2000

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Cook, Michael D., and William N. Evans. "Families or schools? Explaining the convergence in white and black academic performance." Journal of labor Economics 18.4 (2000): 729-754.
https://hdl.handle.net/10945/66022

Families or Schools? Explaining the Convergence in White and Black Academic Performance

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Differences in test scores of white and black students have narrowed substantially over time, falling by one-half since 1970s. Some have speculated that this convergence is due to changes in family background or convergence in school quality. In this article we decompose the convergence in test scores into that portion due to changes in parental education, changes in school quality, and a narrowing of the within-school gap in test scores. Only about 25% of the overall convergence is attributable to changing family and school characteristics. We find that nearly 75% of the convergence is attributable to changes within schools.

I. Introduction

At any point in time, the average academic performance of white students exceeds that of black students. The gap between black and white academic performance has however narrowed sharply since 1970. Difference in test scores, for example, has fallen by about one-half over this time period.[1] This result is consistent across a wide variety of tests, subjects,

We wish to thank Jennifer Mellor, Edward Montgomery, Sheila Murray, and Robert Schwab for their numerous helpful suggestions. This work was completed while Cook was a Research Fellow at the Brookings Institution. Evans gratefully acknowledges financial support from the National Science Foundation through grant SBR9409499.

[1] Although we focus on the convergence in test scores in this article there has

[*Journal of Labor Economics*, 2000, vol. 18, no. 4]

0734-306X/2000/1804-0008$02.50

age groups, and data sets. The most widely cited data on trends in test score performance are the National Assessment of Educational Progress (NAEP), which tests 9-, 13-, and 17-year-olds in reading, math, and science every 4 or 5 years. Results from these tests show convergence in white and black test scores at all ages and for all subjects. In figure 1, we report the time series for white and black test scores from the NAEP reading and math exams for all three age groups. As the results in the figure indicate, the gap in white and black scores have declined considerably over the past 20 years. The results in the figure also indicate that this convergence in test scores is driven primarily by rising black scores. Over this period, white scores have not changed much. The NAEP results show that the gap in reading test scores fell by 34%, 54%, and 60% respectively for 9-, 13-, and 17-year-old over the period 1970–88, while the gap in math scores closed by 23%, 41%, and 48% for these three age groups over the period 1973–90.

There are two commonly offered explanations for this convergence in test scores. The first emphasizes the shrinking difference in observed family characteristics across races. Armor (1992) is perhaps the strongest advocate of this view. There has been a sharp convergence in the levels of educations of white and black parents, suggesting that changes in parental education may be an important explanation of the convergence in test scores.[2] Armor argues that the convergence in parents' education is responsible for about one-half of the overall convergence in test scores and suggests that a substantial part of the remaining half may be attributable to changes in other socioeconomic factors.

The second primary hypothesis is that the convergence in test scores is due to a convergence in the relative quality of schools that whites and blacks attend. This convergence in school quality, it is argued, is driven by two trends: the convergence in resources across schools and desegregation. Boozer, Krueger, and Wolken (1992) report that in 1970 blacks attended schools where pupil-teacher ratios were 11% higher than in the schools that whites attended. By 1990 this difference had disappeared. Recent reports by the Department of Education confirm that by 1991

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been a similar convergence in high school graduation rates of white and black students. In 1970, the proportion of 19- and 20-year-olds who had graduated high school stood at 86.3% for non-Hispanic whites, and 70.3% for blacks. By 1990 these figures had risen to 89.3% and 82.8% for whites and blacks, respectively. The gap in white and black high school graduation rates had fallen by nearly 60% (authors' calculations from the October 1970 and 1990 Current Population Surveys).

[2] The NAEP contains data on parents' education but does not contain information on other important family characteristics such as family income, poverty status, or family structure.

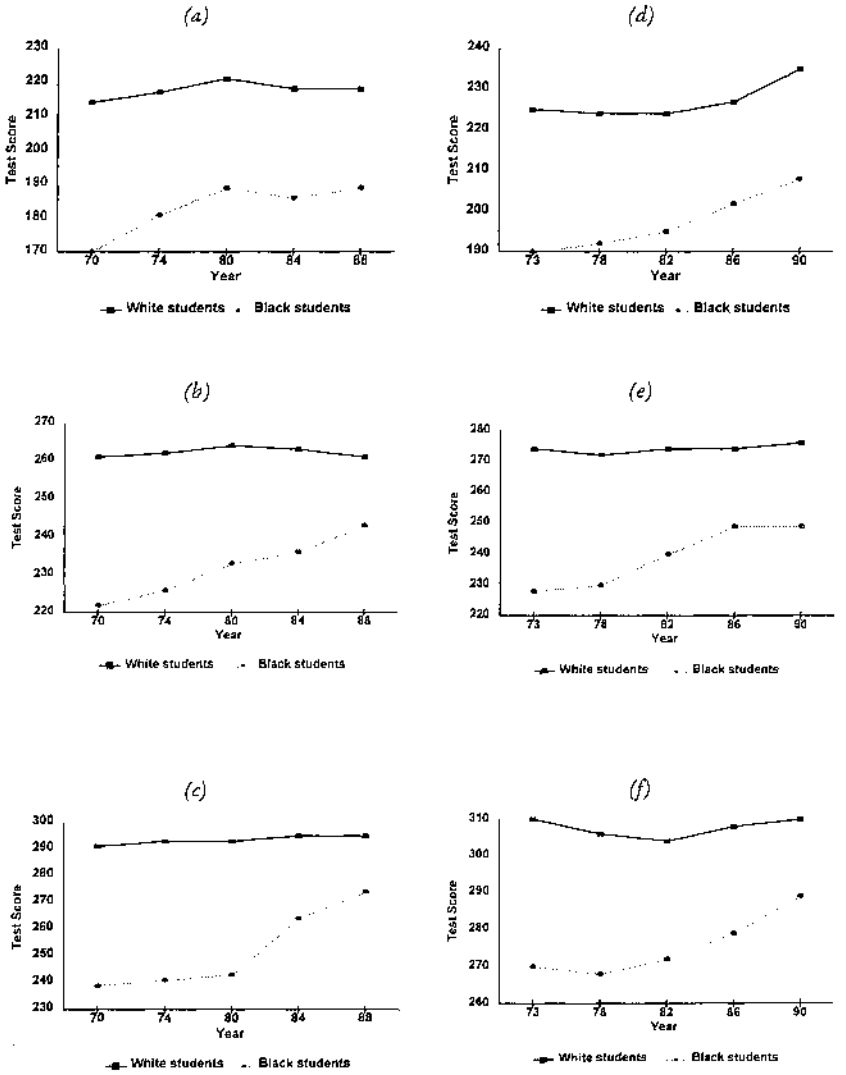

FIG. 1.—National Assessment of Educational Performance (NAEP) reading scores: (*a*) 9-year-olds, (*b*) 13-year-olds, (*c*) 17-year-olds; NAEP math scores: (*d*) 9-year-olds, (*e*) 13-year-olds, (*f*) 17-year-olds.

there was no difference in the resources expended in the schools white and blacks attend.

