SCHOOL FINANCE COURT CASES AND DISPARATE RACIAL IMPACT
The Contribution of Statistical Analysis in New York

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Although analyses of state school finance systems rarely focus on the distribution of funds to students of different races, the advent of racial discrimination as an issue in school finance court cases may change that situation. In this article, we describe the background, analyses, and results of plaintiffs' testimony regarding racial discrimination in *Campaign for Fiscal Equity Inc. v. State of New York*. Plaintiffs employed multiple regression and public finance literature to show that New York State's school finance system had a disparate racial impact on New York City students. We review the legal basis for disparate racial impact claims, with particular emphasis on the role of quantitative statistical work, and then describe the model we developed and estimated for the court case. Finally, we discuss the defendants' rebuttal, the Court's decision, and conclude with observations about the role of analysis in judicial decision making in school finance.

Keywords: education; discrimination; statistical evidence in court cases

In the United States, each state is responsible for public elementary and secondary education services within its boundaries. Almost all states have chosen to set up local school districts to administer and deliver education, with the property tax as the primary local revenue source. These arrangements have created a nation of 50 school finance systems with substantial funding disparities across and within states. Plaintiffs in 45 states have challenged these finance systems in their state courts and, in almost one half the states,

the courts have found that the system in question violates the state constitution (Access Network, 2003). Thus, the judiciary is needed to ensure the outcomes envisioned by the state constitutional framers. In the United States, primary and secondary education policy needs the courts to keep it on the right track.

New York State is among the 45 states that have had their finance systems challenged. In *Campaign for Fiscal Equity, Inc. v. State of New York* (*CFE*; 2001), the New York State Court of Appeals ruled that New York State's school finance system violated the State's Education Clause,[1] and the trial court ruled earlier that the system violated the implementing regulations of Title VI of the Civil Rights Act of 1964 (see *CFE*, 2003, pp. 162-185). The previous school finance case in New York State, *Levittown Union Free Sch. Dist. v. Nyquist* (1982), was decided against the plaintiffs. Plaintiffs in that case claimed the finance system was unconstitutional on equity grounds, whereas in the *CFE* case they claimed the system was discriminatory and inadequate. The *CFE* case was brought on behalf of New York City schoolchildren, and the ruling applied to funding for New York City. Nonetheless, the plaintiffs' arguments involved the way the entire state funding system works, with a focus on how that system affected New York City.

Given the findings of *Levittown v. Nyquist* (1982) that a challenge based on equity was not supported by the state's constitution, the plaintiffs in the *CFE* case argued that the Levittown case did open the door to an adequacy case. More specifically, the plaintiffs argued, and the Court agreed, that the state education financing system in New York did not provide the schoolchildren in New York City with the sound basic (adequate) education that the constitution guarantees. In addition, the plaintiffs argued that, with more than 80% of New York City's pupil population composed of students of color, the state education financing system was discriminatory based on race.

This article focuses specifically on the analysis that was presented by the plaintiffs in the trial court to show that the state's school finance system was discriminatory, that is, had a disparate racial impact. Although the *CFE* case was ultimately decided on the grounds of educational adequacy, the racial issues raised in the case broke new ground in school finance,[2] even though the race-based part of the case was overturned on appeal.[3] This article addresses the underattention to race in school finance that has existed for decades, and the article is of interest because it illustrates how the courts approach evidence based on social science research in general and based on the use of multivariate statistical analysis in particular. In the second section of the article, we provide a brief overview of New York State's school finance system. We then turn to the question of disparate racial impact, and in the third section we present the conceptual and legal basis for the claim and the quantitative

work that has been accepted by the courts in discrimination cases. In the fourth section, we review the public finance literature on intergovernmental aid, and in the fifth section we develop a model of state aid in New York. In the sixth section, we analyze how regression analysis was used by the New York State Court, and in the seventh section we conclude with observations on the role of analysis in judicial decision making in school finance.

SCHOOL FINANCE IN NEW YORK
STATE AND NEW YORK CITY

At a general level, the New York State school finance system can be described as a combination of local revenues and state funding, the latter composed of general operating formulas and categorical aid. Using the most recent report on actual state aid (New York State Education Department, 2002), New York State general and special aid fund expenditures for 2.827 million students were U.S. $34.22 billion in 2000-2001, of which $13.88 billion, or 40.6%, were state revenues. This percentage of state contribution has varied between 38% and 44% during the past decade.

New York State has close to 700 school districts, and all but five are independent districts that have their own taxing power. Five cities—Buffalo, Rochester, Syracuse, Yonkers, and New York City—have dependent school districts where the education system is part of the municipal government. In these cities, local revenues for education come from all city tax and revenue sources, and decisions on education are determined alongside decisions about other city functions such as police, fire, and health care services. All other independent school districts, on the other hand, overlap municipal jurisdictions, often without being coterminous, and thus tradeoffs across functions are less explicit and obvious. In 2000-2001, total expenditure per pupil in New York State[4] was $11,871 and in New York City, $11,474.

