (1.6)	0.7 (1.2)	2.8 (1.7)	-2.0 (1.9)	2.9 (2.2)
Number of obs.		4101			819		819	
PPVT (standardized score)	6.8 (0.5)	3.7 (0.4)		5.8 (1.2)	4.0 (1.0)		0.8 (1.4)	
	5.2 (0.6)	3.3 (0.4)	3.1 (0.5)	5.2 (1.4)	3.7 (1.1)	1.4 (1.4)	1.4 (1.6)	-2.1 (1.6)
Number of obs.		4607			794		794	
PPVT, 6+ year olds (standardized score)	6.8 (0.6)	2.6 (0.5)		9.0 (1.9)	2.3 (1.7)		6.8 (2.2)	
	5.1 (0.7)	2.1 (0.5)	3.1 (0.7)	8.4 (2.1)	2.1 (1.7)	0.9 (1.8)	8.3 (2.5)	-3.3 (2.7)
Number of obs.		1784			139		139	
Behavior problems index (standardized score) (higher=more problems)	-1.6 (0.4)	-0.5 (0.3)		-2.2 (0.8)	0.2 (0.8)		-1.4 (1.2)	
	-1.4 (0.4)	-0.5 (0.3)	-0.4 (0.4)	-1.8 (0.9)	0.4 (0.8)	-1.0 (1.0)	-0.9 (1.2)	-1.8 (1.1)
Number of obs.		4101			819		819	

Notes: see next page

Notes:

XSEC: cross-section; FE: fixed-effects; YR: year-round; PPVT: Peabody Picture Vocabulary Test
HOME: Home Observation for Measurement of the Environment (short form).

1. See Table 1 for a description of dependent variables and samples.

2. Models contain controls for age (z-score) and, where appropriate dummy variables for gender, race/ethnicity (3 dummy variables), year and child's age at the time of assessment. Standard errors are corrected for non-independence of observations among youths from the same baseline household. Thus, unlike Herrnstein and Murray, we combine races and control for race (and gender) of youth, and we do not use sampling weights.

3. Sibling fixed effects models for continuous dependent variables (outcomes) are sibling differences estimated by including in the models a dummy variable for each family of origin. For dichotomous outcomes, samples used to conduct sibling cross-section and fixed-effects analyses are restricted to the oldest sibling pair in each household for which necessary data are available. The number of observations that enter fixed-effects logit analyses is relatively small because a sibling pair enters the likelihood function only if outcome values differ (e.g., one graduated from high school and one did not).

4. Models for "all children" are based on average (across years) of values of outcomes and control variables for children who were assessed in more than one year. In fixed-effects models for children (i.e., first cousin-differences), standard errors are corrected for non-independence of observations among (child) siblings.

Table 3: Effects of reliability corrections on coefficient estimates[1,2]

	Coefficients (SEs)			Reliability Ratios[3]		
	zAFQT	zSES	zED	zAFQT	zSES	zED
1. Family income						
1989	6,977	4,578		1.00	1.00	
	(353)	(324)				
	6,825	5,675		0.95	0.85	
	(419)	(436)				
	6,047	7,036		0.95	0.76	
	(457)	(538)				
	4,135	3,623	4,613	1.00	1.00	1.00
	(421)	(330)	(379)			
	3,583	4,458	5,072	0.95	0.85	0.90
	(529)	(453)	(408)			
	3,189	5,634	4,713	0.95	0.76	0.90
	(541)	(571)	(514)			
2. Annual Earnings, 1989						
YR Workers						
	4,866	1,531		1.00	1.00	
	(262)	(239)				
	5,072	1,762		0.95	0.85	
	(306)	(317)				
	4,855	2,162		0.95	0.76	
	(330)	(389)				
	3,040	910	3,092	1.00	1.00	1.00
	(306)	(243)	(279)			
	2,917	942	3,514	0.95	0.85	0.90
	(379)	(328)	(363)			
	2,842	1,175	3,445	0.95	0.76	0.90
	(386)	(409)	(371)			

(table continues)

