EQUITY MATTERS: Research Review No. 2

Class-Size Reduction: Policy, Politics, and Implications for Equity

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A Research Initiative of the Campaign for Educational Equity

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Is Smaller Better?

Over the past several decades, researchers, politicians, and corporate leaders have focused reform efforts on the size of educational contexts. Hundreds of billions of public and private dollars have been invested to reduce the size and scope of both classrooms and schools (Lee & Ready, 2007). Unlike many education reforms, these downsizing plans have attracted support from virtually every quarter, and a united front of stakeholders has coalesced behind the notion that "smaller is better." Efforts to reduce elementary-school class sizes have garnered particularly strong popular and political support. Indeed, the American public feels that creating smaller class sizes is the most effective way to recruit and retain highly qualified teachers (Rose & Gallup, 2007). Thirty-two states now fund either voluntary or mandated class-size reduction programs, with California and Florida together investing almost $20 billion to reduce class sizes.

Despite its popularity, some academics and policy makers remain skeptical of class-size reduction, concluding that the research may not justify the enormous sums currently being invested (see Hanushek, 2002; Harris, 2002). In particular, critics question the axiom that class size is related to student learning. One such author suggests that efforts to identify a relationship between class size and student academic performance may "rival the search for the Holy Grail in both duration and lack of results" (Slavin, 1989, p. 99). Another common criticism of class-size initiatives is that they neglect teaching and learning, focusing on structure at the expense of instruction (see Cohen, Raudenbush, & Ball, 2003; Hanushek, 2002; Milesi & Gamoran, 2006). Among the more cynical conclusions is that support for smaller classes among teachers stems from a desire to reduce workloads, and to increase the number of teachers and union members (see, for example, Hoxby, 2000).

As even a cursory examination will attest, the class-size debates waged in the popular press and academic journals often fail to reflect the complex and nuanced nature of the issue. For example, references in these debates to a unitary "class-size effect" ignore the absence of a unitary "class-size treatment." Class-size reduction programs vary enormously in scope and funding, and even how they define "small classes."[1] Moreover, a single class size may be unable to maximize both academic *and* economic utility. Similarly, the optimal class size may not be the same for all students, in all subjects, across all grades. The truth is, for most children, the ideal class size is *one*—one student working with a single teacher. Although one-on-one tutoring may be the most effective instructional strategy, class sizes of one are not financially viable. At the opposite extreme, even zealous opponents of class-size reduction concede that exceptionally large class sizes are undesirable; few claim that a first-grade classroom enrolling 100 children is as effective as five classes, each with 20 students (Lazear, 1999). As this review demonstrates, establishing an appropriate class size is, at the very least, a balancing act between contemporary fiscal realities and children's developmental needs, which vary considerably depending upon their life circumstances and social advantages or disadvantages. Indeed, the matter assumes even greater complexity when we consider the relationship between class size and educational equity. This is the central focus of this review.

Class Size and Educational Equity

One primary argument for class-size reduction is its potential to reduce racial and socioeconomic disparities in student academic performance. Researchers have examined two separate issues related to class size and educational equity. The first concern is with equal access. Assuming for the moment that smaller classes benefit all children equally, traditionally disadvantaged students may be less likely to experience small classes. Hence, providing these students with class sizes equal to those experienced by their more-advantaged peers should reduce social disparities in cognitive development. The second issue recognizes that the relationship between class size and student outcomes may vary by student social

and academic background. Specifically, minority and low-income children may benefit *more* from smaller classes.

Differential Access

Within the context of educational equity, a central question is whether traditionally disadvantaged children are more often enrolled in large elementary school classes. In terms of children's socioeconomic status (SES), the answer is somewhat complicated, as the relationship between class size and SES is curvilinear. On average, children who attend public schools with either small *or* large kindergarten and first-grade classes are less socially advantaged than children attending schools with medium-sized classes (Ready & Lee, 2007). This is largely explained by the fact that public schools that offer the smallest classes are more likely to be located in rural areas (which are often economically depressed), while schools offering the largest classes are more often located in large cities. Similarly, schools with small *or* large class sizes also enroll greater proportions of children from single-parent homes and children for whom English is not the primary home language (Ready & Lee, 2007).

Although not as strong as the relationship between SES and class size, the relationship between race/ethnicity and class size does exist, with the burden of large kindergarten and first grade classrooms shouldered disproportionately by children of color.[2] For instance, while non-Asian minority groups constitute about a third of all kindergarten and first grade students, they account for almost half of the children attending public schools with kindergarten and first grade classes larger than 25 students (Ready & Lee, 2007). Reflecting this link between race/ethnicity and class size, urban schools offer considerably larger classes than those located in rural areas, and somewhat larger classes than suburban schools. For example, the typical K-8 classroom enrollment in Chicago is almost 14% larger than the state average (Illinois State Board of Education, 2007). New York City K-3 class sizes are roughly 10% larger than the state average, while the city's fourth- through sixth-grade classes are 17% larger (New York State Education Department, 2007). Urban school districts with declining populations also offer larger classes than their rural and suburban counterparts. Despite massive declines in student enrollment in both the Cleveland and Detroit urban school districts over the past several decades, the typical student in both of these districts will be in a class that is between 20% and 25% larger than their statewide class-size averages (Michigan Department of Education, 2007; Ohio Department of Education, 2007). It is important to stress that across states, these regional variations are driven largely by urban/rural rather than urban/suburban differences in class sizes.

Differential Effectiveness

For public schooling to fulfill its compensatory aims, certain educational practices and policies must produce *greater* benefits for disadvantaged students. Low-income children and children of color generally begin formal schooling with fewer academic skills (Lee & Burkam, 2002). Eliminating these initial gaps requires that such children learn at a *faster rate* than more advantaged children. Reforms that benefit all students equally—although certainly welcome—are less likely to reduce racial and social class disparities in student outcomes. Moreover, the universal implementation of a particular policy may *increase* inequality by producing greater gains among initially high-achieving students—a situation in which the "rich get richer" (see Ceci & Papierno, 2005).