When we move beyond the basics, the complexity of the state's school finance system increases substantially. The Court itself said, in *CFE v. State* (2001),

> The evidence demonstrates that the State aid distribution system is unnecessarily complex and opaque. It is purportedly based on an array of often-conflicting formulas and grant categories that are understood by only a handful of people in State government. Even the State Commissioner of Education testified that he does not understand fully how the formulas interact. (p. 134).

There are more than 50 discrete formulas, several different pupil units and weighting schemes (explained later in the article), many idiosyncratic features that can vary from year to year, and several caps and hold-harmless features that tend to nullify some of the features of the formulas. About 50% of the state funding is distributed through its principal operating formula that is a form of percentage-equalizing grant taking into account per-pupil wealth measured by equally weighting full value of property and income (from immediately preceding years), both measured in per-weighted pupil terms. The formula has a per-pupil ceiling, a per-pupil floor and includes multiple pupil weightings.

In addition to the general operating formula, other formulas address extraordinary student needs, tax equalization aid, tax effort aid, gifted and talented aid, limited English proficiency aid, excess cost aid for disabled students, transportation aid, growth aid, and so on. New York State has implemented a school property-tax relief program, School Tax Relief Program (STAR), that is outside of the various formulas but has a substantial effect on the distribution of state funds (Duncombe & Yinger, 1998). For purposes of the empirical analysis in this article, the property-tax relief program is excluded because even though it is arguably part of the school finance system broadly defined, it is administered separately and treated somewhat separately by the New York State courts in the *CFE* case.

Finally, the Court found that the complex school finance formulas are not permitted to run based on actual input factors but instead are used to fit a politically determined division of state school aid between New York City and the rest of the state. Thus, if school finance in New York is racially biased, it is not because the so-called formulas produced this result, rather it is because the legislators and the governor allocated state aid to produce this outcome (see *CFE*, 2002, p. 135).

THE DISPARATE RACIAL IMPACT CLAIM: THE CONCEPTUAL AND LEGAL BASIS FOR THE CLAIM

Compared to the adequacy claim in the *CFE* case where the plaintiffs and state presented extensive evidence about what constitutes a sound basic education, the part of the case that addressed the disparate impact claim was considerably shorter and more focused. According to Trial Court Judge DeGrasse in *CFE v. State* (2001), the claim

arises from the implementing regulations promulgated pursuant to Title VI of the Civil Rights Act of 1964 (42 USC § 200d). Section 601 of Title VI provides that: "[n]o person in the United States shall, on the ground of race, color, or national origin, be excluded from participation in, be denied the benefits of, or be subjected to discrimination under any program or activity receiving Federal financial assistance." (p. 162)

In addition, Judge DeGrasse indicated that the courts have ruled (though not the U.S. Supreme Court) that the plaintiffs' burden in a Title VI claim should be the same as in a Title VII employment discrimination case. In these latter cases, for plaintiffs to succeed, they must first show that a seemingly neutral policy actually discriminates. Then the defendants are given a chance to show how the policy meets a legitimate state need. If the defendants are successful, in rebuttal the plaintiffs must demonstrate that other less discriminatory policies could meet the need (see *CFE*, 2001, pp. 164-165).

Justice DeGrasse was building on a history of legal rulings in discrimination cases. Some of these cases also established the use of statistical analyses to make claims. We briefly highlight some of the previous analytical work in discrimination court cases, focusing on and giving examples of two issues: (a) how the concept of disparate impact has been used as the basis for court cases brought against entities accused of discriminating against a population subgroup and (b) how regression analysis has been used in particular in establishing disparate impact.

THE CONCEPT OF DISPARATE IMPACT

Discrimination cases can be based on two different legal concepts of discrimination: disparate treatment or disparate impact. When formulating an argument based on disparate treatment, plaintiffs must establish discriminatory motive. Disparate impact claims, on the other hand, do not require establishment of intention or motivation, rather only that a certain practice has a disproportionate impact on a population subgroup. With respect to employment cases, for example, Brilmayer (1982) wrote,

> The essence of disparate treatment is that the employer is differentiating on the basis of some illegal factor such as race or sex; [the essence] of disparate impact [is] that the employer is differentiating on the basis of some factor that is *correlated* with an illegal factor such as race or sex. (p. 789)

Becker (1957) conducted one of the first empirical studies of discrimination's economic effects on population subgroups by examining income differences between Black and White and female and male workers. This early empirical work played a minor role in cases brought to court based on the Equal Pay Act of 1963 and the Civil Rights Act of 1964 but, according to Ashenfelter and Oaxaca (1987), over time became the primary form of analysis for decisions of disparate impact against population subgroups. The U.S. Supreme Court has heard many cases in which statistical evidence of disparate impact discrimination has been admitted in cases involving jury selection and employment discrimination, focusing on factors such as gender, race, and age (see, e.g., Ashenfelter & Oaxaca, 1987; *Castaneda v. Partida*, 1977; Gunderson, 1989; *Hazelwood School District v. United States*, 1977; Gastwirth, 1984, 1997; Kaye, 1982; Lee, 1989: Shafritz, Hyde, & Rosenbloom, 1986).