Two related points are made in support of this hypothesis. First, there have been substantial federal expenditures for remedial math and reading instruction through the Chapter 1 programs directed to schools with a

large number of students below the poverty line.[3] Second, after the 1977 Milliken II decision many states and local school districts increased the resources available to predominantly minority schools in lieu of efforts to improve the racial balance of schools. (This occurred in Los Angeles and Detroit, for example.) Some commentators have argued that this redirecting of resources to segregated, low-income, and often inner-city schools has been a major factor in the convergence in white and black scores and is responsible for improving the performance of segregated and poor inner-city schools. Some have even argued that these efforts and the resulting improvement in those schools have reduced the need to further desegregate schools (Armor 1992).

A second source of the convergence in the relative quality of schools may be the efforts at desegregating schools. A comprehensive study on the position of blacks in American society sponsored by the National Academy of Sciences identified desegregation as one of the two contributing factors to the convergence in white and black test scores (Jaynes and Williams 1989). Similarly, a former president of the Educational Testing Service, which administers the NAEP, suggested that test score convergence was due to desegregation (Angrig 1984). The portion of the overall convergence in test scores that researchers attribute to efforts at desegregating schools varies, but at least some view it as responsible for nearly all of the convergence in test scores.

In this article we use standard econometric techniques to decompose the convergence in test scores into that portion due to (*a*) changes in the levels of parental education, (*b*) changes in the relative quality of schools, and (*c*) a narrowing of the gap in test scores between black and white students who attend the same school and have the same level of parental education. The decompositions we use are familiar to labor economists. Among other things, they have been used to account for the convergence of southern wages over the postwar period, to explain the growth in wage inequality during the 1980s, and to examine changes in the gap in white and black wages over time (Corcoran and Duncan 1979; Sahling and Smith 1983; and Cain 1986).

We stress that in comparison to other studies, we use an output-based concept of school quality. We define school quality as the effect that attending a given school has on student performance after controlling for the student's observable characteristics. Other papers, including the recent work of Grogger (1996), measure school quality as the purchased inputs to a school. In this article, we broaden the definition to encompass

[3] However, a recent Congressional Budget Office report suggested that Chapter 1 funds are responsible at most 10% of the convergence in test scores. Other researchers have assigned a bigger role to this program (Koretz 1987).

not only those factors that may be measured in other data sets (such as per-pupil spending or the quality of the peer group) but also the unmeasured characteristics of schools such as teacher quality or quality of the curriculum. To obtain our measure of school quality, we exploit the fact that in the NAEP data there are multiple observations per school, which allows us to include school-fixed effects into the test score equation.[4] If school quality plays a large role in explaining the convergence in school quality, then this omnibus measure of output would leave us with the difficult task of isolating those school characteristics that have been altered that would explain test score convergence. As we note below, changes in school quality explain little of the convergence in white/black test scores and our measure of quality is used more as a means to eliminate a potential explanation.

Our results suggest that the two most common explanations for the convergence in test account for less than one-quarter of the overall convergence in test scores. At least 3 quarters of the convergence is due to a narrowing of the gap in test scores between white and black students who attend the same school and have the same level of parental education.

These results are very robust. The results are similar across test types (reading and math) and age groups (13- and 17-year-olds). Significant changes in model specification also fail to alter the conclusions. We investigate if the results are driven by our inability to control for family characteristics other than parental education. To the contrary, we find that omitting these variables leads us to overestimate the role that observable family characteristics play in the overall convergence in test scores.

In the next section, we describe the NAEP data used in our analysis. In Section III we outline the basic decomposition and present the results. In Section IV we note that the results from the decompositions have implications for many other issues in the economics of education.

II. Data

The primary data for this analysis is from the National Assessment of Educational Progress. The NAEP data are the most widely cited test score data on trends in student performance over time. According to one specialist in the field, the NAEP provides "the only dependable national index for monitoring the performance of our schools" (Bock 1986). Through the NAEP, the Department of Education has periodically tested

[4] Many researchers have used school quality as a synonym for measured school inputs, such as teacher-pupil ratios or expenditures per pupil. This is not what we mean by school quality. However, if school resources affect student performance, then changes in resources will have an effect on school quality. This point is made to argue that the convergence in the resources of schools that whites and blacks attend has led to a convergence in school quality.

9-, 13-, and 17-year-olds in reading, math, and science, usually every 4 years. The tests were first given in 1970 in reading and in 1973 in math.

We primarily use data on test scores for 13-year-olds because of fundamental problems with the data for 9- and 17-year-olds students. We are unable to use data for 9-year-olds because the primary measure of family background available in the NAEP data, the education level attained by each parent as reported by the student, is not reported by a large fraction of 9-year-olds. There is a different problem with 17-year-olds. Because the NAEP only samples students in school at a given age, high school dropouts are not tested. Over the time period of our analysis, enrollment rates of blacks have increased relative to that for whites. Using data from the Enrollment Supplement to the October 1970 Current Population Survey (CPS), we calculate enrollment rates of 87.7% and 83.2% for 17-year-old white and black students respectively. Data from the 1988 October CPS indicate that the enrollment rates for whites and blacks increased to 88.4% and 89.0%, respectively. By 1988, enrollment rates were actually higher for 17-year-old blacks than for whites. Thus, in comparing white and black test scores for 17-year-olds, the results are confounded by the changing racial mix of those taking the test and those excluded. This is not a problem with 13-year-olds because nearly all students in this age group are enrolled in school. Data from the 1988 October CPS indicate that 99.7% of white 13-year-olds and 99.4% of blacks were enrolled in school. For completeness, we do estimate the decompositions for 17-year-olds.

Until 1979, the NAEP tests were designed to be comparable across years. After 1979, the NAEP gave distinct tests to two separate samples, a trend sample designed to continue measuring trends in performance over time, and a cross-sectional sample designed to measure performance at a point in time, but not to be comparable across years. In our analysis we use the trend samples only.

The trend samples are a stratified probability sample representative of all 13-year-olds enrolled in public or private schools in a given year. The NAEP samples are constructed in two stages. First, a representative sample of all schools that 13-year-olds attend are selected, then a probability sample of students within that school are surveyed.[5] We exploit the fact that there are multiple observations per school to estimate school effects and we use these school effects as a measure of school quality.

In their summary publications, the NAEP uses procedures based on Item Response Theory (IRT) to calculate test scores. Item Response

[5] Actually it is a representative sample of all schools when used with the appropriate sample weights, which we use in this analysis. The NAEP oversamples low-SES (socio-economic status) schools located in big cities and rural areas.

Table 1
Sample Means, NAEP Data Sets

	White			Black			White–Black		
	1970	1988	Change, 1970–88	1970	1988	Change, 1970–88	1970	1988	Change, 1970–88
Reading scores—IRT scored	261 (35.3)	261 (33.9)	.0	222 (34.3)	243 (32.1)	19	39	18	−21
Math scores—IRT scored	274 (33.1)	276 (29.4)	2.0	228 (31.1)	249 (27.4)	21	46	27	−19
Reading scores—% correct	63.1	63.7	.6	46.1	54.1	8.0	17.0	9.6	−7.5
Math scores—% correct	57.0	58.3	1.3	39.4	46.7	7.3	17.6	11.6	−5.9
Parental education (% in each group):									
< 12 years	15.3	9.5	−5.8	28.1	6.2	−21.9	−12.8	3.3	16.1
12 years	34.0	30.3	−3.7	25.6	36.5	10.9	8.4	−6.2	−14.5
> 12 years	38.9	51.0	12.1	19.6	46.0	26.4	19.3	5.0	−14.3
Missing	11.8	9.2	−2.6	26.7	11.3	−15.4	−14.9	−2.1	12.8
Racial mix of schools (% in each group):									
> 80% white	83.5	67.2	−16.3	15.5	14.1	−1.4	68.0	53.1	14.9
< 20% white	1.0	1.2	.2	35.0	32.1	−2.9	−34.0	−30.9	3.1

NOTE.—Standard deviations are in parentheses. NAEP = National Assessment of Educational Progress; IRT = Item Response Theory. The results for the NAEP math test scores are for 1972 and 1990.