Within the context of educational equity, the influence of a particular universally applied educational intervention on student outcomes can be grouped into one of four categories: (1) all student demographic groups benefit equally from the program; (2) no students benefit from the program; (3) all students benefit, but certain groups of students benefit *more* than others; and(4) on average, students do not benefit, but certain groups of students do. Smaller classes will increase educational equity only if they produce the outcomes from categories three or four. Moreover, as discussed below, if small classes are beneficial *only* for certain students, we should question whether universal approaches to class-size reduction are warranted.

Fortunately, many educational interventions produce stronger effects for socially and academically disad-

vantaged children (see Cronbach & Snow, 1977; Grissmer, 2002). A central explanation for this phenomenon is that, in the United States, less variability exists across *school* academic environments than across *family* academic environments (see Downey, von Hippel, & Broh, 2004). In other words, the gap between high- and low-quality schools is smaller than the gap between families that provide high and low levels of educational support based on their own educational backgrounds, work schedules, resources, and so on. As a result, disadvantaged children who attend a high-quality school may benefit more academically than socially advantaged children in the same school. Coleman and his colleagues (1966) argued that peer influences were "asymmetric," with greater effects for poor and minority students. The authors hypothesized that "family background which encourages achievement reduces sensitivity to variations in schools" (p. 304).

These differential effects of schooling across student sociodemographic subgroups are explained largely by differences in the *private* investments families and neighborhoods are able to make in their children. Because these private investments are related to familial economic resources, public efforts represent a greater proportion of the overall investment in low-income compared with more advantaged children. As such, additional public allocations for disadvantaged children often have larger educational effects. These assertions stem in part from a large body of research concluding that poor and minority children gain fewer academic skills during the summer when school is not in session, when they spend more time within family and neighborhood contexts (Alexander, Entwisle, & Olson, 2001; Burkam, Ready, Lee, & LoGerfo, 2004; Heyns, 1978).

The central question then in this review is whether class-size reductions can improve educational equity by benefiting disadvantaged students more than their advantaged peers. Determining the extent to which students have equal access to small classes is relatively simple. Ascertaining whether smaller classes have equalizing effects on student outcomes, however, is methodologically more complex. A theoretical framework developed by Lazear (1999) may be helpful in conceptualizing the mechanisms through which smaller classes might provide greater benefits for disadvantaged children. Lazear begins by noting that student learning within classrooms can be impeded by "negative externalities," namely, the behavioral and academic characteristics of other children in the classroom.[3] He then asserts that children in classrooms with large numbers of disruptive students will benefit more from having fewer classmates. In other words, the relationship between class size and student learning will depend on the characteristics of children in the class—well-behaved and/or academically strong students could potentially be placed into larger classes without suffering adverse effects. To the extent that classrooms in schools that enroll substantial proportions of low-income children and children of color enroll more disruptive students and/or students with more academic challenges, smaller class sizes will produce greater gains for disadvantaged children. I return to this notion below within the context of the Tennessee and Wisconsin class-size experiments, which provide the strongest evidence of the compensatory effects of class-size reduction.

Organization of the Review

I organize this interpretive and analytic review into three main sections, each of which focuses on the potential links between elementary-school class size and educational equity. In the first section I discuss findings from the three distinct analytic approaches employed in class-size research: randomized experiments, quasi- and nonexperiments, and meta-analyses. The second section moves from research to practice, and describes the large-scale class-size reduction programs currently operating in California and Florida, and what we have learned from these programs in relation to educational equity. The third section addresses the financial and opportunity costs associated with universal class-size reduction policies, particularly how these costs influence the educational experiences of low-income and minority children.

Evaluating Class-Size Effects on Student Achievement and Educational Equity

Over the past two decades, class-size research has generally employed one of three analytic approaches: (1) experimental designs in which students are randomly placed into small and large elementary-school classes; (2) quasi-experimental and nonexperimental designs that utilize survey data and advanced statistical methods to compare the outcomes of students in different size classes, and; (3) meta-analyses, in which the results from multiple class-size studies are combined and then systematically analyzed. Each of these three methodological approaches presents different strengths and weaknesses. This partly explains their contradictory findings, as well as the seemingly endless nature of the class-size debate. In this section I describe the seminal studies in each area and briefly explore their unique contributions and limitations.

Randomized Experiments

Tennessee

In 1985 Tennessee initiated a longitudinal class-size reduction experiment that would serve as the foundation for similar efforts across the country. The experiment, titled Project STAR (Student/Teacher Achievement Ratio), randomly assigned over 6,000 kindergartners to one of three within-school experimental conditions: a small class enrolling between 13 and 17 children, a large class enrolling between 22 and 26 children with a single teacher, or a large class with a teacher and an aide (see Finn & Achilles, 1999; Krueger, 2000; Krueger & Whitmore, 2002; Nye, Hedges, & Konstantopoulos, 2002). At the end of kindergarten, the achievement of children in small classes was almost one month ahead of the achievement of children in the other two classroom conditions. By the end of first grade, the same children were almost two months ahead. After four years of the treatment, children who attended small classes were ahead by roughly one-quarter standard deviation. In terms of grade-equivalent norms, after four years of the intervention, small-class children were 5.4 months ahead in reading, and 3.1 months ahead in mathematics (Finn & Achilles, 1999).

Tennessee funded subsequent studies to determine whether these class-size effects were sustained after students returned to regular-sized classes in fourth grade. Analyses of mathematics, reading, and science achievement measured in eighth grade—five years after the conclusion of the STAR program—suggest that roughly 70% of the benefits of assignment to small K-3 classes remained (Nye, Hedges, & Konstanopoulos, 1999). These positive effects may have even extended into high school. Compared with students who had experienced large K-3 class-sizes, children in small classes earned higher high-school grades, and were more likely to complete advanced academic classes, take college admissions tests, and ultimately graduate (Krueger & Whitmore, 2001).