Table 3 (continued): Effects of reliability corrections on coefficient estimates

	Coefficients (SEs)			Reliability Ratios		
	zAFQT	zSES	zED	zAFQT	zSES	zED
3. Annual Earnings 1989, Males, YR Workers	4,433	2,059		1.00	1.00	
	(379)	(361)				
	4,515	2,469		0.95	0.85	
	(447)	(484)				
	4,199	3,052		0.95	0.76	
	(488)	(598)				
	2,798	1,450	2,790	1.00	1.00	1.00
	(451)	(370)	(426)			
	2,630	1,674	3,111	0.95	0.85	0.90
	(567)	(508)	(569)			
	2,499	2,114	2,966	0.95	0.76	0.90
	(578)	(642)	(584)			
4. Education 1990 (z-score)						
	0.62	0.20		1.00	1.00	
	(.01)	(.01)				
	0.64	0.24		0.95	0.85	
	(.01)	(.01)				
	0.61	0.29		0.95	0.76	
	(.01)	(.01)				

Notes:

1. Models also include controls for race/ethnicity (3 dummy variables), age, and, where appropriate, gender.

2. Sample sizes are, for outcomes (1) to (4): (1) 7,978 (2) 4,974 (3) 2,776 (4) 9,886

3. Reliability ratios are ratios of signal variance to total variance. The values for reliability of zAFQT are from Murray (personal communication) and Bock and Moore. Reliability ratios for zSES are taken from Herrnstein and Murray and Jencks (see text for discussion). The reliability ratio for education is the average of two values reported by Ashenfelter and Krueger based on their analyses of twins.

Table 4: Summary of effects from models of socioeconomic status and child development, with and without detailed family background controls[1]

	OLS or Logit Coefficients (SEs)				Composite Effects (Absolute Values)	
	Herrnstein & Murray Controls[2]		Add Detailed FB Controls[3]			Race +
	zAFQT	zSES	zAFQT	zSES	FB + SES	FB + SES
Family income ($1990) in 1989	6,975 (354)	4,580 (324)	6,516 (383)	3,615 (410)	6,157	6,108
In poverty in 1989	-0.95 (.05)	-0.33 (.04)	-0.93 (.05)	-0.24 (.05)	0.54	0.57
Annual earnings ($1990), YR workers, in 1989	4,866 (270)	1,531 (246)	4,669 (271)	1,285 (279)	3,007	3,287
Yrs. schooling completed (z-score)	0.62 (.01)	0.20 (.01)	0.58 (.01)	0.18 (.01)	0.27	0.29
HS dropout	-1.82 (.06)	-0.48 (.04)	-1.76 (.06)	-0.40 (.05)	0.80	0.87
BA degree	1.76 (.06)	0.70 (.05)	1.72 (.06)	0.67 (.05)	0.90	0.89
High IQ occ.	1.36 (.08)	0.39 (.07)	1.34 (.08)	0.30 (.08)	0.65	0.68
Out of LF 1+ mos. in 1989, men	-0.39 (.06)	-0.02 (.05)	-0.40 (.06)	0.00 (.06)	0.43	0.45
Unemployed 1+ mos. in 1989, men	-0.44 (.07)	-0.09 (.07)	-0.42 (.07)	-0.04 (.08)	0.29	0.31
Married by age 30	-0.04 (.05)	-0.07 (.04)	0.01 (.05)	-0.09 (.05)	0.30	0.56
Divorced, first 5 years of marriage	-0.22 (.05)	0.18 (.05)	-0.27 (.05)	0.13 (.05)	0.25	0.34
Middle class values index	0.75 (.04)	0.23 (.03)	0.73 (.04)	0.16 (.04)	0.47	0.51
Ever interviewed in jail, men	-0.91 (.08)	-0.06 (.07)	-0.88 (0.08)	-0.05 (0.09)	0.60	0.68

(table continues)

Table 4 (continued): Summary of effects from models of socioeconomic status and child development, all races combined