MEASURING IMPACT THROUGH REGRESSION ANALYSIS

It was not until the 1980s that multiple regression analysis was recognized as a method to measure discrimination by the U.S. Supreme Court, although it had already been established as a technique for providing evidence in other areas of litigation such as antitrust cases (Gray, 1993). Because simple mean salaries for men and women are not sufficient evidence on which to build a case and do not take into consideration other (legal or legitimate) factors that might influence differences in salaries, multiple regression became a more prominent technique for controlling variables such as education and experience. Regression is used to account for a variety of factors that may be related to the dependent variable so that the effect of the suspect variable—race, gender, or age—can be estimated separately from these other factors that may be viewed as legitimate factors affecting differences.

In the *Bazemore v. Friday* (1986) case, in which the North Carolina Extension Service was accused of pay discrimination based on race, the U.S. Supreme Court recognized multiple regression analysis as evidence (although constituting only circumstantial evidence), allowing the statistical technique to be used in establishing disparate impact against various population subgroups (Gastwirth, 1988; Lee, 1989). In particular, multiple regression was used to establish the base of similarly situated individuals and working conditions by using salary data as the dependent variable, controlling for race, education, tenure, and job title.

A few years after the *Bazemore* decision, in *Ward's Cove Packing Co. v. Atonio* (1989), the Supreme Court ruled that the plaintiffs bore the burden of

proving that no other factor than race could be responsible for observed disparities (in this particular case, between hiring rates of White and non-White potential employees) (Gray, 1993). In subsequent decisions—most importantly, *Allen v. Seidman* (1989) and *Green v. USX* (1990)—lower courts moved away from that stringent guideline for showing disparate impact through regression analysis, so that plaintiffs were required to incorporate major—as opposed to all—measurable variables in their regression models (Gastwirth, 1993).

In these disparate impact cases, regression analyses were used by the courts to determine whether the variable of interest—race, age, or gender—is related to the key outcome (employment, for example) controlling for other legitimate or possible influences on the outcome.

PUBLIC FINANCE LITERATURE

Public finance scholars often analyze state aid for education as a specific example of intergovernmental aid grants. We review this literature for two reasons. First, we aim to make clear why we chose our model and variables to analyze New York State's funding of education; and second, we wish to highlight the role of race—or, more specifically, the lack of a role of race—in such analyses. We also review the political economy literature with an eye toward seeing if there is any theoretical reason to include race in models of state aid for education.

THE LITERATURE ON HOW NEED-BASED AID SHOULD BE DISTRIBUTED: WHAT ROLE DOES RACE PLAY?

School finance experts spanning a broad range of academic and practitioner communities have devoted a great deal of attention to the design and implementation of equitable and efficient aid formulas (see Schwartz, Stiefel, & Rubenstein, 1998 for a brief overview; and Guthrie, Garms, & Pierce, 1998; Monk, 1990; or Odden & Picus, 2000 for a full discussion). All recognize the potential importance of adjusting school aid for differences in costs and revenue-raising capacity across school districts.[5] Although there is substantial variation in the definition and measurement of these concepts across states and aid formulas, there is some degree of consistency. Measures of revenue-raising capacity typically rely on measures of the size of the property-tax base, and, less commonly, income, poverty, and other measures

of economic activity within the jurisdiction. Measures of costs typically include some quantification of the incidence and severity of student disabilities and/or students with special needs, and, less commonly, some adjustment for differences in the costs of purchased inputs or productivity.

In an influential article, Bradbury, Ladd, Perrault, Reschovsky, and Yinger (1984) described and discussed a methodology based on multiple regression analysis that is designed for implementing a need-based state aid program in Massachusetts. The heart of this work was in specifying the cost factors that are outside the control of local governments and forming estimates of cost disparities and revenue-raising ability across jurisdictions. Of particular interest, for our purposes, is that the authors provided examples and discussion of the nature and type of variable that might and should be included in need-based aid formulas, in principle, and with an eye toward feasibility and ease of implementation.

In principle, they argued, needs should be calculated including variables capturing "the extra costs of providing education to 'special needs' children, such as those with learning disabilities or those coming from disadvantaged households" (Bradbury et al., 1984, p. 153). One way to do this is through the use of weighted pupil measures in which "weights reflect the extra cost" of educating students with different needs (Bradbury et al., 1984, p. 153).[6] The need-based aid formula that they designed for Massachusetts awarded more aid to those jurisdictions with higher measured cost factors.

In addition to cost factors, Bradbury et al. (1984) argued that need-based aid should consider revenue-raising ability. Thus, the aid formula they designed was based on variables intended to capture differences in jurisdictions' ability to raise revenue. These include equalized valuation, income, as well as revenues from other sources (i.e., motor vehicles excise fees, special assessments, etc).

In the resulting aid distribution system they proposed, and Massachusetts adopted, the amount of aid a municipality is given by the state is, for all intents and purposes, linearly increasing with the jurisdiction's cost factors and decreasing with its revenue-raising ability. Put simply, the higher the costs, the more aid awarded, the higher the revenue-raising capacity, the less aid awarded.

Thus, this work suggested a set of independent variables that might represent the legitimate justification for variations in state aid across school districts. Neither the race of the students nor the race of the population was included in the regression analyses they performed or the aid formula they designed.