Although Project STAR is generally considered the premier educational study with a randomized design, it has garnered some methodological criticism.[4] Despite any lingering methodological concerns surrounding the STAR study, authors have asserted that potential biases "do not appear to threaten the basic [positive] conclusions" (Ehrenberg et al., 2001, p. 18; see also Krueger, 1999; Nye et al., 1999). Indeed, other analyses of the STAR data conclude that the positive effects of small classes on student learning may be *larger* than actually reported. Due to the influx of new students during the course of the study, not all students received smaller classes for four years. Academically, students who received the full "treatment" completed third grade roughly seven months ahead of their peers who attended large classes for four years (Krueger, 1999; Krueger & Whitmore, 2001; Nye et al., 1999). STAR's restricted class-size ranges further suggest that the study underestimated the benefits of small (or even medium-sized) classes: "large" control group classrooms were designed to enroll 26 or fewer students. Nationally representative data, however, indicate that a considerable number of public school students are enrolled in classrooms larger than this

(Ready & Lee, 2007). Moreover, due to student mobility, many "large" STAR classes actually enrolled *fewer* than 22 children, thus attenuating the negative effects of large classes (Evertson & Randolph, 1989).

The STAR Study and Educational Equity

As I discussed above, for class-size reduction programs to increase educational equity, smaller classes must afford greater benefits to disadvantaged children. Results from the Tennessee class-size experiment do suggest differential class-size effects. There is some evidence of equalizing effects of smaller classes for low-income students. Free-lunch eligible students in smaller classes gained slightly more skills than more-advantaged students in small classes (Schanzenbach, 2007). The results suggest stronger effects of smaller classes for black children (Finn & Achilles, 1999; Krueger, 1999; Krueger & Whitmore, 2001, 2002; Molnar, Smith, Zahorik, Palmer, Halbach, & Ehrle, 1999). On average, black students in small classes ended third grade roughly 7 to10 percentile points higher than black students who attended large classes. In contrast, white students in small classes were only 3 to 4 percentile points ahead of white students in large classes. In other words, the small-class effect was roughly twice as large for black students (Krueger & Whitmore, 2002). Moreover, these compensatory effects appear to have persisted over time. For instance, by high school, black students who had been in the small elementary school classes were 25% more likely to take college admissions tests and to score higher on those tests than black children who were enrolled in large classes (Krueger & Whitmore, 2002).

Importantly, however, these compensatory effects for black children were contingent upon the types of schools they attended—the disproportionate benefits for black students were not found in all schools. Black students who attended predominantly white schools experienced no compensatory effects: the effects of smaller classes in such schools were the *same* for black and white students. Similarly, the small-class effect for whites was *larger* in schools that were predominantly black. Only black students in predominantly black schools made gains that were larger than those made by white students in small classes. These findings lend strong empirical support to Lazear's (1999) theoretical argument described above. Indeed, additional authors have argued that this phenomenon of differential effectiveness is related to the social and academic characteristics of schools that were predominantly black compared with those that were predominantly white. Schools that enroll substantial numbers of minority students tend to have higher concentrations of lower-achieving and lower-income students. As such, teaching and learning environments may be somewhat more difficult and less conducive to student academic development. Further supporting this assertion is the fact that on average, academically low-performing students did not receive disproportionately greater benefits from smaller classes (Nye et al., 2002), although students in low-performing *schools* did benefit more from smaller class sizes (Krueger & Whitmore, 2002). In short, in schools with large numbers of low-achieving and/or minority students, smaller classes appear to have larger effects on student learning.

Wisconsin

In 1996 Wisconsin launched a similar (although more modest) class-size reduction experiment titled SAGE (Student Achievement Guarantee in Education). Unlike STAR, the SAGE design was randomized between rather than within schools. Kindergarten through third-grade classrooms in SAGE schools enrolled only 15 students, compared with classrooms of 21 to 25 in the control schools (Molnar et al., 1999; Molnar, Zahorik, Smith, Halbach, & Ehrle, 2002). Wisconsin's program differed from Tennessee's in another way, in that it targeted low-income schools. Both SAGE and control schools enrolled substantial proportions of children living in poverty; at least 30% of students in the participating schools—and at least 50 of students in participating school districts—were living below the poverty level. Despite these differences in design and study participants, findings from the SAGE program are comparable with those from the Tennessee study: between the start of kindergarten and the end of first grade, children in SAGE schools had experi-

enced somewhat higher achievement gains than their control-school counterparts (ES ≈ 0.1-0.2 SD; Molnar et al., 1999).

The SAGE Study and Educational Equity

As I noted above, unlike Tennessee's class-size experiment, which involved a socioeconomically diverse sample of schools, only lower-income schools and districts participated in SAGE. As a result, researchers have not explored whether class-size effects were stronger for low-income children in SAGE schools. However, authors have examined the compensatory effects of smaller classes for black children. Recall that SAGE was a between-school experiment, unlike STAR's within-school experimental design. As such, SAGE researchers could compare black students in SAGE schools with three other types of students: (1) blacks in non-SAGE schools; (2) whites in SAGE schools; and (3) whites in non-SAGE schools (see Molnar et al., 2002). SAGE researchers were also able to follow two separate cohorts, one that began first grade in 1996 and another that entered first grade in 1997.

Black students in SAGE schools gained more language arts, reading, and mathematics skills between the start of first-grade and the end of third grade than black students in schools with regular-sized classrooms. These results from the first comparison were consistent across both student cohorts. Within SAGE schools (the second comparison), black students in the 1996 cohort showed larger achievement gains than whites, while blacks in the second cohort gained skills equal to whites (i.e., their learning rates were parallel). The third set of comparisons suggests that within non-SAGE schools—the schools with regular-sized classes—academic gains among black and white students in the first cohort were equal, while white students' gains were larger in the second cohort. In short, across both cohorts, the smaller classes offered by the SAGE schools produced the best outcomes for black students. Only in SAGE schools did any cohort of black children gain more than whites, and only in a non-SAGE school did a cohort of white children gain more than black children.

Medium-Sized Classrooms

Interestingly, neither the Tennessee nor the Wisconsin class-size experiments examined medium-sized classrooms.[5] Classrooms with enrollments between 17 and 22 did not participate in Project STAR, and Wisconsin's SAGE program involved no classrooms enrolling between 15 and 21 students. This is quite understandable, in that these evaluations sought to maximize their ability to identify class-size effects. However, the nationally representative data indicate that in roughly half of all public schools, kindergarten and first-grade classrooms enrolling between 17 and 25 students are the norm (Ready & Lee, 2007). One consequence is that neither study was able to determine if the effects of medium-sized classes were equal to those of small classes. This is important considering the potential cost savings of moving from large to medium rather than large to small classes.