	OLS or Logit Coefficients (SEs)				Composite Effects (Absolute Values)	
	Herrnstein & Murray Controls		Detailed FB Controls			Race +
	zAFQT	zSES	zAFQT	zSES	FB + SES	FB + SES
Child outcomes, first-borne children						
"Illegitimate" (out-of-wedlock) birth	-0.46 (.06)	-0.22 (.05)	-0.45 (.07)	-0.14 (.06)	0.58	1.14
Early AFDC use	-0.54 (.08)	-0.19 (.06)	-0.54 (.08)	-0.14 (.07)	0.55	0.67
Poor, first 3 years of life	-1.32 (.16)	-0.78 (.13)	-1.35 (.16)	-0.67 (.15)	1.03	1.11
Mother smoked during pregnancy	-0.52 (.06)	-0.01 (.05)	-0.49 (.06)	-0.00 (.06)	0.36	0.73
Low birth weight	-0.35 (.10)	-0.08 (.09)	-0.41 (.11)	-0.10 (.10)	0.32	0.45
Ever in foster or relative care?	-0.42 (.10)	-0.22 (.09)	-0.41 (.13)	-0.34 (.11)	0.58	0.70
Child outcomes, all children[4]						
HOME score (percentiles)	6.9 (0.5)	4.4 (0.5)	6.1 (0.5)	3.0 (0.5)	6.4	9.0
Motor & social development index (percentiles)	2.2 (0.6)	1.9 (0.5)	1.5 (0.7)	1.0 (0.6)	4.1	4.7
PPVT (standardized score)	6.8 (0.5)	3.7 (0.4)	6.2 (0.5)	3.3 (0.5)	5.0	8.2
PPVT, 6+ year olds (standardized score)	6.8 (0.6)	2.6 (0.5)	6.5 (0.6)	2.2 (0.5)	3.3	5.6
Behavior problems index (standardized score) (higher=more problems)	-1.6 (0.4)	-0.5 (0.3)	-1.5 (0.4)	-0.3 (0.3)	1.4	1.5

Notes: see next page

Notes:

1. For complete models, see Appendix 2. For sample and variable descriptions, see Table 1.

2. Controls include, AFQT score and SES score, age (z-score) and, where appropriate dummy variables for gender, race/ethnicity (3 dummy variables), year and child's age at the time of assessment. Standard errors are corrected for non-independence of observations among youths from the same baseline household.

3. Detailed family background controls include family arrangement at age 14 (3 dummy variables); dummy variables for the following family characteristics at age 14: urban residence, adult female worked outside the home, family received magazines regularly, received newspapers regularly, had a library card; number of siblings (4 dummy variables); age of mother at birth of respondent (quadratic); whether the respondent was first-borne; and whether the respondent was born outside the U.S.

4. Models for "all children" are based on averages (across years) of outcomes and control variables for children who were assessed in more than one year. In fixed-effects models for children (i.e., first cousin-differences), standard errors are corrected for non-independence of observations among (child) siblings.

Table 5a: Standardized Effects of Family Background and AFQT Score from Analyses of Siblings, Continuous Outcomes[1]

	Estimated Effect (SE)			
	OLS		Fixed Effects	
	zAFQT	zSES	zAFQT	zFB[2]
Family income 1989 (N=3,316)	7,296 (622)	4,487 (577)	5,558 (890)	12,482 (543)
Annual earnings 1989, YR Workers (N=1,579)	5,548 (604)	1,169 (459)	5,317 (765)	6,180 (526)
Yrs. schooling 1990 (z-score) (N=4,758)	0.59 (.02)	0.18 (.02)	0.45 (.02)	0.50 (.01)

Notes:

FB: Family Background.

1. Other controls include: zAGE, black, Latino, other race, and, where appropriate, gender.
2. See text for discussion of the Family Background effect.

Table 5b: Standardized Effects of Family Background and AFQT from Bivariate Probit Analyses of Siblings[1]

	Estimated Effects (SEs)			
			Absolute Value of Effect	
	zAFQT	zSES	Latent[2] FB	Total[3] FB
In poverty in 1989	-0.37 (.04)	-0.18 (.04)	0.65 (.04)	0.68 (.01)
HS dropout	-0.64 (.04)	-0.29 (.04)	0.78 (.03)	0.83 (.01)
BA degree	0.68 (.04)	0.24 (.03)	0.75 (.03)	0.79 (.01)
Out of labor force 1+ mos. in 1989 (men)	-0.21 (.03)	-0.08 (.03)	0.54 (.04)	0.55 (.004)
Unemployed 1+ mos. in 1989 (men)	-0.20 (.03)	-0.11 (.03)	0.74 (.03)	0.75 (.004)
Married by age 30	0.10 (.06)	-0.03 (.07)	0.37 (.13)	0.37 (.01)
Divorced, first 5 years of marriage	-0.19 (.07)	0.17 (.06)	0.21 (.26)	0.27 (.004)
Ever interviewed in jail, men	-0.19 (.03)	-0.13 (.04)	0.96 (.01)	0.96 (.004)
Middle class values index	0.47 (.04)	0.12 (.03)	0.55 (.05)	0.56 (.01)
High IQ occupation	0.25 (.04)	0.06 (.04)	0.73 (.04)	0.73 (.004)

FB: family background

Notes:

1. Other controls include: zAGE, black, Latino, other race, and, where appropriate, gender. See Table 1 for variable and sample definitions.
2. The latent effect is the square root of the cross-equation correlation for siblings.
3. The total effect is the square root of the sum of the SES effect squared plus the latent effect squared.