Research and policy work on intergovernmental aid, in general, and aid to education, in particular, in the 20 years since Bradbury and colleagues'

(1984) article was published has continued to emphasize costs of providing services and ability to raise revenues as the major determinants of state aid, although the methods, formulas and data grow increasingly sophisticated. Downes and Pogue (1994), for example, used data on Arizona school districts to develop and illustrate a method for adjusting need-based school aid formulas to compensate for cost differentials across districts. It is interesting to note, their regression analyses include race variables (fraction Black, Hispanic, Asian, and Native American) as control variables; however, they found that the coefficients on these variables are statistically insignificant. Again, the amount of aid in their formulas does not directly depend on the racial composition of the students or the population.

In the proceedings of the Symposium in Fiscal Equalization published in the *National Tax Journal*, Ladd and Yinger (1994), Oakland (1994), and Reschovsky (1994) examined and explored the case for equalizing aid—that is, state aid awarded to offset cost and revenue-raising disparities across jurisdictions. Reschovsky (1994) argued that the best way to distribute state aid is through the use of a cost-adjusted foundation aid formula that relies on a cost index "reflecting the costs of providing education services that are beyond the control of local school districts" (p. 195). Ladd and Yinger (1994) came to similar conclusions. Oakland (1994) distinguished between cost differentials because of variations in the costs of factor inputs and differentials arising from variations in the "effectiveness of public inputs in producing public outputs" (p. 203). Again, race was not mentioned by any of these authors as either a cost factor or a determinant of revenue-raising capacity.[7]

Duncombe and Yinger (1998) explored the practical and theoretical issues in the construction of a school aid formula for New York State and demonstrated how to estimate the requisite cost index, including an adjustment for potential inefficiency. Their cost model includes variables capturing differences in input prices and environmental factors that might lead to higher costs of providing education services in a New York State school district: a teacher salary index, enrollment, percentage of children in poverty, percentage of households with a female single parent, percentage of children with limited English proficiency, and percentage of students who were severely disabled. Their companion demand model, which was necessary for constructing their aid formula, included variables on income, aid, tax share, percentage owner-occupied housing, and relative percentage of adults with a college education. Again, neither the race of the students nor the race of the population as a whole entered into their analyses.

Although these articles represent only a fraction of the wealth of literature examining and evaluating the appropriate design and implementation of need-based or equalizing aid, the exclusion of race as a factor in an aid

distribution formula is characteristic of the larger literature. At the same time, one might be tempted to argue that, although race per se is neither a cost nor revenue-raising factor, it might usefully serve as a proxy for other factors for which measures are unavailable, such as the educational attainment or poverty of parents. It is important to note that this logic would suggest that aid increases with percentage of students who are Black or Hispanic. We know of no credible argument for distributing state aid to school districts based on the racial composition of either their students or their population. Instead, our review of the literature yields a set of variables that should capture the legitimate justification for variations in state aid across school districts.

Our regression analyses of disparate impact, described in detail below, include these variables and investigate the extent to which the race of the students explains the variation in state aid that is unexplained by the variation in these legitimate factors.

THE LITERATURE ON THE POLITICS OF STATE AID: WHY MIGHT RACE MATTER AFTER ALL?

Although the importance of race and racial politics are well studied across a broad range of fields and disciplines, relatively little attention has been paid to estimating the impact and importance of race in public finance. At the same time, variables describing the racial composition of the population are sometimes included in expenditure-determination studies, albeit with little justification or analysis beyond noting that these variables might capture differences in tastes or preferences. Poterba (1997) and Ladd and Murray (2001) are particularly relevant exceptions because each focused specifically on the relationship between demographic structure and spending on education per se. Both attempt to empirically investigate whether, and to what extent, the representation of the elderly determines spending on public education. Poterba (1997) reported the finding that

> an increase in the fraction of elderly residents in a state is associated with a significant reduction in *per-child* educational spending. This reduction is even larger when the elderly residents are predominantly from a different racial group than the school-age population. (p. 63)

Ladd and Murray's (2001) analysis utilized county-level data to investigate the robustness of the Poterba finding and obtained results suggesting that there was no direct effect of a change in the representation of the elderly on education spending; however, they also found "a reduction in per child

TABLE 1
Regression Results: State Operating Aid per Pupil, 1995-1996 ($N = 643$)

	TAPUEP UNWGT		TAPUEP WGT		ENROLL UNWGT		ENROLL WGT	
Intercept	4042.96*	(1596.86)	1116.82	(907.17)	−7076.70**	(2003.12)	−779.55	(1128.12)
CCWRATIO	−507.76**	(26.50)	−713.29**	(26.13)	−594.59**	(33.40)	−834.85**	(32.76)
EFRTRATE	21.57**	(4.18)	−1.61	(3.01)	29.49**	(5.28)	1.40	(3.75)
ATTRATE	56.69**	(16.64)	9.92	(9.71)	89.48**	(20.87)	32.54**	(12.08)
SMALL	117.85**	(45.16)	97.09**	(26.48)	166.87**	(64.15)	112.32**	(33.96)
PCTLCH	18.28**	(1.16)	14.17**	(.94)	26.09**	(1.45)	20.78**	(1.17)
LEPRATE	3.27	(3.96)	−6.28	(4.90)	1.46	(5.00)	−4.13	(5.92)
PCTNONWH	−11.57**	(1.29)	−7.16**	(1.10)	−14.36**	(1.62)	−10.24**	(1.35)
F	297.91		429.53		302.01		424.46	
R^2	.77		.83		.77		.82	

SOURCE: New York State Education Department, Fiscal Analysis and Services Unit, specially provided numbers for 1995-1996, and New York State Education Department (1998).