Nonexperimental Studies

In addition to the randomized class-size experiments in Tennessee and Wisconsin, a second group of studies employs large datasets and nonexperimental designs. Rather than randomly assigning children to small and large classes, these studies rely on naturally occurring differences in class size. As such, these approaches may afford more "realistic" estimates of class-size effects, due in part to the broader range of settings in which the data are collected. Compared with the more homogeneous conditions associated with randomized experiments, the policy contexts and teacher incentives present in nonexperimental data may more accurately reflect the actual conditions in which large-scale class-size reduction policies are implemented (Hoxby, 2000).

Despite the potential advantages of these designs, the methodological concerns that accompany analyses of extant survey data often outweigh the benefits. Nonexperimental class-size studies, which rely on statistical adjustments rather than random assignment, likely suffer unobserved and unmeasured selection bias. That is, children who attend small classes likely differ in many ways from children who attend large classes, and researchers are rarely able to measure and account for every difference. This is true even for studies that entail

sophisticated analyses of longitudinal data. Thus, reported class-size effects may be spurious, meaning that they reflect other traits of teachers, schools, and communities that are related to both student performance and class size but not necessarily the relationship between the two (Biddle & Berliner, 2002; Hoxby, 2000; Lazear, 1999). For example, class-size effects may be biased upward if more-affluent parents select schools with smaller class sizes.

Conversely, quasi-experimental studies may underestimate class-size effects. For example, school principals may create smaller classes for weaker or less-experienced teachers, believing that stronger teachers can successfully manage larger classes. Struggling students may also be organized into smaller classrooms as a compensatory approach, again producing attenuated class-size effects. Estimates may also be attenuated by nonlinear relationships between class size and student outcomes: the effect produced by a numerically similar class size reduction may vary across the range of class sizes (see Lazear, 1999). For instance, reducing class sizes from 25 to 15 students may improve student performance, while a similar ten-student reduction from 55 to 45 students may not produce measurable effects. Moreover, as noted above, schools that offer small classes are often located in poor, rural areas, thus "masking" the benefits of smaller class sizes. In this sense, schools that consciously create classes with fewer students likely differ from those that offer small classes simply because they do not enroll many students. Schools with class sizes that are small by default are likely different in many ways from those that provide smaller classes by design.

These methodological challenges are inherent in efforts to statistically model class-size effects without a randomized experiment. Due partly to these differences in data as well as differences in the statistical methods employed, nonexperimental studies have reported contradictory findings. One study with a quasi-experimental design examined almost 650 Connecticut elementary schools (see Hoxby, 2000).[6] To reduce the potential for selection and omitted variable bias, the author examined naturally occurring class-size variation within the same schools over time. Hoxby (2000) concludes that class size is unrelated to student learning. Her primary explanation points to the fact that unlike the teachers in her sample of Connecticut schools, small-class teachers in the Tennessee study were aware that they were part of the treatment group, and thus may have had incentives to produce greater student achievement gains that teachers in her study did not.

Several recent nonexperimental class-size studies have employed data from the Early Childhood Longitudinal Study, Kindergarten Cohort (ECLS-K). Sponsored by the National Center for Education Statistics, ECLS-K is currently recording the progress of a nationally representative group of over 20,000 children who were in kindergarten during the 1998-99 school year. Using these data and multilevel methods, Milesi and Gamoran (2006) explored class-size effects on kindergarten cognitive development in public and private schools. The authors conclude that kindergarten class size is unrelated to student learning in either reading or mathematics. Other nonexperimental analyses of the ECLS-K data, however, support findings from the Tennessee and Wisconsin class-size experiments. Ready and Lee (2007) explored class-size effects in both kindergarten and first grade, limiting their analyses to public schools, which are the focus of the class size debate. Compared with children in schools with large classes (greater than 25 students), children in schools with small classes (17 or fewer students) gained somewhat more in literacy (ES = 0.14 SD in kindergarten; ES = 0.20 SD in first grade) and mathematics (ES = 0.15 SD in kindergarten; ES = 0.18 SD in first grade). These positive effects represent roughly three weeks of additional schooling. Interestingly, again compared with children in schools offering large classes, children in schools with *medium*-sized classrooms—between 18 and 25 students—also gained more in literacy (ES = 0.19 SD) and mathematics (ES = 0.15 SD).

Ready and Lee (2007) also estimated the effects of small compared with medium-sized classrooms for kindergarten and first grade students. Importantly, they found no differences in kindergarten literacy or math-

ematics learning, or first-grade mathematics gains, between schools offering small rather than medium-sized kindergarten classrooms. Only in first-grade literacy learning did the authors find small class sizes to be more beneficial than medium-sized classes (ES = 0.13 SD). These results indicate *detrimental* effects of large kindergarten classes on student learning rather than *beneficial* effects of small classes. By including schools with medium-sized classrooms in the analyses—which neither the Tennessee nor the Wisconsin experiments considered—these results suggest that schools may enjoy similar advantages by decreasing enrollment from large to mid-sized classrooms. Moving to even smaller classes may not provide additional academic benefits, even though such a change would surely require considerable additional costs.

Nonexperiments and Educational Equity

As discussed above, nonexperimental studies attempt to approximate randomized experiments through statistical controls. This distinction from experimental studies has important implications for studies focused on class size and educational equity, because variability in class sizes is due to countless purposeful and naturally occurring causes that may be related to school racial/ethnic and socioeconomic compositions. For example, affluent schools may decide to allocate funds to reduce class sizes, while schools with declining student enrollments may simply have small numbers of students. Such contextual factors are likely related to student learning, above and beyond the actual influence of class size. These factors may partly explain why, in contrast to the results from the randomized studies in Tennessee and Wisconsin, nonexperimental studies have not found differential class-size effects across student subpopulations (see Hoxby, 2000; Milesi & Gamoran, 2006; Ready & Lee, 2007). Although Ready and Lee found that students in schools with smaller class sizes gained somewhat more academic skills, these effects did not vary by children's race/ethnicity or social class.

Meta-Analyses

A third type of class-size research analyzes the results of extant experimental and nonexperimental class-size studies. These "meta-analyses" are in essence "studies of studies." Rather than collecting new data or conducting original analyses of available data, meta-analyses distill the outcomes of dozens (or even hundreds) of existing studies (see Shadish et al., 2002). Although this approach has numerous advantages, it has also garnered criticism. Perhaps the prime concern—and the one most often levied against the meta-analyses described below—is that the results from one solid study are often of greater use to policymakers than are those from any number of methodologically weak studies.