Appendix 1: Estimated effects from models of socioeconomic status, by race

	OLS Coefficients (SEs)							
	Full Sample			Siblings XSEC			Siblings F-E	
	zAFQT	zSES	zED	zAFQT	zSES	zED	zAFQT	zED
Family income ($1990), 1989								
Whites	6,627	4,146		7,003	5,208		6,166	
	(500)	(481)		(855)	(877)		(1562)	
	3,765	3,840	4,713	4,084	3,849	5,043	3,910	5,335
	(595)	(500)	(542)	(954)	(916)	(942)	(1578)	(1442)
Number of obs.		4468			1811		1811	
Blacks	6,923	5,352		7,108	3,586		3,685	
	(651)	(574)		(1112)	(1023)		(1384)	
	4,582	4,647	4,201	5,393	3,263	2,849	1,932	3,408
	(756)	(581)	(706)	(1532)	(982)	(1577)	(1807)	(1594)
Number of obs.		1931			861		861	
Latinos	8,425	2,272		8,629	3,038		6,444	
	(863)	(698)		(1365)	(932)		(2000)	
	5,912	1,934	3,839	6,740	2,859	3,354	5,900	1,325
	(1031)	(697)	(876)	(1466)	(916)	(1172)	(2083)	(2232)
Number of obs.		1225			501		501	
Annual Earnings, 1989 Year-Round Workers								
Whites	5,056	1,923		6,007	1,410		6,412	
	(389)	(375)		(913)	(804)		(1433)	
	2,906	885	3,663	4,084	591	3,163	4,738	3,061
	(455)	(388)	(415)	(922)	(819)	(903)	(1299)	(1457)
Number of obs.		2823			878		878	
Blacks	5,145	1,362		4,539	1,181		3,046	
	(439)	(393)		(933)	(631)		(881)	
	3,613	859	2,949	3,313	1,047	2,097	2,213	1,458
	(502)	(396)	(490)	(1029)	(622)	(757)	(1017)	(964)
Number of obs.		1161			401		401	
Latinos	3,741	1,283		5,138	926		5,469	
	(583)	(470)		(1154)	(870)		(1570)	
	2,984	1,228	1,158	4,555	963	877	4,838	1,158
	(698)	(470)	(591)	(1212)	(851)	(883)	(1761)	(1002)
Number of obs.		796			248		248	

(table continues)

Appendix 1 (continued): Estimated effects from models of socioeconomic status, by race

	OLS Coefficients (SEs)				
	Full Sample		Siblings XSEC		Siblings F-E
	zAFQT	zSES	zAFQT	zSES	zAFQT
Years of Schooling Completed, 1990 (z-score)					
Whites	0.60	0.28	0.55	0.30	0.40
	(.01)	(.01)	(.02)	(.02)	(.03)
Number of obs.		5261		2385	2385
Blacks	0.55	0.17	0.57	0.13	0.50
	(.02)	(.02)	(.03)	(.03)	(.04)
Number of obs.		2603		1415	1415
Latinos	0.71	0.07	0.63	0.02	0.48
	(.03)	(.02)	(.05)	(.03)	(.05)
Number of obs.		1603		778	778

Notes:

XSEC: cross-section; FE: fixed-effects; YR: year-round

1. See Table 1 for description of dependent variables and samples.

2. Models contain controls for age (z-score) and gender. Standard errors are corrected for non-independence of observations among youths from the same baseline household.

3. Sibling fixed effects models are sibling differences estimated by including in the regression models a dummy variable for each family of origin.