NOTE: Standard errors in parentheses. Operating aid per pupil is aid that may be used for all district expenses; total aid per pupil is operating plus non-operating aid. Nonoperating aid includes among other funds, transportation aid and building aid. TAPUEP or total aidable pupil units for expense is based on the district's combined adjusted average daily attendance, which is weighted according to each pupil's grade level; there is also a weighting for pupils with handicaps; UNWGT = unweighted; ENROLL is district total K-12 enrollment, including prekindergarten, kindergarten, and ungraded handicapped enrollment; WGT means weighted; CCWRATIO or calculated combined wealth ratio is an equally weighted combination of property wealth and adjusted gross income of a district; EFRTRATE is local revenue divided by the full property value of the district in the prior year, times 1,000; ATTRATE is the actual average daily attendance divided by maximum possible average daily attendance; SMALL is a categorical variable that takes a value 1 if the district has fewer than 5,000 pupils; PCTLCH is the percentage of students in full-day kindergarten through Grade 6 participating in the free and reduced-price lunch program; LEPRATE is the percentage of students of limited English proficiency; PCTNONWH is 100 minus the percentage of pupils who are White, non-Hispanic.

NOTE: *$p < .05$. **$p < .01$.

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TABLE 2
Regression Results: Total Aid per Pupil, 1995-1996 ($N = 643$)

	TAPUEP UNWGT		TAPUEP WGT		ENROLL UNWGT		ENROLL WGT	
Intercept	2317.25	(3974.23)	5710.64*	(2383.59)	−1316.87	(4982.48)	3403.51	(2988.05)
CCWRATIO	−727.73***	(65.96)	−1093.43***	(68.65)	−843.87***	(83.08)	−1274.76***	(86.77)
EFRTRATE	35.66***	(10.41)	11.18	(7.90)	48.49***	(13.12)	21.44*	(9.94)
ATTRATE	.34	(41.42)	−24.42	(25.51)	39.22	(51.91)	2.90	(32.00)
SMALL	247.93*	(112.39)	212.26***	(69.58)	436.77***	(159.56)	332.22***	(89.94)
PCTLCH	32.72***	(2.88)	20.77***	(2.47)	46.50***	(3.59)	31.48***	(3.10)
LEPRATE	29.91***	(9.86)	−60.16***	(12.88)	2.96	(12.44)	−63.21***	(15.69)
PCTNONWH	−25.97***	(3.20)	−6.57*	(2.89)	−27.36***	(4.03)	−10.70**	(3.59)
F	120.68		167.42		125.51		167.34	
R^2	.57		.65		.58		.65	

NOTE: Standard errors in parentheses. TAPUEP or total aidable pupil units for expense is based on the district's combined adjusted average daily attendance, which is weighted according to each pupil's grade level; there is also a weighting for pupils with handicaps; UNWGT = unweighted; ENROLL is district total K–12 enrollment, including prekindergarten, kindergarten, and ungraded handicapped enrollment; WGT means weighted; CCWRATIO or calculated combined wealth ratio is an equally weighted combination of property wealth and adjusted gross income of a district; EFRTRATE is local revenue divided by the full property value of the district in the prior year, times 1,000; ATTRATE is the actual average daily attendance divided by maximum possible average daily attendance; SMALL is a categorical variable that takes a value 1 if the district has fewer than 5,000 pupils; PCTLCH is the percentage of students in full-day kindergarten through Grade 6 participating in the free and reduced-price lunch program; LEPRATE is the percentage of students of limited English proficiency; PCTNONWH is 100 minus the percentage pupils who are White, non-Hispanic.
NOTE: *$p < .05$. **$p < .01$.

education spending when the adults and the school-age population are members of different racial groups" (Ladd & Murray, 2001, p. 344). Underlying these studies is the rather obvious notion that race matters in determining outcomes in the political arena in general, and in the determination of education expenditures in particular.

What these studies did not examine, however, is the role that race plays in the determination of state aid, specifically, and we know of no study that does so. It is interesting to note, de Bartolome (1997) developed a model of state aid that explicitly derived from a model of political decision making and estimates an empirical model that includes demographic variables. His specifications were quite parsimonious, including only the fraction of the population that is older than age 65; however, this work provided a useful conceptual foundation on which to build more sophisticated analyses of state aid determination. We now turn to a case study of the disparate racial impact of New York State's education funding system, where race is the variable of interest and state school funding is the key outcome.