Two seminal meta-analyses have garnered particular attention. The first is Glass and Smith's (1978) meta-analysis of 77 class-size studies (also Glass, Cahen, Smith, & Filby, 1982). The authors conclude that "the relationship of class size to pupil achievement is remarkably strong" (Glass et al., 1982, p. 50). A second meta-analysis arrives at very different conclusions from Glass and Smith. Hanushek (1997, 2002) analyzed 59 publications that provided 227 estimates of the relationship between class size (or student/pupil ratios) and student outcomes. Hanushek (2002) concludes, "Despite the political popularity of overall class size reduction, the scientific support of such policies is weak to nonexistent" (p. 61). Delving into the technical details of the critiques of these analyses is well beyond the scope of this review, and I will not attempt to adjudicate or reconcile these quite disparate findings here.[7] Rather, I mention these studies due to their historical and continued importance within the ongoing class-size debates.

Summary

In general, only randomized field trials consistently report class-size effects on student learning. Why are class-size effects so difficult to identify outside of these experimental conditions? One important consideration is the distinction between "internal" and "external validity" across these different types of studies (Ehrenberg et al., 2001). The traditional definition of "internal validity" refers solely to the degree to which a particular study can make valid causal inferences that "X caused Y" (see Shadish et al., 2002). Due largely to their randomized designs, both the Tennessee and Wisconsin

experiments enjoy a considerable degree of internal validity. Indeed, despite the concerns raised by some researchers, the Tennessee study is considered the premier randomized trial in education research. Given the legitimacy of their designs and procedures, the causal claims emanating from these studies appear warranted. Within these particular contexts, and under these specific conditions, children assigned to small classes gained more academic skills. Moreover, both studies found that the effects of smaller classes were greater for traditionally disadvantaged children.

However, internal validity is only one factor policymakers must consider—external validity is equally important. External validity is concerned with the extent to which the findings from a particular study are generalizable to other contexts. Can we assume that the *internally* valid findings of the Tennessee and Wisconsin class-size studies are applicable to other policy conditions? Based on the results of quasi-experimental studies, it is unclear whether class-size effects occur naturally in practice, or if large-scale class-size reduction programs elsewhere could replicate the findings of these randomized experiments. Policy contexts with different student demographics, teacher labor markets, and economic conditions may not produce similar results. In this sense, the "class-size debates" are somewhat misguided, in that the outcomes of particular class-size initiatives likely depend on the specific contexts in which they are implemented. I return to this point later in the paper. But as I discuss below in the context of California and Florida, serious questions remain.

Large-Scale Class-Size Reduction Programs

Based largely on the positive findings from the Tennessee class-size experiment, dozens of states over the past decade have implemented class-size reduction policies. In this section I describe the programs adopted in California and Florida. I focus on these two initiatives not only because they are the largest in terms of cost and the number of students involved, but also because they differ from one another in several important respects. As I explain below, my discussion necessarily focuses on the policies themselves rather than their effects on student outcomes.

California

In 1996 California launched the nation's first large-scale class-size reduction program. The state offered districts $650 for every child enrolled in a classroom with 20 or fewer students. A complex political drama unfolded involving then-Governor Pete Wilson and the California Teachers Association (see Shrag, 2007; Wexler, Izu, Carlos, Fuller, Hayward, & Kirst, 1998).[8] Observers have deemed the legislation resulting from this Machiavellian approach to education reform a "near-textbook example of how not to reduce class size" (Biddle & Berliner, 2002, p. 13).

In general, evaluations of California's efforts have been formative rather than summative, describing the policy and politics surrounding the initiative rather than its effects on student academic development. This has been the case for several reasons. Unlike class-size initiatives in Tennessee and Wisconsin, the California class-size reduction program was not experimental. All districts were permitted to receive funds and reduce class sizes simultaneously, rendering meaningful evaluation difficult. For example, after four years of implementation, the average third-grader in the "treatment group" had been enrolled in smaller classes for only one year more than her "control group" peer. Moreover, selection bias was quite apparent, in that low-income schools were the last to implement smaller classes, despite the financial incentives. Even if these design flaws are ignored, directly estimating the relationship between student learning and class size would not be possible. Because students' cognitive skills were not assessed in the early grades, the California data permit only cross-sectional comparisons (i.e., "snapshot" portraits of achievement rather than estimates of children's learning over time). Although the primary evaluators report class-size "effects," their judgment that findings regarding student achievement are "inconclusive" seems appropriate (CSR Research Consortium, 2002).[9] Furthermore, as I discuss below, the data suggest that there may well be several unintended negative consequences of California's class-size initiative for educational equity.

Florida

Unlike California, which adopted class-size reduction through a highly politicized legislative process, Florida's program is the product of a voter-driven ballot initiative. In 2002, Florida voters narrowly passed a constitutional amendment limiting K-3 classroom enrollments to 18. Again, in contrast to California, Florida extended its efforts beyond the primary grades to include all students. Class sizes in grades 4-8 are restricted to 22, and high school classes in core subjects are capped at 25. Immediately prior to the amendment's passage, the average K-3 class size in Florida was over 23 students (Office of Program Policy Analysis & Government Accountability [OPPAGA], 2007). As in California, Florida's program provides funds to all schools—even those that were in compliance prior to the class-size requirements. These districts are permitted to appropriate these funds however they wish. By the spring of 2007, Florida had spent almost $1.9 billion on class-size reduction.

Florida's class-size requirements are being phased in over time. Its incremental approach exploits the fact that class-size measurements calculated at higher aggregate levels are more lenient and offer greater flexibility. During the first three years of the program, class sizes were calculated at the district level. Beginning with the 2006-07 school year, the state measured class sizes at the school level. At this compli-

ance stage, some within-school variability in class size was permitted, so long as the school-average class size remained within mandated limits. By the 2010-11 school year, class size will be measured at the classroom level: every class in each district must meet the requirements (Council for Education Policy, Research, and Improvement [CEPRI], 2005). As in California, Florida's class-size program was implemented universally, meaning experimental and control groups were unavailable, and researchers have not yet attempted to estimate the influence of Florida's class-size program on student outcomes.