Theory weights individual questions based on the difficulty of the questions and the student's performance on other questions. In the public release data tapes, these scores are not reported. Rather, the public use tapes provide the individual student's answer to each question as well as the correct answer for each question. The test score that we use is a percent correct score calculated from the number of questions that are asked of each student and the number that the student answers correctly.[6]

The basic facts surrounding the convergence in test scores are reported in table 1. In the first two rows, we report the published NAEP reading and math test scores for white and black 13-year-olds in the early 1970s and late 1980s. These scores are calculated using sample weights and IRT. The results in these lines mirror the results in figure 1. First, white test scores in both reading and math have remained constant over the time period of analysis, but black test scores have risen considerably, accounting for nearly all the convergence in test scores. In the next two lines, we

[6] We count questions that were not answered as wrong. We have estimated our econometric models two additional ways: with not answered questions counted as not being given and not answered questions given partial credit equal to $1/n$, where n is the number of possible answers. Neither of these adjustments changed the results in a fundamental way.

report our measure of performance—the percent correct on the exam. Although the two sets of scores are calculated by vastly different methods, the percentage changes in the white/black test score gap are quite similar. The published NAEP results suggest that the white/black gap in reading and math scores fell by 54% and 41% between the early 1970s and late 1980s. Our estimates based on the percent correct test score measure for the reading and math exams suggest a reduction in the white/black gap of 44% and 34%, respectively.

In the second panel of the table, we report the highest level of education attained by either parent. There has been a sharp rise in the level of education attained by white and black parents, a result that others have found in data sets such as the Current Population Surveys (Grissmer et al. 1994). Also reported is the distribution of white and black students across predominantly white and predominantly black schools. There are two results to notice. First, a significant number of white and black student attend schools that are neither predominantly white nor black. Second, despite efforts to integrate schools, the actual changes in the racial mix of schools appear to be relatively small.

III. Empirical Analysis

The question we wish to address is rather straightforward: What has caused the convergence in white and black academic performance over the past 20 years? To answer this question, we use a decomposition technique used widely in labor economics attributed to Oaxaca (1973). The Oaxaca decomposition has been used primarily as a method to explain the differences in wages across groups in a cross section (Cain 1986), but the procedure has also been used to explain the time-series pattern of wages in repeated cross sections (Sahling and Smith 1983).

A. Decomposing Changes in Test Scores: A Simple Model

To construct the test score decomposition, we begin by estimating education production functions that explain test scores for 13 years for yearly cross sections of NAEP tests. In the education production function literature, the covariates in a test score equation include family and school characteristics (Hanushek 1986). In this model, because we have multiple observations per school, we capture all differences across schools by estimating models with school-fixed effects. Let T_{ijt} represent the test score for student i in school j in year t. The fixed-effect estimate of the production function is of the form

$$T_{ijt} = X_{ijt}\beta + \beta_{ijt}\delta_t + \mu_{jt} + \varepsilon_{ijt}, \tag{1}$$

where X_{ijt} is a vector of demographic characteristics including measures

of parental education,[7] B_{ijt} is an indicator variable that equals one if the student is black, μ_{jt} is a school-fixed effect, and ε_{ijt} is a random error. The coefficient δ_t is a measure of the difference in black and white test scores among students who attend the same school, controlling for the sex and parental education of the student. We refer to this coefficient as a "within-school" measure of test scores across races. Because we have multiple observations per school we can estimate for each school the school fixed-effect μ_{jt}, which is an estimate of the quality of the school.

In a given cross section, S_t represents the number of schools and n_j is the number of students surveyed from school j. The average difference in test scores between whites and blacks students is by definition

$$\Delta \bar{T}_t = \frac{1}{N_w} \sum_{j=1}^{S_t} \sum_{i=1}^{n_j} (1 - B_{ijt}) T_{ijt} - \frac{1}{N_b} \sum_{j=1}^{S_j} \sum_{i=1}^{n_j} B_{ijt} T_{ijt}, \tag{2}$$

where N_w is the number of white students and N_b is the number of black students. Given 2 years of data, the difference $\Delta \bar{T}_{t+1} - \Delta \bar{T}_t$ represents the change in test scores in the 1 year after time period t. Given the data generating process described in equation (1), changes in the difference in white and black test scores from 1970 to 1988 can be decomposed as

$$\begin{aligned} \Delta \bar{T}_{88} - \Delta \bar{T}_{70} = {} & (\Delta \bar{X}_{88} - \Delta \bar{X}_{70}) \hat{\beta}_{70} + \bar{X}_{70} (\hat{\beta}_{88} - \hat{\beta}_{70}) + (\Delta \bar{\mu}_{88} - \Delta \bar{\mu}_{70}) \\ & + (\hat{\delta}_{88} - \hat{\delta}_{70}) + (\Delta \bar{X}_{88} - \Delta \bar{X}_{70})(\hat{\beta}_{88} - \hat{\beta}_{70}). \end{aligned} \tag{3}$$

Most of the terms in the decomposition require little explanation. The mean levels of parental education in year t are denoted by $\bar{X}_t$, while $\Delta \bar{X}_t$ represents the average difference in parental education between white and black students in year t. The parameters $\hat{\delta}_t$ and $\hat{\beta}_t$ are estimated from standard regression models. In contrast to most applications of the Oaxaca decomposition, the only additional term in our model is

$$\Delta \bar{\mu}_t = \frac{1}{N_w} \sum_{j=1}^{S_t} \sum_{i=1}^{n_j} (1 - B_{ijt}) \hat{\mu}_{jt} - \frac{1}{N_b} \sum_{j=1}^{S_t} \sum_{i=1}^{n_j} B_{ijt} \hat{\mu}_{jt}, \tag{4}$$

[7] The X vector includes indicator variables for mother's education less than 12 years, greater than 12 years, and mother's education missing, with mother's education equal to 12 years as the omitted category. The X vector also includes indicator variables for father's education identically defined. The X vector also includes a male indicator variable.

which denotes the difference in the relative quality of schools that white and black students attend (or the gap in school quality) in year t.[8]

Given these simple definitions, the terms in the decomposition can be easily defined. The first right-hand-side term in equation (3) is the effect of changes in the levels of parental education, the second is the effect of changes in the returns to parental education over time, the third is the effect of changes in school quality, and the fourth the effect of changes in the gap in black and white test scores among students who attend the same school, controlling for parental education. The last term on the right-hand side is a residual term. The decomposition in equation (3) uses 1970 as the base year. There is an ambiguity in the Oaxaca decomposition as to whether the initial or ending year should be used as the base year. We do all of the analysis using both the beginning and end of period years as the base and report both sets of results.[9] The definition of the base year is relevant only for the results for the levels and returns to parental education.