A MODEL OF STATE AID IN NEW YORK STATE

The model we developed used state aid to districts as its dependent variable rather than the broader revenue measure, state plus local revenue. Although the broader measure captured the entire state-local effect of the state school finance system, it was possible that the Court would have said that higher spending by local choice was justifiable and thus did not constitute racial impact.[8]

The parallel argument in favor of state aid alone was that it comprised the resources directly distributed by the state and it was intended to compensate for factors such as high need and low wealth. If it was found that aid intended to compensate for these factors discriminated by race then it would be a stronger argument than if the sum of individual-spending decisions discriminated by race because the state, alone, can control what is spent in state aid.[9]

Therefore, based on the literature and the stated principles guiding New York State's aid distribution, we estimated the following model of state aid per pupil received by school districts:

$$\text{STATEAIDPP}_i = \beta_0 + \beta_1 \text{ CCWRATIO}_i + \beta_2 \text{ EFRTRATE}_i + \beta_3 \text{ ATTRATE}_i + \beta_4 \text{ SMALL}_i + \beta_5 \text{ PCTLNCH}_i + \beta_6\text{LEPRATE}_i + \beta_7\text{PCTNONWH}_i + \varepsilon_i$$

where *STATEAIDPP*, the amount of aid received by district *i*, was measured in 10 different ways, using two different numerators and five different denominators. Total aid and operating aid were alternative numerators. Pupil counts included the five alternative measures defined and used by New York State in the state's allocation process or in its own aid analyses: an enrollment number (ENROLL), an attendance number, a membership number that captured students receiving services at a district's expense, and two weighted (or adjusted) student numbers that accounted for such factors as grade level, handicap status, and summer school students (TAPUEP). The weighted student numbers might, as described earlier, be viewed as controlling for cost differences because of differences in the representation of students with special needs. Thus, we performed separate analyses for each of 10 alternative dependent variables.

The independent variables included district wealth (CCWRATIO), as per the discussion above, in an effort to capture differences in revenue-raising capacity and because, according to state policy, aid was explicitly aimed at wealth neutralization. According to theory and state policy, aid should decrease with district wealth, other things equal. The local tax rate (EFRTRATE) captured several of the components of the New York State aid formulas, which are explicitly based on those factors, apparently to reward districts with higher tax efforts. Similarly, the student attendance rate (ATTRATE) was included because state aid formulas were designed to encourage higher attendance rates. We included a dichotomous variable, taking a value of 1 if the district had fewer than 5,000 pupils in an effort to control for myriad ways in which the state aid system recognized the particular needs of small districts (SMALL). Finally, we included several measures representing student needs or costs including the percentage of students who were poor as measured by those eligible for free- and reduced-price lunches in Grades K through 6 (PCTLNCH), the percentage of students with limited English language proficiency (LEPRATE), and, in one equation, the percentage of students who were disabled. Finally, our main variable of interest was a measure of students' race—the percentage of the pupils who were non-White (PCTNONWH). The state aid system did not, of course, recognize race, and we included it to see if, after controlling for all the measurable variables that were recognized in state aid systems and, in particular, in the one in New York State, race had an independent effect. All data used to estimate the models were obtained from state sources and were made available to plaintiffs and defendants (see footnotes to Tables 1 and 2 for specific definitions and sources of variables.)

There were a variety of functional forms that plausibly could be used to model the determinants of state aid including simple linear, logarithmic, or

quadratic. We estimated a simple linear model following the standard practice in the academic and policy literature, and also because it was the most straightforward—estimated coefficients would capture the average relationship between the dependent and independent variable. Although more complicated functional forms might have revealed that the relationship varied with the magnitude of the independent variable, the purpose here was not to find the best fit (which might lead to dubious statistical inference tests) but rather to ascertain whether the race variable had a statistically significant and independent effect on state aid.

Whether and how to weight the district observations in the regressions was the subject of some debate and testimony by plaintiffs and defendants. Weighting by the number of students might, for example, be justified as a method of correcting for potential heteroskedasticity problems that might arise because of the wide range in the size of school districts in New York State. Thus, we estimated unweighted (UNWGT) and weighted (WGT) regressions for the proportion of students in each district and the ratio of students in the district to the average number of students per district.[10]

Finally, we used the most recent year of data for which we could obtain a complete set of audited expenditures, which was 1995-1996. Only unaudited data were available for 1996-1997, and, although some regression results based on 1996-1997 data were discussed in court, we favored the 1995-1996 results, even though these did not include a measure of the percentage of students with handicaps, which was only available for 1996-1997.

In the end, with two dependent variables, five student counts and three weighting methods (including UNWGT), we estimated 30 regressions. In addition, because one student count was unavailable for five districts, we ran one set of 30 regressions with all data available (643 districts) and another with a consistent sample size (638 districts), yielding a total of 60 regressions.