Surprising many, the vast majority of Florida schools have thus far reduced class sizes to required levels. For the 2006-07 school year, when school-level measurements of class size began, less than 6% of schools failed to meet the requirements (Florida Department of Education, 2006; OPPAGA, 2007).[10] As a result, from 2003 to 2006 the size of the typical Florida K-3 classroom declined by over six students.[11] Schools and districts not in compliance have considerable leeway in meeting the class-size requirements. They can adopt year-round calendars or institute double sessions during the day; rezone school boundaries; return district-level certified personnel to the classroom; offer on-line classes; reduce graduation requirements; utilize facilities from local colleges; and even review and revise collective bargaining agreements with teachers. Despite the urgings of then-Governor Jeb Bush and the State Board of Education that Florida could not afford the considerable costs associated with universal class-size reduction, numerous ballot and legislative efforts have failed to reduce the size and scope of Florida's class-size initiative (Goodnough, 2003, 2005; Pogrebin, 2006).

Universal Class-Size Reduction Efforts and Educational Equity

In addition to the foreseeable economic and opportunity costs associated with these large-scale class-size initiatives, the California and Florida programs have been accompanied by a host of unforeseeable negative consequences. In this section I discuss the most commonly cited negative outcomes in California and Florida: diminished teacher quality and overburdened school facilities. Importantly, each of these undesirable outcomes has fallen disproportionately on low-income students and students of color.

Teacher Quality

Teacher labor market studies suggest that qualified teachers are more likely to leave low-achieving schools for more "appealing" schools and districts (Boyd, Lankford, Loeb, & Wyckoff, 2005).[12] This has concerned observers of large-scale class-size reduction initiatives, which assume a surplus of qualified teachers. Because these programs require substantial numbers of new teachers in all schools, positions created in the most desirable districts may lure teachers away from low-achieving districts. Schools serving large numbers of disadvantaged students may be forced to hire lower-quality teachers, potentially offsetting gains associated with class-size reduction efforts. This has important implications for large urban districts, which are more likely to have lesser-qualified teachers even prior to class-size reduction (Lankford, Loeb, & Wyckoff, 2002). Evidence from California and Florida suggests that average teacher quality may have indeed declined due to their nontargeted class-size reduction policies. To staff new classrooms, districts in both states have hired teachers lacking full credentials. When voters approved Florida's class-size amendment, the state already had the most severe teacher shortage in the nation. Since the implementation of universal class-size reduction, many Florida schools districts have struggled to find teachers to staff newly created classrooms (CEPRI, 2005).

Teacher shortages resulting from class-size reduction were a much greater problem in California. Prior to class-size reduction, less than 2% of California's K–3 public school teachers were uncertified. By the second year of the program, however, 12.5% lacked full credentials. Overall, 30% of teachers hired as a result of California's class-size initiative were uncertified (Legislative Analyst's Office [LAO], 1997). Importantly, these declines in teacher quality were not equally shared by

all schools and districts: low-income California schools were disproportionately forced to hire uncertified and inexperienced teachers, since many certified teachers left low-income schools and districts for positions in higher-income areas (CSR Research Coalition, 1999, 2000; Jespen & Rivkin, 2002). Teacher relocations even occurred *within* school districts as teachers moved from less to more desirable schools (Wexler et al., 1998). Among the lowest-income schools, 2% of teachers were uncertified in 1995-96. By 1997-98, the first year of the program, 20% of teachers were uncertified in these schools. Conversely, high-income schools went from having less than 1% uncertified teachers to roughly 5% uncertified (CSR Research Consortium, 2002). In other words, low-income schools experienced a ten-fold increase in uncertified teachers compared with a five-fold increase in high-income schools.

Another result in California was that teacher quality in predominantly black schools declined to the point where the potential benefits of smaller classes were offset (Jespen & Rivkin, 2002). Limited English proficiency (LEP) students were also disproportionately affected, due largely to the links between family income and LEP status. Schools serving large proportions of LEP students were actually *more* likely to hire teachers *without* LEP certification. Even prior to the class-size initiative, California had only one fully qualified teacher for every 98 LEP students, and between 1996 and 1997, the state issued over 8,000 emergency LEP teaching licenses (Wexler et al., 1998). Despite these very real concerns about the effects of large-scale class-size programs on educational equity, it is important to stress that the effects of universal class-size reduction on teacher quality depend on the elasticity of local teacher labor markets (Jespen & Rivkin, 2002). In this regard, California and Florida are unique. Both states had experienced decades of tremendous student enrollment growth, and each state had suffered teacher shortages before the programs were implemented. States or districts that enjoy a surplus of highly qualified teachers are unlikely to suffer a similar deterioration in teacher quality and may be able to craft policies that increase (rather than decrease) educational equity.

Space and Facilities

Universal class-size policies have also produced overcrowding in California and Florida's already strained educational facilities. California was forced to create 18,000 additional classrooms virtually overnight, and already crowded low-income districts often had inadequate facilities to accommodate new classrooms (CSR Research Consortium, 2002). Many schools and districts not only adopted year-round calendars, but also transformed teacher lounges, gymnasiums, auditoriums, libraries, labs, special education facilities, and even storage rooms into classrooms. In one study, one-quarter of principals reported that they had resorted to "doubling up" by placing 40 students and two teachers in a classroom to meet the 20 student class-size limit (Wexler et al., 1998).

Implementation of class-size reduction in California faced two additional challenges related to facilities. Proposition 13, a ballot initiative approved by California voters in 1978, not only reduced property taxes, but also required that future school construction bonds pass by a two-thirds majority of local voters. Partly as a result, many California communities found it difficult to pass bond issues to fund new school construction. Proposition 13 effectively shifted the responsibility for new school construction from localities to the state. Although the state has increased funding somewhat for construction, the level of funding made available to localities has been demonstrably inadequate compared with the state's enormous enrollment growth.