We calculate standard errors for each component of the decomposition using a simple simulation procedure. Let $\hat{\pi}_t$ be the vector of parameter estimates for year t where

$$\hat{\pi}_t = (\hat{\beta}_t, \hat{\delta}_t, \hat{\mu}_{jt}),$$

and let $\bar{w}_t$ be the vector of mean variables for year t used in the decompositions. The elements of the decompositions are nonlinear functions of the $\bar{w}_t$'s and $\hat{\pi}_t$'s. Let these elements be represented by the vector $\hat{d} = f(\hat{\pi}_{70}, \hat{\pi}_{88}, \bar{w}_{70}, \bar{w}_{88})$. To calculate the standard errors on $\hat{d}$, we draw random vectors for $\hat{\pi}_{70}$ and $\hat{\pi}_{88}$ from a multivariate t distribution, calculate $\hat{d}$ for each draw, then calculate the variance/covariance for these random vectors. In this procedure, we assume zero covariance between $\hat{\pi}_{70}$ and $\hat{\pi}_{88}$. Standard errors are based on 20,000 random draws to both for $\hat{\pi}_{70}$ and $\hat{\pi}_{88}$.

B. Basic Results

The results of this decomposition are presented in table 2. In columns 1–4 of the table, we report the results for the NAEP reading scores, and

[8] The discussion in the text ignores sample weights. Conceptually, the decomposition in the text is correct; however in practice we use the weighted sums in the decomposition.

[9] Another alternative is to use the average of 1970 and 1988 levels and returns as the "base." These results would simply be the average of the results using 1970 and 1988 as the base years since

$$\begin{aligned}(X_{88} - X_{70})\beta_{ave} &= (X_{88} - X_{70})\{(\beta_{88} - \beta_{88})/2\} \\ &= \{(X_{88} - X_{70})\beta_{88} - (X_{88} - X_{70})\beta_{70}\}/2.\end{aligned}$$

Table 2
Decomposition of the Convergence in White and Black Test Scores: NAEP Math and Reading Tests, 13-Year-Olds

	NAEP Reading				NAEP Math			
	1970	1988	Change, 1970–88	% of Total Change	1970	1988	Change, 1970–88	% of Total Change
Difference in average test scores	17.02	9.55	−7.47	100	17.56	11.64	−5.92	100
Difference attributable to:								
Within-school differences	11.14	4.92	−6.22	83.3	10.24	5.72	−4.52	76.4
	(.40)	(.98)	(.12)		(.50)	(.96)	(.13)	
School quality	3.23	4.15	.92	−12.3	4.01	3.32	−.69	11.7
	(.21)	(.69)	(.72)		(.24)	(.67)	(.69)	
Family characteristics:								
1970 as base year:								
Levels	...	...	−2.08	27.8	...	...	−1.46	24.6
			(.07)				(.09)	
Returns	...	...	−.18	2.4	...	...	−.08	1.3
			(.25)				(.25)	
1988 as base year:								
Levels	...	...	−1.90	25.4	...	...	−1.23	20.8
			(.24)				(.26)	
Returns	...	...	−.11	1.5	...	...	−.14	2.3
			(.09)				(.09)	

NOTE.—Standard errors are in parentheses. NAEP = National Assessment of Educational Progress.

in the final four columns, we replicate the analysis for the NAEP math exams. Columns 1 and 2 report the within-year difference in white and black reading test scores attributable to each of the components in the test score decomposition. Column 3 reports the change in the test score gap due to changes in each component, and column 4 reports the proportion of the overall convergence in test scores explained by these changes.

In the first row, we note that the difference in white and black reading test scores fell from 17.02 to 9.55 points in the 1970–88 time period, a drop of 7.47 points. In the next row, we report the results for the within-school differences in test scores which is measured by δ_t, the coefficient on the black indicator variable in equation (1). In 1970, blacks test scores were 11.14 percentage points lower than white test scores due to differences within schools. By 1988, this difference had fallen to 4.92 percentage points. Thus, by 1988, the gap in white and black test scores was 6.22 percentage points lower due to changes within schools, and this change accounted for 83% of the overall convergence in test scores (calculated by dividing the change in test scores due to changes within schools, −6.22, by the overall change in the gap in test scores, −7.47).

School quality refers to the difference in test scores due to the fact that

white and blacks attend schools that differ in quality. The measure of school quality is calculated as the school-fixed effect in equation (1). The difference in the average school quality of white and black students is defined in equation (4) and is measured by averaging the school-fixed effects across all white and all black students, and taking the difference of the two. In 1970, white reading scores were 3.32 percentage points higher than black scores due to differences in school quality. By 1988, this difference rose to 4.15, implying that the schools that blacks attended worsened relative to the schools that whites attended. Thus, changes in school quality explain a negative amount of the convergence in reading test scores.

Changes in the levels in parental education accounted for a surprisingly small part of the convergence in test scores given its prominence in the literature as an explanation of that convergence. In the last four rows of results for the reading tests, we report the changes in test scores due to changes in both the levels and returns to parental education, reporting the results using both the beginning and end of period as the base year. We find that although the gap in reading test scores declined due to changes in the levels of parental education, these changes accounted for 25%–28% of the convergence in NAEP reading tests. There was little change in the returns to parental education over time, and these changes were not an important factor in the convergence in test scores.

In the last four columns of table 2, we report the decomposition results for NAEP math scores. The results are very similar to those for the reading exam with only one notable exception. Overall the white/black gap in math test scores fell 34% over the time period, from a difference of 17.56 in 1972 to a gap of 11.64 in 1988. The gap in white and black math test scores fell by 4.52 percentage points due to changes within schools, accounting for 76% of the overall convergence. In contrast to the results for reading scores, we found that the schools blacks attended improved relative to those whites attended, and that the gap in test scores narrowed due to changes in school quality. However these changes were relatively small, and they were responsible for less than 12% of the overall convergence in test scores. As with the reading test scores, changes in parents' education were responsible for only 22%–30% of the convergence in the NAEP math tests.

Although changes in school quality explain little of the convergence in white/black test scores, the variation in test scores explained by schools is quite high. The adjusted R^2 for the 1988 reading test score model we use in table 2 is 0.265, but the adjusted R^2s with only school-fixed effects and with only demographic characteristics are 0.201 and 0.180, respectively. This suggests that school characteristics explain between 8.5% and 20.1% of the sample variation or between 32% and 78% of the explained variation in test scores. The importance of the school-fixed effect in explaining outcomes was

also noted by Grogger (1996) who found a large fraction of explained variation in wages was due to the school-fixed effects.

The decompositions of both the reading and math tests lead to three basic conclusions. First, three-quarters or more of the convergence in test scores was due to a narrowing of the gap in test scores among white and black students who attend the same school and with the same level of parental education. Second, although there was a sharp convergence in the levels of parental education, this accounts for only 22%–30% of the overall convergence in test scores. Third, changes in the relative quality of schools can account for little or none of the convergence in test scores. In fact, in the analysis of the NAEP reading tests, we found a divergence in the relative quality of schools that white and black students attend, while the results for NAEP math tests show that changes in school quality can account for only one-eighth of the convergence in test scores.