REGRESSION RESULTS AND THEIR
USE IN THE *CFE* COURT CASE

Tables 1 and 2 show eight typical regressions from the 60—four in Table 1 with operating aid and four in Table 2 with total aid as dependent variables, each with an adjusted student count (TAPUEP) and with enrollment (ENROLL), and each UNWGT and WGT. The independent variables did a somewhat better job explaining the variation in operating aid than total aid as measured by an R^2 ranging from 0.77 to 0.83 for the former to 0.57 to 0.65 for

the latter. Nonetheless, both equations exhibited high R^2s given the simplicity of the regressions. The wealth, free lunch, and size variables were consistently significant in all regressions with the expected signs. In addition, the tax rate was often significant in both equations. Beyond these variables, attendance was positive and significant for operating aid and percentage with limited English proficiency (LEP) was either insignificant or differing in sign across the two equations.[11]

The variable of interest was the percentage non-White students, and it was significant and negative in all regressions shown and in 56 of the 60 alternatives (remember that 30 of these were really the same so that only two of 30 coefficients were insignificant). The range of the coefficient was somewhat wide (–.66 to –27.4 in the tables shown) but taking a common value over all 60 regressions of –.10. As plaintiffs did in court testimony, we can interpret this coefficient as follows: In the late 1990s, 83% of the students in New York City were non-White and the average percentage statewide was 43%. If the percentage non-White students were the only difference between New York City and the state, New York City would have received $400 dollars less per pupil (–.10 × [83 – 43]) than comparably situated other districts, or about a difference of 10% of per-pupil state aid; the $400 is a measure of the size of the disparate racial impact.[12]

The results were summarized for the Court for all 60 regressions in tables such as the example in Table 3, where the results for one student count are illustrated. Our conclusion for the Court was that after controlling for legitimate variables, race was a factor in determining the variation in state aid, and thus there was a disparate racial impact that was not explained by legitimate policy variables.

THE RESPONSE BY THE STATE'S EXPERTS IN COURT

New York State's experts presented similar regressions in court in response to plaintiffs' regression results; however, they differed in several ways. The most significant difference was that instead of using district wealth as a single independent variable, the defendants' experts included wealth in a manner that drew on the specific features in the formula; that is, because there was a level above which districts received minimum state aid even if they had high wealth, the defendants' regressions included this high wealth factor. They claimed in their court testimony that their regressions showed that with this variable for high wealth, the race variable was no longer significant.

In effect, the defendants were curve fitting the equation to the formula; that is, they were searching for alternative specifications of the regression

TABLE 3
Sample Presentation for Court

Summary of Standard Regression Results

State Aid and Percentage Non-White With Controls, Maximum Sample Size, 1995-1996

Aid Variable	Pupil Measure	Weighting Method	Sample Size	Relationship Between Aid and Percentage Non-White	Statistical Significance	Exhibit
Operating aid	TAPU for expense	Unweighted	643	(–)	Significant	1
Operating aid	TAPU for expense	Weighted with share of total	643	(–)	Significant	2
Operating aid	TAPU for expense	Weighted with share of mean	643	(–)	Significant	3
Total aid	TAPU for expense	Unweighted	643	(–)	Significant	4
Total aid	TAPU for expense	Weighted with share of total	681	(–)	Significant	5
Total aid	TAPU for expense	Weighted with share of mean	643	(–)	Significant	6

NOTE: The – signifies a negative relationship. TAPU = total aidable pupil units.

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equation that would yield higher explanatory power without producing any more substantive explanation. If they carried this to the extreme, and could perfectly fit the equation to the formula, race would be statistically insignificant because clearly the formula did not include a race variable.

We argued that it was most appropriate to control for the factors in a linear, single variable fashion and that curve fitting was not a valid way to test the hypothesis about discrimination. The provision of state aid to the wealthiest districts, called minimum aid, was not justified by an educational rationale.

The Court found that the "regression analyses are probative evidence of disparate racial impact and provide independent proof of disparate impact" (*CFE*, 2001, p. 175). The judge did not accept the inclusion of the high-wealth variable in the analysis, as shown by his words:

> Accounting for the $400 floor that is guaranteed even the richest districts—which generally have low percentages of minority students—would appear to exacerbate, not ameliorate, the funding disparities favoring low minority districts. . . . [The plaintiff] adequately justified [his] decision not to model the $400 floor in his regressions. The regression analyses were not meant to exactly replicate the computer aid formulas run by the State. Minority status is obviously not an explicit factor in the State aid formulas. The point of the regression analyses is to see if minority status of students is, *sub rosa*, a factor that determines the distribution of State aid. This factor cannot be measured if the funding formulas are simply recreated verbatim. (*CFE*, 2001, pp. 177-178).

Thus, by accepting our functional form and specification, the Court concluded that the specification presented by the state, that controlled for the minimal aid received by rich districts such as Scarsdale and Great Neck, was incorrect in that the minimum aid had no real educational policy justification. Empirically, the minimum aid contributed to our conclusion that state aid has a disparate racial impact.

CONCLUSIONS

Our conclusion for the courts was that after controlling for legitimate variables, race was a factor in determining the variation in state aid, and thus there was a disparate racial impact that was not explained by legitimate policy variables. If the percentage non-White students were the only difference between

New York City and the state, New York City would receive $400 dollars less per pupil than comparably situated districts; the $400 is a measure of the size of the disparate racial impact. Based on our multivariate analysis of state aid in New York, the judge found that the evidence demonstrates the existence of a disparate racial impact on minority students caused by the State's school funding system (*CFE*, 2001).