Appendix 2: Estimated effects from models of socioeconomic status and child development with detailed family background controls

OLS or Logit Coefficients (SEs)

	Ann. Income	Poor	Ann. Earns.	Years Schl.	HS Drop	BA	High IQ OCC	Out of LF	Unemp
SES + FB (abs. value)	6157	0.54	2767	0.27	0.80	0.90	0.65	0.43	0.29
SES + FB + Race (abs. value)	6108	0.57	2251	0.29	0.87	0.89	0.68	0.45	0.31
zAFQT	6515	-0.93	4669	0.58	-1.76	1.71	1.34	-0.40	-0.42
	(383)	(.05)	(271)	(.01)	(.06)	(.06)	(.08)	(.06)	(.07)
zSES	3614	-0.24	1285	0.18	-0.40	0.67	0.30	0.00	-0.04
	(409)	(.05)	(279)	(.01)	(.05)	(.05)	(.08)	(.06)	(.08)
zAGE	1806	-0.03	1580	-0.03	0.11	-0.10	-0.17	-0.08	-0.05
	(296)	(0.04)	(220)	(.01)	(.04)	(.04)	(.07)	(.05)	(.07)
Black	115	0.17	892	0.57	-1.72	1.24	1.00	0.16	0.05
	(749)	(.09)	(548)	(.02)	(0.11)	(.11)	(.18)	(.12)	(.15)
Latino	2418	-0.07	917	0.25	-0.64	0.28	0.87	0.08	-0.23
	(910)	(.12)	(673)	(.03)	(0.12)	(.14)	(.21)	(.14)	(.21)
Other race	-1865	0.37	-1931	-0.03	0.61	0.01	0.17	0.32	0.03
	(1422)	(.16)	(719)	(.04)	(.17)	(.20)	(.32)	(.22)	(.31)
Female	-1410	0.79	-7635	0.09	-0.35	0.28	-0.22	---	---
	(562)	(.07)	(405)	(.01)	(.07)	(.07)	(.13)		
<u>Family arrangement, age 14</u>									
Mother only	-3721	0.42	160	-0.01	0.44	-0.05	0.00	0.37	0.35
	(779)	(.09)	(581)	(.02)	(.10)	(.13)	(.21)	(.12)	(.16)
Step	-3776	0.28	-369	-0.17	0.83	-0.69	0.12	0.40	0.05
	(859)	(.11)	(693)	(.02)	(.11)	(.14)	(.22)	(.14)	(.19)
Other	-5160	0.40	-236	-0.06	0.66	-0.20	-0.71	0.73	0.50
	(1191)	(.15)	(1373)	(.04)	(.16)	(.25)	(.61)	(.20)	(.27)
<u>Age 14</u>									
Urban residence	727	0.26	787	-0.00	0.27	-0.06	0.20	0.39	0.06
	(651)	(.10)	(434)	(.02)	(.09)	(.10)	(.17)	(.13)	(.15)
Adult female worked	-384	-0.10	-399	-0.04	0.15	-0.15	0.24	0.01	-0.04
	(588)	(.08)	(433)	(.02)	(.08)	(.08)	(.13)	(.09)	(.13)
Magazines	920	-0.10	993	0.09	-0.29	0.21	0.39	0.02	-0.10
	(652)	(.08)	(467)	(.02)	(.08)	(.09)	(.17)	(.10)	(.14)
Newspapers	474	-0.13	-69	-0.02	-0.09	-0.18	0.05	-0.07	0.00
	(653)	(.08)	(442)	(.05)	(.09)	(.12)	(.20)	(.11)	(.15)
Library card	1676	0.03	1218	-0.03	-0.17	0.15	0.21	0.19	0.12
	(595)	(0.08)	(421)	(.03)	(.08)	(.10)	(.19)	(.10)	(.14)

(table continues)

Appendix 2 (continued): Estimated effects from models of socioeconomic status and child development with detailed family background controls

OLS or Logit Coefficients (SEs)

	Ann. Income	Poor	Ann. Earns.	Years Schl.	HS Drop	BA	High IQ OCC	Out of LF	Unemp
Number of sibs:									
None	-1576	0.02	-1279	-0.02	-0.44	-0.22	0.24	-0.18	0.05
	(1860)	(.28)	(1050)	(.05)	(0.32)	(.21)	(.33)	(.33)	(.41)
Two	-1046	-0.03	489	-0.03	0.06	-0.16	0.01	0.09	-0.12
	(1179)	(.16)	(789)	(.03)	(.16)	(.11)	(.19)	(.18)	(.24)
Three	-2725	0.09	-67	-0.09	0.06	-0.35	0.30	-0.04	0.14
	(1149)	(.15)	(772)	(.03)	(.16)	(.12)	(.20)	(.18)	(.24)
Four or more	-3297	0.31	-336	-0.14	0.37	-0.51	-0.03	0.20	0.26
	(1073)	(0.14)	(728)	(.03)	(.15)	(.12)	(.20)	(.16)	(.22)
Age mother at birth	1157	-0.10	47	0.02	-0.02	0.05	0.09	0.01	-0.04
	(289)	(0.04)	(269)	(.01)	(.04)	(.05)	(.09)	(.05)	(.08)
(Age mother squared)/100	-1926	0.16	-74	-0.02	0.01	-0.03	-0.12	-0.02	0.03
	(504)	(.07)	(481)	(.02)	(.07)	(.09)	(.15)	(.09)	(.14)
First born	253	-0.12	-366	0.01	-0.08	-0.10	0.05	-0.08	-0.05
	(801)	(.11)	(631)	(.02)	(.11)	(.10)	(.17)	(.14)	(.18)
Foreign born	7215	-0.55	-4091	0.06	-0.29	0.77	0.69	-0.25	-0.44
	(1438)	(.18)	(796)	(.04)	(.15)	(.19)	(.27)	(.21)	(.30)
Number of obs	7977	7977	5009	9885	8739	9588	7944	4144	3225