Our results indicating a small fraction of the convergence can be explained by changes in parental education are close to estimates that can be inferred from the work of Grissmer et al. (1994). Their methodology is similar to ours, although the questions they address are different. They examine the effect of time-series changes in demographic characteristics on the time path of test scores. They find that the aggregate rise in test scores is explained by changes in family background. However, simple "back of the envelope" calculations show that our results are consistent with theirs. Grissmer et al. find that changes in family background led to a rise in black math scores by 0.3 standard deviations and nonblack scores by 0.2 standard deviations. Put another way, changes in family background led to a convergence in test scores of 0.1 standard deviations. The overall convergence in NAEP math test scores is approximately 0.5 of a standard deviation. To express their results in the terms we use, changes in family background account for about 1/5 of the overall convergence of white/black math scores (0.1/0.5).

To test the sensitivity of these results we repeated the analysis making a number of specification changes. First, we estimated models using test scores for 17-year-olds. These results are presented in table 3. As we noted above, although data for 17-year-olds have fewer observations where information on parents' education is missing, the sample composition has changed over time as graduation rates have increased. In the end, however, the results for this group are strikingly similar to estimates for 13-year-olds. For the sample of 17-year-olds, changes in within-school differences explain 78% and 68% of the convergence in reading and math scores, respectively. For this older group, changes in parents' education explain about 30% of the convergence in both tests, a result somewhat higher than the estimates for the younger sample. Like the results for 13-year-olds, we find that school quality as measured by

Table 3
Decomposition of the Convergence in White and Black Test Scores: NAEP Math and Reading Tests, 17-Year-Olds

	NAEP Reading				NAEP Math			
	1970	1988	Change, 1970–88	% of Total Change	1970	1988	Change, 1970–88	% of Total Change
Difference in average test scores	18.31	10.31	−8.01	100	16.53	10.33	−6.20	100
Difference attributable to:								
Within-school differences	11.49	5.23	−6.26	78.2	10.41	6.19	−4.22	68.1
	(.45)	(.92)	(.10)		(.39)	(.97)	(.09)	
School quality	4.17	4.78	.61	−7.6	4.20	4.09	−.10	1.6
	(.21)	(.69)	(.74)		(.21)	(.68)	(.71)	
Family characteristics:								
1970 as base year:								
Levels	...	...	−2.16	26.9	...	...	−1.83	29.5
			(.10)				(.07)	
Returns	...	...	−.31	3.8	...	...	−.23	3.7
			(.11)				(.25)	
1988 as base year:								
Levels	...	...	−2.03	25.3	...	...	−1.70	27.4
			(.24)				(.25)	
Returns	...	...	−.20	2.5	...	...	−0.19	3.1
			(.12)				(.08)	

NOTE.—Standard errors are in parentheses. NAEP = National Assessment of Educational Progress.

reading exams fell for blacks relative to whites, but the same index increased for math scores over the time period of analysis.

Since there is a large literature on the possibility of differences in white and black returns to parental education, we also allowed the returns to education to vary across race as well as across time. The results are essentially unchanged: changes in parental education account for 25%–30% of the convergence in reading test scores, changes in the relative quality of schools that whites and blacks can account for little or none of the convergence in test scores, and almost all of the convergence in test scores is due to changes within schools.

C. The Effect of Omitted Family Variables

As the title of the article suggests, our goal is to determine whether changes in families or schools were responsible for convergence in white and black test scores. We would like to include an extensive list of family characteristics, but unfortunately the only measure available for all years in the NAEP is the highest level of education of each parent. In many education production functions, other parental characteristics are important determinants of test scores. If these omitted factors are also converging for black and white students, then excluding these from the analysis

Table 4
Median Family Income by Race

Racial Group	1972	1990	Change, 1970–88
Non-Hispanic whites	34,440	36,915	2,375
Blacks	20,783	21,423	640

NOTE.—All families have children under 18. The 1972 and 1990 data from March Current Population Surveys; 1990 dollars.

will understate the effect that changes in family characteristics have had on the gap in white/black test scores. In this section we investigate whether omitting two important variables—family income and family structure—seriously bias our conclusions.

There are really two questions we address in this section. First, what effect did changes in family income and the proportion of children in two-parent families have on the gap in white and black test scores? Second, are our estimates of the effect of the changes in the levels of parental education biased due to the omission of important family characteristics? The answers to both of these questions leads to the same conclusion. By omitting the family income and two-parent family variables from the decompositions, we overstate the role of changing family characteristics as an explanation for the convergence in white/black test scores.

The first question is what is the effect of changes in the family income and two-parent family variables on the convergence in white and black test scores. If these variables were included as covariates in the basic test score equation, the effect of changes in the levels of these variables on the gap in white and black performance would be

$$(\Delta \bar{I}_{88} - \Delta \bar{I}_{70})\tilde{\alpha}_{70} + (\Delta \bar{P}_{88} - \Delta \bar{P}_{70})\tilde{\gamma}_{70}, \tag{5}$$

where $\Delta \bar{I}_t$ is the difference in white and black mean family income in year t, $\Delta \bar{P}_t$ is the difference in the proportion of white and black children in two-parent households, and $\hat{\alpha}_{70}$ and $\hat{\gamma}_{70}$ are the estimates on the income and family structure coefficient from the 1970 cross sections. Presumably both $\hat{\alpha}_{70}$ and $\hat{\gamma}_{70}$ are positive, an assumption we confirm later in this section.[10] Subsequently, the sign of (5) depends on the signs of $(\Delta \bar{I}_{88}$

[10] The result that family income has a positive effect on student performance is not controversial. The result that living in a two-parent family has a positive effect on performance, after controlling for parental education and income, is less clear. However, the debate is on the magnitude and the statistical significance of the variable, and no one suggests that it is negative. For this argument to hold, we only need for the effect of living in a two-parent family to be nonnegative. See Krein and Beller (1988) and Manski et al. (1992).

Table 5
Percent of Two-Parent Families with Children

Racial Group	1972	1990	Change, 1970–88
Non-Hispanic whites	89.9	76.4	−13.5
Blacks	64.3	39.4	−34.9

NOTE.—All families have children under 18. The 1972 and 1990 data from March Current Population Surveys.

$-\Delta\bar{I}_{70})$ and $(\Delta\bar{P}_{88}-\Delta\bar{P}_{70})$. In tables 4 and 5, we show that both of these terms are negative. Both tables are based on the March Current Population Surveys. Table 4 reports the median family income for all families with children under 18 for whites and blacks in 1972 and 1990. There has been no convergence in median family income, in stark contrast to the substantial convergence in levels of parental education. At best, the term $(\Delta\bar{I}_{88}-\Delta\bar{I}_{70})$ is zero or slightly negative. Table 5 reports the percent of families with children living in a two-parent family in 1972 and 1990 for whites and blacks. There has been a sharp drop in the number of both white and black children living in a two-parent family. However, the drop has been much sharper for blacks than it has for whites and thus the term $(\Delta\bar{P}_{88}-\Delta\bar{P}_{70})$ is negative. Simply put, changes in family income and family structure cannot explain the convergence in test scores because there has been no convergence in family income and family structure.