These findings have implications for the use of race as an explanatory variable in future analyses of the de facto distribution of state aid to districts. Even though the *CFE* case focused on New York City and its situation as the district with the great majority of the state's minority student population, other states with smaller districts may find the arguments and methods used in the court case useful.[13] In New York State, for example, race is not a factor explicitly mentioned in the approximately 50 discrete formulas, several different pupil units, and weighting schemes that ostensibly are used to distribute aid to the state's districts. Many idiosyncratic features that can vary from year to year, as well as several caps and hold-harmless features, tend to nullify some of the features of the formulas. If this school finance system were reformed to be transparent with logical relationships to the requirements of students and districts to produce adequate levels of education, we believe the association between funding and race would be moot.

The differences between the analyses presented by the two sides in the case highlight the role of experts and multivariate analyses in school finance litigation. The differences between a court process and the more academic peer review process is striking; in the courts, the ultimate judgments are made by nonexperts rather than experts; there is not an opportunity to respond to constructive criticism by peers; only information contained in the two presentations can be used—no more can be added; and the clarity and effectiveness of an argument is a joint product of the expert and the attorneys for both sides, not the expert alone. In this case, the experts on both sides presented multivariate analyses with what they each believed to be valid specifications and functional forms. The differences between each side's analyses were effectively communicated to the judge. Unfortunately, in many other school finance cases that involve multivariate statistical analysis, the analyses presented by one or both sides would not stand up to the scrutiny of peer review.

Our results also suggest a potentially larger issue that we believe warrants additional research. Regardless of what was ultimately decided by the courts in school finance litigation, it is highly troubling that after years of attention and reform, a state such as New York is distributing state aid in a way that disadvantages students of color.

NOTES

1. The State's Education clause is as follows: "The legislature shall provide for the maintenance and support of a system of free common schools, wherein all of the children of this state may be educated" (N.Y. Const. Art. XI § 1).

2. Morgan (2001) outlined a so-called fourth wave of school finance litigation based on violations of the implementing regulations of Title VI of the Civil Rights Act of 1964, using the concept of distributive rather than corrective justice.

3. The decision was overturned on appeal, not based on the evidence and analysis of racial impact but, instead, based on court rulings issued after the trial court's finding. The appellate and court of appeals found that the claim was based on Title VI implementing regulations that went beyond what was intended in statute.

4. Students measured in total aidable pupil units (TAPU) for expense, one of the weighted pupil measures used by the state.

5. Guthrie et al. (1998), for example, noted that "equalization may be needed to balance differences among districts in the cost of providing educational services of similar quality and kind" (p. 147). Monk (1990) wrote, "A district with a disproportionate number of more costly students has a greater need than does an otherwise equivalent district" (p. 187). Odden and Picus (2000) made an explicit link to student demographic characteristics:

> The demographics of students with different types of special educational needs vary from school district to school district. . . . Furthermore, the prices districts face in providing these additional services vary considerably, further intensifying the fiscal burden caused by these special needs students . . . because of demographics and price differences, a state role is necessary to make the provision of extra services for special-needs students fair across all school districts. (p. 198)

6. At that time, they reported Massachusetts used a weight of 1.4 for each student in a bilingual program, while students who were low income and students with special education classifications received weights of 1.2 and 4, respectively. The weight for students in the general education program was 1.0. Because their focus was on need-based aid in general, and not limited to education aid solely, they enumerated a longer list of cost factors that might also lead to higher costs of providing public services: density, the age of the housing stock, poverty rate, crime rate, and local road mileage.

7. Only Ladd and Yinger (1994) provided any discussion of race at all, focusing on the implications of racial discrimination in housing markets for the capitalization of the benefits of increased aid into the price of housing. In this case, their interest was in the extent to which capitalization thwarts the intention to give financial assistance to families who are low income and students.

8. This was a distinct possibility because the state court had ruled previously in *Levittown v. Nyquist* that inequity in total funding was not unconstitutional.

9. In both cases, it is clear that federal funding should not be included because the state does not control legislation on how these funds are allocated.

10. Although these yield identical regression coefficients and standard errors, additional regression statistics produced by standard statistical packages such as the sum of squares and root mean square error may differ, and as a result both were presented to the court, in an effort to avoid confusion.

11. Regressions based on 1996-1997 data (not shown here) include the percentage of students who had handicaps. This variable generally had a positive sign, and the other variables the

same signs as for the 1995-1996 data. We do not show these regressions here because court testimony was based primarily on the 1995-1996 results.

12. Page 11,998, court transcript. We did not use the percentage of non-White in the rest of New York State (without New York City), which would have resulted in a larger than 40% differences. Our measure was conservative.

13. For example, in *Montoy v. State of Kansas* (2003), plaintiffs argued, and the Court agreed, that the state school finance system had a disparate impact on Kansas' minority students, as well as students who were English-language learners and disabled. In this case, plaintiffs did not concentrate on one geographic area with the majority of the impacted student population; rather, they examined how funds were "geographically distributed under the present funding scheme; second, where the vulnerable and/or protected categories of students generally attend school within that geographic funds distribution system" (*Montoy*, 2003, p. 110).

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