(table continues)

Appendix 2 (continued): Estimated effects from models of socioeconomic status and child development with detailed family background controls

	OLS or Logit Coefficients (SEs)									
	Mar.	Div.	MC Values	Ever Jail	Illeg. Birth	Early AFDC	Early Pov.	Smoke	LBW	Foster Care
Combined FB (abs. value)	0.30	0.25	0.47	0.60	0.58	0.55	1.04	0.36	0.32	0.58
Combined FB & Race (abs. value)	0.56	0.34	0.50	0.68	1.14	0.67	1.11	0.73	0.45	0.70
zAFQT	0.01	-0.27	0.73	-0.88	-0.45	-0.54	-1.35	-0.49	-0.41	-0.41
	(.05)	(.05)	(.04)	(.08)	(.07)	(.08)	(.16)	(.06)	(.11)	(.13)
zSES	-0.09	0.13	0.16	-0.05	-0.14	-0.14	-0.67	-0.00	-0.10	-0.34
	(.05)	(.05)	(.04)	(.09)	(.06)	(.07)	(.15)	(.06)	(.10)	(.11)
zAGE	0.07	-0.03	-0.02	0.02	-0.21	-0.16	-0.34	0.08	0.13	0.20
	(.08)	(.04)	(.03)	(.06)	(.05)	(.06)	(.10)	(.04)	(.08)	(.08)
Black	-1.26	-0.35	-0.22	0.40	1.91	0.55	0.51	-1.15	0.73	0.69
	(.10)	(.12)	(.08)	(.17)	(.11)	(.13)	(.22)	(.12)	(.21)	(.21)
Latino	-0.34	-0.36	0.15	-0.10	0.20	-0.18	-0.41	-1.50	0.43	0.20
	(.12)	(.13)	(.09)	(.22)	(.14)	(.17)	(.31)	(.16)	(.25)	(.27)
Other race	-0.15	0.41	-0.32	0.78	0.03	0.07	0.24	-0.13	0.50	0.07
	(.20)	(.15)	(.14)	(.29)	(.21)	(.25)	(.43)	(.19)	(.36)	(.44)
Female	0.42	0.12	0.34	---	---	---	---	---	---	---
	(.07)	(.08)	(.05)							
Family arrangement, age 14										
Mother only	-0.19	0.10	-0.51	0.52	0.65	0.38	0.64	0.17	-0.13	-0.11
	(.11)	(.12)	(.08)	(.17)	(.12)	(.13)	(.22)	(.11)	(.19)	(.20)
Step	0.08	0.22	-0.67	0.78	0.44	0.56	0.91	0.41	-0.30	0.41
	(.12)	(.11)	(.09)	(.17)	(.12)	(.14)	(.26)	(.12)	(.24)	(.21)
Other	-0.28	0.19	-0.66	0.74	0.43	0.42	0.72	0.31	-0.08	-0.04
	(.18)	(.19)	(.16)	(.25)	(.19)	(.21)	(.33)	(.19)	(.30)	(.33)
Age 14										
Urban residence	-0.16	-0.02	-0.18	0.32	0.39	0.32	0.05	0.14	0.01	0.22
	(.10)	(.09)	(.07)	(.18)	(.12)	(.13)	(.22)	(.10)	(.19)	(.20)
Adult female worked	0.21	0.14	-0.05	0.27	-0.11	-0.02	-0.33	0.06	-0.04	-0.09
	(.08)	(.08)	(.06)	(.14)	(.09)	(.10)	(.19)	(.08)	(.15)	(.17)
Magazines	0.06	-0.08	0.23	-0.22	-0.11	-0.28	-0.15	-0.26	0.08	0.11
	(.09)	(.09)	(.06)	(.14)	(.10)	(.11)	(.20)	(.10)	(.17)	(.18)
Newspapers	0.05	-0.14	0.06	0.06	-0.04	0.03	0.07	0.23	0.01	-0.10
	(.10)	(.10)	(.07)	(.15)	(.11)	(.12)	(.20)	(.10)	(.18)	(.18)
Library card	-0.17	0.26	-0.06	0.02	0.13	0.23	0.03	0.02	0.08	-0.17
	(.09)	(.09)	(.07)	(.14)	(.10)	(.12)	(.19)	(.09)	(.18)	(.18)