In California, classrooms that could have been used to accommodate growing student populations in all grades were instead used to reduce class sizes for younger children. Recall that California's initiative involved only kindergarten through third grade. As such, upper-grade classrooms in schools with limited space were forced to accommodate even more students (CSR Research Coalition, 1999; U.S. Department of Education, 1997). Only two out of every five schools met class-size guidelines after the first two years of the program. Of the 60% that did not meet the guidelines, 81% cited limited space as the central reason for noncompliance (CSR Research Coalition, 1999). In an effort to com-

ply, schools have converted gymnasiums, libraries, and computer labs into classrooms. However, the school facilities most often sacrificed to class-size reduction were special education classrooms, which were reduced or lost completely by 40% of the state's schools (CSR Research Coalition, 1999). California classroom teachers reported that smaller class sizes facilitated the mainstreaming of special education students into their classrooms, but the loss of special education classrooms and spaces may have mitigated some of the benefits for special education students (Wexler et al., 1998). Of course, the extent to which facilities present a challenge to class-size reduction depends on excess facilities capacity. States and districts with declining enrollments would find it easier, from a facilities standpoint, to accommodate new classrooms. But these concerns were present (to a lesser extent) even in the randomized class-size experiments. Because the program targeted low-income schools, several Wisconsin SAGE schools were forced to sacrifice classroom spaces previously used for art and music instruction to create regular classrooms (Graue, Hatch, Rao, & Oen, 2007).

A common response to facility shortages in both California and Florida has been the installation of portable trailers on school grounds for use as classrooms (see California Department of Health Services, 1998; Dunn, 2006; EdSource, 1998; LAO, 1997; OPPAGA, 2007; Ross & Walker, 1999). School districts in both California and Florida reported that a primary reason for using portable classrooms rather than constructing new schools was the high cost of purchasing new property. Recall that from the late 1990s until very recently, both California and Florida experienced remarkably strong housing markets, which drove property values to record levels. However, the overall facilities situation has been less severe in Florida, and 90% of new classrooms funded through class-size monies entailed the construction of new schools or the permanent expansion of existing schools (OPPAGA, 2007).

Class-size reduction in California and Florida has been further hampered by a rapid increase in their school-age populations. In this regard, California leads the nation. Between 1987 and 1997, California public school enrollments increased by between 160,000 and 190,000 students per year (U.S. Department of Education, 1997). Projections estimate that public school enrollments in California and Florida will continue to increase at rates much higher than the national average. Between 2006 and 2014, public schools in California expect almost 700,000 additional students, while Florida's schools will admit over 150,000 new children (National Center for Education Statistics, 2005). Such population growth will likely further complicate class-size reduction efforts.

Summary

The large-scale class-size reduction programs in California and Florida seek to replicate the positive results from Tennessee and Wisconsin. Although state-level politics are inextricably linked with the implementation of these policies, the rationales offered California and Florida officials is that smaller classes lead to improved student achievement, particularly among disadvantaged children. For these ideal outcomes to be realized, however, the California and Florida initiatives must replicate both the program *and* the conditions under which the randomized experiments were conducted. Both states, however, have found it difficult to maintain fidelity to the conditions of the original studies. For example, due largely to fiscal constraints, the class size limits instituted in California and Florida are larger than those in STAR and SAGE. Small classes in the STAR experiment were designed to enroll 13-17 students, but California set its K-3 class limit at 20, and Florida instituted a cap of 18 students. This departure from the randomized experiments likely limits the ability of these large-scale programs to produce the desired outcomes. In other respects, the inability to maintain fidelity to the conditions the randomized experiments was beyond the state's control. For example, the extent to which California and Florida could influence teacher labor markets, student enrollment growth, and changing state demographics is debatable. I return to these concerns in the discussion section.

Economic and Opportunity Costs of Class-Size Reduction

The most contentious public policies are typically those that adjudicate disagreements over the distribution of fiscal resources. Rarely are such policies politically or ideologically neutral (Majone, 1989). Contemporary debates over class-size reduction are a clear example. Although teachers and parents at all levels favor smaller classes, basic issues of educational cost and efficiency cannot be ignored. California and Florida *each* spend over $1.6 billion per year to reduce public-school classroom enrollments. Moreover, even if small class sizes improve student achievement, creating smaller classes may not be the most efficient means to obtain a given increase in student learning (Brewer, 2005). Indeed, despite its popularity, the educational return on class-size reduction remains contested, and school districts and taxpayers are interested in whether such a costly investment is educationally sound. One rarely discussed fact is that Tennessee itself has not implemented a universal class-size reduction program. Despite their place at the center of the class-size debate, Tennessee lawmakers have repeatedly decided that the financial costs of universal class-size reduction outweigh the educational benefits (Ritter & Boruch, 1999). [13]

In addition to these fiscal considerations, class-size reduction efforts are necessarily accompanied by opportunity costs, which reflect the lost benefits of programs that might have been adopted in lieu of class-size reduction (Brewer, Krop, Gill, & Reichardt, 1999). Such opportunity costs often have important ramifications for educational equity, in that the abandoned initiatives may have had stronger benefits for disadvantaged children, particularly if they were programs targeted at poor and/or minority students.

Monetary Costs of Class-Size Reduction

The cost of a national effort to reduce class sizes to 18 students in grades one to three is estimated at $5-6 billion per year, not including expenses associated with new construction and capital improvements that might be needed to house these classrooms (Brewer et al., 1999). However, as with all public policies, the monetary costs of class-size reduction depend on the parameters of specific programs. Three programmatic definitions in particular influence costs (see Brewer et al., 1999). The first concerns the upper limit of acceptable class sizes—how large is "small"? The second issue is whether the program is targeted or universal—do all children receive smaller classes all the time, or are particular children, grades, or subjects targeted? Third, at what level are class sizes calculated—the classroom, school, district, or state?

Defining "Small"

The first consideration in estimating costs is perhaps the most obvious. The cost of a particular class-size initiative depends on how "small" is defined. Because smaller classes require more teachers and additional facilities, policies that create classes of 15 children are more expensive than those that cap enrollments at 20. For example, roughly 40,000 new teachers would be needed to reduce primary-grade class sizes to 20 students nationwide, but reducing class sizes to 18 would require almost 100,000 additional teachers, and classes of 15 would require over 200,000 more teachers (Brewer et al., 1999). The reason for this nonlinear increase in labor requirements is simple: as any hypothetical class-size target moves away from the average current class size, we encounter more classes that do not meet the target.