The second potential problem is bias in our estimates of the return to education due to omitting other family factors. The estimate of the effect of changes in the level of parental education on the white and black test score gap is defined as

$$(\Delta\bar{X}_{88}-\Delta\bar{X}_{70})\hat{\beta}_{70}, \tag{6}$$

where $\Delta\bar{X}_t$ is the difference in mean levels of the parental education of white and black students in time t, and $\hat{\beta}_{70}$ is estimated from equation (1). If family income and whether a student is in a single parent household are correlated with family income, then the estimates from equation (6) are biased. It is likely that parental education is positively correlated with both family income and whether a child lives in a two-parent household and, therefore, the estimate of $\hat{\beta}$ from (1) will be too large.

This hypothesis is easy to verify using data from High School and Beyond (HS&B) data set.[11] The HS&B is a longitudinal data set that

[11] The HS&B data set is a longitudinal data set sponsored by the Department of Education. In 1980 it interviewed a representative sample of students enrolled in tenth

Table 6
OLS Estimates of Test Score Equations:
High School & Beyond Data Set for 15-Year-Olds

	1982 HS&B Reading Test		1982 HS&B Math Test	
	(1)	(2)	(3)	(4)
Black indicator variable	−.273	−.228	−.244	−.210
	(.048)	(.048)	(.050)	(.050)
Parents' education:				
Less than 12 years	−.192	−.186	−.160	−.123
	(.036)	(.036)	(.043)	(.044)
More than 12 years	.143	.126	.312	.289
	(.034)	(.034)	(.031)	(.031)
Missing	−.404	−.356	−.237	−.194
	(.050)	(.050)	(.040)	(.041)
Family income:				
$7K–$12K	...	−.388	...	.202
		(.075)		(.070)
$12K–$16K	...	.002	...	.294
		(.059)		(.066)
$16K–$20K	...	.009	...	.303
		(.052)		(.069)
$20K–$25K	...	.013	...	.330
		(.051)		(.070)
$25K–$38K	...	.025	...	.466
		(.051)		(.074)
> $38K	...	.170	...	.268
		(.053)		(.068)
Missing	...	−.244	...	.175
		(.052)		(.66)
Two-parent family	...	.054	...	.037
		(.034)		(.03)
R^2	.345	.360	.274	.283
N	5,957	5,957	5,957	5,957

NOTE.—OLS = ordinary least squares. Standard errors in parentheses.

interviewed a nationally representative sample of sophomores and seniors in 1980. One advantage of the HS&B compared to the NAEP is that there is a much more extensive array of variables. Like the NAEP, the HS&B data tested a number of students per school.

In this analysis we use only 15-year-olds from the HS&B sophomore cohort to insure that our results are roughly comparable to the sample of 13-year-olds in the NAEP. We use HS&B students who were sophomores in 1980 and estimate two test score equations: one without covariates for family income and marital status and one with these variables. In these models, test scores are standardized with a

grade at that time. It gave the students a set of standardized tests and asked them a variety of questions, including questions on their race and family background.

mean of zero and a standard deviation of one. The results are presented in table 6. In each of the models reported, we also include school-fixed effects. The results from the model omitting family income and the two-parent family indicator are presented in column 2 (for the reading test) and column 4 (for the math test). The results that include the family income and two-parent family variables are presented in columns 3 and 5. Note that these results also confirm our assumptions about the positive effects of family income and two-parent families on test scores.

Thus, both sources of bias lead to the same result. Although we omit important family characteristics from the education production function, our initial estimates of the effect of changes in parents' education actually overstate the effect of measured family attributes on the convergence in test scores.[12]

D. A Closer Look at Changing School Quality

Results from the NAEP reading tests show that the gap in the quality of schools that blacks and whites attend has widened over time, even in the face of converging individual test scores and a convergence in the levels of parental education of white and black students. Our results for NAEP math test find a convergence in school quality, but this convergence is small relative to the overall convergence in test scores. In this

[12] Omitting family background variables and whether a student lives in a two-parent family also biases the coefficient estimates for the other independent variables in a cross-sectional test score equation. The potential bias is most troubling for the coefficient estimates for the black indicator variable since it figures prominently in the decomposition of the convergence in test scores. The coefficient for the black indicator variable in eq. (1), denoted δ_t, is a measure of the within-school difference in white and black test score performance at a point in time. Since whether a student is black is highly (negatively) correlated with the omitted family variables, then δ_t is likely to be biased downward (more negative), and the portion of the difference in white and black test scores at a point in time due to differences within schools is likely to be overstated. However, in the decomposition of the convergence in test scores the bias appears to be in the opposite direction. The portion of the overall convergence in test scores that is due to changes within-schools is measured by $\delta_{88} - \delta_{70}$. Both δ_{88} and δ_{70} will be biased downward, but whether the portion of the overall convergence in test scores due to changes within schools is understated or overstated depends on whether the bias in δ is greater in 1970 or in 1988. Since the correlation in family income and whether a student is black is practically unchanged over this time period, and the correlation of whether a student is in a two-parent family and whether the student is black has become much more negative, the downward bias is greater in 1988 than in 1970. This would imply that the actual change in δ is greater than our estimates imply, and that we understate the portion of the overall convergence in test scores that is due to changes within schools.

section, we investigate these changes in school quality in more detail. We find that this divergence in reading scores appears to be due to entirely a worsening in the relative quality of schools located in poor, inner-city areas and in schools that are less than 20% white. We find a similar pattern in the changes in NAEP math scores.

Conceptually, the widening gap in school quality can be thought of as due to two factors. First, the distribution of whites and blacks across different types of schools may have changed over time. For example, over time blacks may be more likely to attend disadvantaged urban schools or schools that are predominantly minority. Second, the quality of the type of schools in which blacks are disproportionately represented may have declined over time relative to other schools. For example, blacks may be no more or less likely to attend disadvantaged, inner-city schools over time, but the quality of these schools may have declined.

We first investigate if the widening gap in school quality is due to changes in the types of schools that blacks attend relative to the schools that whites attend. In table 7 we report the observed characteristics of schools that whites and blacks attend. Many of the results of this table are

Table 7
Mean School Characteristics of White and Black Students: NAEP Reading Tests for 13-Year-Olds

School Characteristics	1970	1988	Change, 1970–88
By community type:			
Whites (% in each group):			
Advantaged urban	13.0	14.3	1.3
Disadvantaged urban	3.5	3.9	.4
Other	83.5	81.8	−1.8
Blacks (% in each group):			
Advantaged urban	4.7	7.7	3.0
Disadvantaged urban	30.0	28.7	−2.3
Other	65.3	63.6	−.7
By racial composition:			
Whites (% in each group):			
Predominantly white	83.5	67.2	−16.3
Predominantly minority	1.0	1.2	.2
Blacks (% in each group):			
Predominantly white	15.5	14.1	−1.4
Predominantly minority	35.0	32.1	−2.9
By community socioeconomic status:			
Whites:			
% Managerial and professional	17.7	27.8	9.5
% Not employed	3.6	3.7	.2
% On welfare	5.0	7.6	2.5
Blacks:			
% Managerial and professional	10.6	18.6	8.0
% Not employed	8.6	6.6	−2.0
% On welfare	16.1	23.9	7.8

NOTE.—NAEP = National Assessment of Educational Progress.