(table continues)

Appendix 2 (continued): Estimated effects from models of socioeconomic status and child development with detailed family background controls

OLS or Logit Coefficients (SEs)

	Mar.	Div.	MC Values	Ever Jail	Illeg. Birth	Early AFDC	Early Pov.	Smoke	LBW	Foster Care
Number of sibs:										
None	0.07	0.22	0.07	-1.10	-0.10	0.63	-0.05	-0.40	-0.11	-0.03
	(.23)	(.25)	(.18)	(.77)	(.32)	(.35)	(.60)	(.32)	(.66)	(.74)
Two	0.26	-0.05	0.07	0.35	-0.09	-0.01	-0.45	0.00	-0.11	0.47
	(.13)	(.14)	(.10)	(.29)	(.18)	(.22)	(.41)	(.16)	(.34)	(.38)
Three	0.19	-0.19	0.12	0.11	0.10	0.01	0.01	-0.02	0.38	0.52
	(.13)	(.14)	(.10)	(.30)	(.18)	(.21)	(.38)	(.15)	(.32)	(.37)
Four or more	0.38	-0.07	-0.01	0.46	0.24	0.34	0.35	-0.04	0.14	0.28
	(.12)	(.13)	(.09)	(.27)	(.16)	(.19)	(.34)	(.15)	(.30)	(.35)
Age mother at birth	-0.03	-0.09	0.04	0.03	-0.11	-0.07	-0.05	-0.12	0.06	-0.17
	(.05)	(.04)	(.03)	(.08)	(.05)	(.06)	(.10)	(.05)	(.09)	(.08)
(Age mother squared)/100	0.01	0.15	-0.07	-0.09	0.20	0.00	0.07	0.19	-0.09	0.00
	(.08)	(.08)	(.06)	(.15)	(.09)	(.00)	(.18)	(.09)	(.15)	(.00)
First born	0.03	0.08	-0.06	-0.08	-0.07	-0.10	0.00	-0.41	0.08	-0.04
	(.10)	(.11)	(.08)	(.19)	(.13)	(.15)	(.28)	(.12)	(.23)	(.23)
Foreign born	0.17	-0.18	0.15	-0.35	-0.80	-0.91	-1.20	-0.74	-1.02	-1.42
	(.16)	(.18)	(.12)	(.29)	(.21)	(.26)	(.47)	(.23)	(.45)	(0.54)
Number of obs	4221	4684	7692	4809	3448	2683	1369	3333	3325	3475

(table continues)

Appendix 2 (continued): Estimated effects from models of socioeconomic status and child development with detailed family background controls