Table 8
Average School Quality by Student and School Characteristics: NAEP Reading and Math Tests, 13-Year-Olds

	Reading Tests			Math Tests		
Demographic Group	1970	1988	Change, 1972–88	1972	1988	Change, 1972–88
Race:						
White	.0	.0	.0	.0	.0	.0
Black	−3.2	−4.1	−.9	−4.0	−3.3	.7
Community type:						
Advantaged urban	3.5	2.9	.7	3.9	3.6	.3
Disadvantaged urban	−2.1	−6.6	−4.5	−2.5	−4.9	−2.4
Racial composition of school:						
Predominantly white	1.3	.8	−.5	1.5	.9	−.6
Predominantly minority	−4.2	−6.2	−2.0	−4.2	−6.2	−1.2
Race (after deleting urban disadvantaged schools):						
White	.0	.0	.0	.0	.0	.0
Black	−4.1	−3.5	.6	−3.9	−2.4	1.5
Race (after deleting predominantly minority schools):						
White	.0	.0	.0	.0	.0	.0
Black	−2.6	−2.4	.2	−2.5	−1.5	1.0

NOTE.—NAEP = National Assessment of Educational Progress.

expected: blacks are more likely to attend disadvantaged urban schools, schools that are less than 20% white, schools that are located in communities with fewer managerial and professional workers, and schools with more people not employed and on welfare. However, there seems to be little change in these characteristics over time.[13] Changes over time in the types of schools that whites and blacks attend do not seem to be responsible for the widening gap in school quality.

Next, we investigate whether the quality of schools that blacks are more likely to attend have declined in relative terms. In table 8, we report mean school quality across a number of dimensions. The measure of school quality is relative to other schools that year, and the scaling is set so that the mean white school effect in each year is equal to zero. In this table we report our findings for both reading and math tests (for 13-year-olds). For example, for reading in 1970 the mean school effect for schools blacks attended was −3.2. In other words, the average black student attended a school where a student in that school was likely to score 3.2 percentage points lower on their reading test relative to a student who attended the mean white school, after controlling for the race and parental

[13] The one exception to this pattern is in the percent of people on welfare in the community in which the school is located. There has been a sharp rise in this number for black students.

education of the individual student. We report relative school quality by race, community type, and racial composition. These results imply that there have been substantial changes in relative school quality across different types of schools. In particular, there has been a decline in the relative quality of disadvantaged urban schools and in the relative quality of predominantly minority schools.[14]

To illustrate the importance that changing school quality in urban and predominantly black schools has had on aggregate scores for blacks, we report at the bottom of table 8 the relative school quality measures for white and black students after disadvantaged urban schools or predominantly minority schools have been deleted from the sample. The results from this exercise produce two interesting results. First, after we delete these types of schools, the quality of schools that blacks attend actually improved between 1970 and 1988. Second, this also suggests that all of the reduction in school quality for schools that blacks attend is attributable to the declining quality of inner-city or predominantly minority schools.

We find a similar pattern in the results for math test scores. Although we find a convergence in white/black school quality overall, we find that a decline in the quality of disadvantaged urban and predominantly minority schools. We also find that the convergence in school quality would have been significantly larger had it not been for the decline in school quality of disadvantaged urban and predominantly minority schools.

IV. Conclusion

Differences in the performance of white and black students on standardized tests have narrowed substantially over time, with the gap in performance on various NAEP tests falling by about one-half since the early 1970s. A number of researchers have speculated that this convergence is due to factors such as changes in family background or a convergence in school quality. However, we find little support for these arguments. Overall, less than 25% of the overall convergence is attributable to these two factors combined. Instead, we find that nearly 75% of the convergence is due to changes within schools, that is, to a narrowing in the gap in test scores between white and black students with the same level of parental education and who attend the same school. As we noted above, some care should be taken when interpreting these results because we can only measure one family characteristic (parents' education). We do however believe that the results are probably an overestimate of the

[14] Predominantly minority schools are defined as those schools that are less than 20% white, and disadvantaged urban schools are defined as schools located in an standard metropolitan statistical area (SMSA) and located in a community with a high number of individuals who are not employed and on welfare.

role of changing family characteristics in the convergence in test scores since black and white differences in other important family characteristics (such as income and the likelihood of living in a two-parent family) have actually diverged over the time period of analysis.

Probably the most interesting result in our analysis is the small change in the relative quality of the schools that blacks and whites attend. Our evidence suggests that the average difference in these school-fixed effects across races changed little for math test scores and actually declined for reading scores. All of this decline is however attributed to a sharp decline in the quality of two types of schools—disadvantaged urban schools and predominately black schools.

These estimates may be viewed as a negative result—what was thought to explain the convergence in test scores cannot. However, we believe these results have a number of implications beyond the question that motivated our work.

First, these results suggest that to understand the convergence in white and black academic performance it is imperative to look to explanations that are consistent with the narrowing gap in performance within schools. Possible explanation for this convergence include changes in the enrollment patterns of white and black students (such as enrollment in remedial or advanced classes), a decrease in discrimination, changes in teachers' expectations for black students, changes in tracking and enrollment patterns. For example, there is evidence that differences in the enrollment patterns of white and black students have narrowed significantly over time, and these measures of enrollment patterns are highly correlated with student performance (Cook 1997).

We can also make some conclusions about which mechanisms have not worked. In the early 1970s, blacks attended schools with larger classes and lower per-pupil expenditures compared to whites. Since then, these differences have disappeared (Boozer et al. 1992). Any convergence in test scores caused by the convergence in per-pupil spending and class size would be captured by our measures of school quality. But as the results of tables 2 and 3 indicate little or none of the convergence in test scores was due to changes in school quality. This does not mean that increases in spending cannot improve outcomes, just that they are not responsible for the convergence in white and black performance. However, these results are consistent with a long line of work in economics that has established that educational outcomes such as test scores are typically uncorrelated with measures of purchased inputs to education such as per-pupil expenditures or teacher-pupil ratios (Hanushek 1986).[15] Rather, as Hanushek (1994) notes, improvements

[15] In contrast to the work on test scores, recent research suggests that measured school inputs are correlated with labor market outcomes such as returns to education

in student performance must focus on using existing resources more efficiently. For example, shifting students into an academic-based curriculum may generate positive returns at little cost.

Sometimes the research on the effect of resources on student performance is interpreted more broadly. Rather than concluding merely that "money doesn't matter," some have suggested the schools don't matter. For example, in their highly controversial book *The Bell Curve*, Hernstein and Murray (1995) argue that policies directed at reducing the dispersion in test scores in general and policies directed at narrowing the gap in white and black performance in particular are likely to be ineffective. They conclude that "the school is not a promising place to try to raise intelligence or reduce intellectual differences" (p. 381). Our results flatly contradict this notion. Almost all of the convergence in test scores occurred within schools, and the improvements in the NAEP test scores appear to have been produced by changes in the school environment.

Our research is not a direct test of the analyses in their book. We focus on changes in the gap in performance over time, while the analysis in *The Bell Curve* focuses on differences at a point in time. However, *The Bell Curve* clearly implies that little can be done to narrow the gap in white and black test scores. Interestingly, Hernstein (1971) actually made this same point in the early 1970s so the results of the past 25 years stand in direct contradiction to their analysis.

A similar argument often encountered in the debates on education policy is that there is little that schools or educational policy can do because families and family background are so important. Our research suggests that we should be skeptical of this argument as well. We find that changes in family background are relatively unimportant in explaining the convergence in white and black test scores, even though family background is very important in explaining differences at a point in time. Our results suggest that there can be significant changes in academic performance even if observable family characteristics are unchanged. An important caveat to our conclusions is that the only measure of family background we have is parents' education.

Our results also have implications for the debate over the effects of efforts at integrating schools. Critics of these efforts often make two arguments. First, they argue that efforts to integrate schools are not responsible for the convergence in academic performance. Second, some argue that because of the efforts to improve predominantly minority schools, there is less need to

(Card and Krueger 1992*a*, 1992*b*) or levels of education (Murray, Evans, and Schwab 1996). Betts (1995) and Grogger (1996) offer dissenting opinions, however. Heckman (1996) argues that Card and Kreuger's results differ from other studies because of a misspecification due to nonlinearities in the returns to education.

integrate schools now than in the past (Armor 1992). Our results confirm the first point but contradict the second.

Any convergence due to the integration of schools would appear in our analysis as a convergence in the relative quality of schools. But, as we have mentioned before, we find no evidence that a convergence in school quality is an important component in the overall convergence in test scores. This suggests that it is unlikely that efforts at integrating schools have been an important part of the convergence in academic performance, at least since the early 1970s. This is not a surprising result because the NAEP indicates that schools were no more integrated in 1988 than they were in 1970.

Our results, however, contradict the argument that there is less need to integrate schools today because of the efforts to improve predominantly minority schools. We find that the relative quality of predominantly minority schools (which we define as schools that are less than 20% white) has become much worse over time. We also find that the relative quality of schools located in poor, inner-city areas has declined substantially. Although we do not address the direct effect of integration on student performance, we find no evidence that the rationale for integration has declined over time.

Finally, our results have important implications for understanding changes in the distribution of wages over time. One of the major issues in labor economics over the last decade and a half has been the sharp rise in the inequality of wages and incomes in the United States during the 1980s. The wage differences of white and black workers also expanded substantially after the mid-1970s, and this issue has also been the focus of a large body of research. Although the gap in white and black wages and income has increased, white and black differences in traditional measures of academic performance have narrowed sharply. Since 1970, there has been a sharp convergence in the academic performance of white and black students, with differences in academic test scores and high school dropout rates falling dramatically from the early 1970s to the late 1980s. Over this time period, differences in white and black test scores fell by about one-half, and the gap in white and black dropout rates fell nearly 60%. There are two clear implications of these results. First, while differences in white and black earnings at a point in time may be partially explained by differences in academic performance, the increasing gap in white and black wages do not appear to stem from changes in academic performance over time. The trends work in exactly the wrong direction, with the gap in academic performance narrowing for precisely those white and black workers whose wages were diverging after the mid-1970s. Second, the growing gap in wages may well have been even larger if the convergence in academic performance had not occurred over this time period, since academic performance has large effects on future earnings. This conclusion is similar to that of Grogger (1996) who

found that changes in school spending cannot explain the divergence in black/white earnings over the past 15 years.

References

Angrig, Greg. "Test Scores on the Rise for Blacks." *Newark Star-Ledger* (May 27, 1984).

Armor, David. "Why Is Black Educational Achievement Rising?" *Public Interest* (September 1992): 65–80.

Betts, Julian. "Does School Quality Matter? Evidence from the National Longitudinal Survey of Youth." *Review of Economics and Statistics* 77 (1995): 231–50.

Bock, R. D. "Designing the National Assessment of Educational Progress to Serve a Wider Community of Users: A Position Paper." ERIC Document no. ED279664, 1986.

Boozer, Michael A.; Krueger, Alan B.; and Wolkon, Shari. "Race and School Quality Since Brown v. Board of Education." *Brookings Papers on Economic Activity—Microeconomics* (1992): 269–326.

Cain, Glen G. "The Economic Analysis of Labor Market Discrimination: A Survey." In *Handbook of Labor Economics*, vol. 1, pp. 693–785, Handbooks in Economics series, no. 5. Amsterdam: North-Holland, 1986.

Card, David, and Krueger, Alan B. "Does School Quality Matter? Returns to Education and the Characteristics of Public Schools in the United States." *Journal of Political Economy* 100 (February 1992): 1–40. (*a*)

———. "School Quality and Black-White Relative Earnings." *Quarterly Journal of Economics* 107 (February 1992): 151–200. (*b*)

Cook, Michael D. "Families or Schools? The Convergence in White and Black Academic Performance, 1970–1988." Ph.D. dissertation, University of Maryland, Department of Economics, 1996.

Corcoran, Mary, and Duncan, Greg J. "Work History, Labor Force Attachment, and Earnings Differences between the Races and Sexes." *Journal of Human Resources* 14, no. 1 (1979): 3–20.

Grissmer, David W., et al. *Student Achievement and the Changing American Family*. Santa Monica, CA: RAND, 1994.

Grogger, Jeff. "Does School Quality Explain the Recent Black/White Wage Trend?" *Journal of Labor Economics* 14, no. 2 (1996): 231–53.

Hanushek, Eric A. "The Economics of Schooling: Production and Efficiency in Public Schools." *Journal of Economic Literature* 24 (September 1986): 1141–77.

———. *Making Schools Work: Improving Performance and Controlling Costs*. Washington, DC: Brookings, 1994.

Heckman, James; Layne-Farrar, Anne, and Todd, Petra. "Human Capital Pricing Equations with an Application to Estimating the Effect of Schooling Quality on Earnings." *Review of Economics and Statistics* 78 (November 1996): 141–77.

Hernstein, Richard J. "I.Q." *Atlantic Monthly* (September 1971).

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

Jaynes, G. D., and Williams, R. M., eds., *A Common Destiny: Blacks and American Society.* Washington, DC: National Academy Press, 1989.

Koretz, Daniel. *Educational Achievement: Explanations and Implications of Recent Trends.* Washington, DC: Congressional Budget Office, August 1987.

Krein, Sheila F., and Beller, Andrea H. "Educational Attainment of Children from Single Parent Families: Differences by Exposure, Gender and Race." *Demography* 25, no. 2 (May 1988): 221–34.

Manski, Charles F., et al. "Alternative Estimates of the Effect of Family Structure during Adolescence on High School Graduation." *Journal of the American Statistical Association* 87, no. 417 (March 1992): 25–37.

Murray, Sheila; Evans, William N., and Schwab, Robert. "The Effects of School Resources on High School Completion: Evidence from Panel Data." Working paper. College Park: University of Maryland, Department of Economics, 1996.

Oaxaca, Ronald. "Male-Female Wage Differentials in Urban Labor Markets." *International Economic Review* 14 (October 1973): 693–709.

Sahling, Leonard G., and Smith, Sharon P. "Regional Wage Differentials: Has the South Risen Again?" *Review of Economics and Statistics* 65, no. 1 (February 1983): 131–35.