	OLS or Logit Coefficients (SEs)				
	HOME	MOSO	PPVT	PPVT6	BPI
SES + FB (abs. value)	6.4	4.1	5.0	3.3	1.4
SES + FB + Race (abs. value)	9.0	4.7	8.2	5.6	1.5
zAFQT	6.1 (0.5)	1.5 (0.7)	6.2 (0.5)	6.5 (0.6)	-1.5 (0.4)
zSES	3.0 (0.5)	1.0 (0.6)	3.3 (0.4)	2.2 (0.5)	-0.3 (0.3)
zAGE	1.7 (0.4)	-0.6 (0.5)	-0.4 (0.4)	-0.6 (0.5)	0.0 (0.3)
Year1	-1.9 (2.0)	0.4 (1.3)	2.4 (0.9)	1.7 (1.3)	5.5 (1.0)
Year2	-0.0 (1.5)	3.9 (1.4)	-0.2 (0.9)	-0.9 (1.3)	3.8 (0.8)
Child's age (months) or[2] age group=#1	-5.1 (1.1)	-0.19 (0.05)	0.07 (.01)	0.00 (.02)	0.02 (.01)
Child's Age group=#2	-3.2 (1.1)	---	---	---	---
Black	-11.2 (1.0)	1.8 (1.3)	-11.3 (0.8)	-8.7 (1.0)	-1.4 (0.6)
Latino	-1.6 (1.2)	-3.9 (1.4)	-6.1 (1.1)	-3.7 (1.3)	-2.3 (0.8)
Other race	-3.8 (1.8)	3.3 (2.3)	-1.4 (1.1)	-1.0 (1.5)	-0.5 (1.1)
<u>Family arrangement age 14</u>					
Mother only	-0.7 (1.1)	-0.6 (1.3)	1.2 (0.9)	0.0 (1.0)	1.4 (0.7)
Step	-2.3 (1.2)	-3.2 (1.4)	0.8 (0.8)	0.8 (1.1)	2.3 (0.7)
Other	-2.3 (1.7)	-2.3 (2.3)	0.5 (1.4)	0.1 (1.8)	2.0 (1.0)
<u>Age 14</u>					
Urban residence	1.5 (0.9)	-0.9 (1.2)	-1.1 (0.7)	-0.6 (1.0)	-0.2 (0.6)
Adult female worked	-0.3 (0.8)	-0.4 (0.9)	-1.0 (0.6)	-0.0 (0.8)	0.9 (0.5)
Magazines	2.0 (0.9)	2.2 (1.1)	0.7 (0.7)	0.3 (0.9)	-0.8 (0.5)
Newspapers	2.2 (0.9)	0.8 (1.2)	0.8 (0.7)	0.7 (1.0)	0.1 (0.6)
Library card	5.1 (0.9)	4.9 (1.1)	2.3 (0.7)	0.8 (0.9)	-0.2 (0.6)

Appendix 2 (continued): Estimated effects from models of socioeconomic status and child development with detailed family background controls

	OLS or Logit Coefficients (SEs)				
	HOME	MOSO	PPVT	PPVT6	BPI
Number of sibs:					
None	3.3	-3.1	0.9	3.2	1.0
	(2.3)	(3.7)	(2.0)	(2.4)	(1.6)
Two	0.5	-3.0	0.7	-0.6	0.9
	(1.5)	(1.7)	(1.1)	(1.7)	(0.9)
Three	0.4	-0.6	-0.4	-2.7	1.2
	(1.4)	(1.8)	(1.1)	(1.6)	(0.9)
Four or more	-1.4	-2.7	-2.5	-1.5	0.9
	(1.3)	(1.7)	(1.0)	(1.5)	(0.8)
Age mother at birth	0.5	-0.1	0.3	0.5	-0.5
	(0.4)	(0.6)	(0.4)	(0.4)	(0.3)
(Age mother squared)/100	-0.8	0.4	-0.3	-0.0	1.0
	(0.8)	(1.1)	(0.6)	(0.1)	(0.5)
First born	-1.4	-2.5	-1.1	-1.1	0.1
	(1.1)	(1.4)	(0.9)	(1.1)	(0.7)
Foreign born	1.8	0.7	-6.1	-4.1	-0.0
	(1.7)	(1.9)	(1.7)	(1.8)	(1.0)
Number of obs	6711	4101	4707	1784	4645

Notes:

1. See Table 1 for a description of dependent variables and samples.
2. Child's age-group for HOME score; age at assessment in months for other outcomes.

Appendix 3: Effects of reliability corrections on fixed-effect coefficient estimates[1]

	Fixed-Effects Coefficients (SEs)		Reliability Ratios	
	zAFQT	zED	zAFQT	zED
1. Family income, 1989	5,558 (975)		1.00	
	3,610 (1044)	4,305 (963)	1.00	1.00
	6,558 (1049)		0.85	
	3,554 (1297)	5,627 (1298)	0.85	0.77
2. Earnings 1989 (Year-Round Workers)	5,317 (852)		1.00	
	4,023 (821)	2,341 (856)	1.00	1.00
	6,228 (659)		0.86	
	4,493 (873)	2,677 (800)	0.86	0.80

Note:
1. Models also include controls for age and sex.

2. Reliability ratios are ratios of signal variance to total variance. The values for reliability of AFQT score are based on Murray (personal communication) and Bock and Moore; the reliability ratio of education is based on Ashenfelter and Krueger. These values are adjusted for use in fixed-effect estimation using the intra-family correlation of test scores and education. See footnote 5 in the text.