Another important consideration in the implementation of class-size reduction policies is that costs are higher when existing average class sizes are far from required limits; reducing class size in a state or district that already offers small classes is obviously less expensive. Cost estimates must also consider reductions in the number of students per class in both relative and absolute terms. For example, reducing class sizes from 40 to 35 students raises costs by 14.3%. Here, class sizes were quite large, so reducing classes by five students represents only a one-eighth reduction in class size.

However, a numerically similar (but *proportionately* greater) five-student reduction from 15 to 10 students per class raises costs by 50% (Hoxby, 2000). In short, class-size reduction efforts are intimately linked with *initial* class sizes, as well as the class sizes mandated by such efforts.

Targeted Class-Size Reduction Policies

A second matter influencing costs is whether a particular class-size reduction program is implemented universally or in a targeted fashion. As discussed above, evidence from the randomized class-size experiments suggests that smaller classes may have larger benefits for traditionally disadvantaged students. As such, many researchers and policymakers argue that programs should target those children most likely to benefit (see Odden, 1990). Unlike Wisconsin's experimental program, which targeted low-income schools, California and Florida have permitted all schools to participate; high-performing schools that already enjoyed low class sizes are equally eligible to receive the additional state funds. Analysts have challenged the wisdom of such "one-size-fits-all" approaches, noting that efforts to raise achievement by creating smaller classes are more efficient with disadvantaged students (Grissmer, 2002). As noted above, another way to interpret this is that the relationship between class size and both fiscal and educational efficiency may be positive depending on the students in a particular context (Lazear, 1999).

Economists have estimated the cost savings associated with targeted versus universal class-size policies. Compared with a universal implementation, a national class-size reduction effort targeting low-income schools would cost roughly one-third as much (Brewer et al., 1999). Such targeted approaches would likely enhance the potential for compensatory effects (see Grissmer, 2002; Hanushek, 2002; Jespen & Rivkin, 2002; Rice, 2002). Eric Hanushek, the most public critic of class-size reduction, concedes that targeted efforts may be warranted, but maintains that "uniform, across the board policies—such as those in the current policy debate—are unlikely to be effective" (Hanushek, 2002, p. 61). Even authors who are relatively agnostic on class-size reduction question the wisdom of universal approaches. Allen Odden (1990) contends that "systemwide class-size reduction would have little effect on student performance and even if it did, would cost too much money" (p. 224). Moreover, universal class-size reduction programs may actually increase fiscal inequality between districts, because many wealthy districts offer smaller classes prior to the implementation of universal programs, yet receive funds for every class that meets the class-size requirement (Brewer, 2005). Conversely, low-income districts must allocate class-size reduction funds to class-size reduction efforts, and these funds often do not cover the attendant costs. However, the political viability of targeted (versus universal) class-size reduction policies remains unclear.

Level of Measurement

The third cost consideration is somewhat more esoteric, but certainly no less important. Class size can be calculated as the *average* class size at the classroom, school, district, or state level. In the context of a mandated class-size reduction program—such as Florida's—class-size limits can be interpreted strictly, whereby all participating classes in a district or state must meet the requirement. Conversely, policies can be more flexible, calculating class sizes at higher levels of aggregation. A class-size limit of 20 students enforced at the classroom level would force a school with 42 first-graders to create three classes, presumably with 14 students per class. Such nonflexible policies require that a new class be created if an existing class is even one student over the enrollment cap. Alternately, class size can also be calculated as the average within-school class size (which would permit within-school variability around the mandated class size), or as the district average (which would permit variability around the mandated class size both within and between schools).

With the example above, a flexible program permitting district-level calculations would allow the school with 42 students to create two classes of 21, provided the district average class size remained at or below 20 (e.g., another school may offer two first-grade classrooms for 38 students for an average class size of

19). As a result, flexible programs may be up to 10% less costly (Brewer et al., 1999). The level of aggregation at which class size is measured has had serious implications for large-scale class-size policies, especially for particular student subgroups (LAO, 1997). For example, in California, schools with 23 Spanish-speaking first graders were placed in an awkward position. Due to the nonflexible 20-student class-size limit, such schools were forced to hire additional teachers or aides, or place the three "spill-over" children into regularclassrooms or even transfer them to another school (Wexler et al., 1998).

Since the implementation of universal class-size reduction, the Florida legislature has debated the appropriate degree of flexibility districts should be afforded. Supporters of the program demand that class size be measured at the classroom level, as the original ballot measure indicated. Critics, however, argue that fiscal realities require flexible, district-level calculations (see Dolinski, 2007; Goodnough, 2003, 2005). Moreover, district-level class-size calculations may mask *within*-district inequalities, as class sizes in schools serving large proportions of disadvantaged children may be larger than those offered by other schools in the same district.

Opportunity Costs of Class-Size Reduction

In addition to monetary costs, policymakers must also consider what policies and programs might be funded in lieu of class-size reductions. Although recent court rulings have challenged the notion somewhat, decisions about school funding generally operate within politically viable parameters. Within those parameters, funds used to reduce class size will necessarily detract resources from other educational interventions; implementing programs in one area limits options in another. Rather than reducing class sizes, public monies might increase access to early childhood programs; fund the renovation of school facilities; develop innovative curricula and improve teaching and learning; or update school-based technology.

A powerful equity argument is that rather than reducing class sizes, funds might be used to attract high-quality teachers to low-income, low-performing schools. Indeed, researchers have argued that because teacher quality matters more to student learning than class size, improving teacher quality is a more efficient route to school improvement and educational equity (see Brewer et al., 1999; Clotfelter, Ladd, & Vigdor, 2007; Hanushek, Kain, & Rivkin, 1998; Harris & Plank, 2000; McCaffrey, Lockwood, Koretz, & Hamilton, 2003; Rivkin, Hanushek, & Kain, 2005). Some authors have suggested that funds dedicated to class-size reduction be allocated to teacher salary raises, thus increasing the size (and arguably the quality) of the teacher labor pool. Commentaries by public education officials and advocates have echoed these sentiments that teacher quality ought to be given priority over class-size reduction (see Cooperman, 2005; Rebell, 2007). The implications for educational equity are particularly important, as extant research suggests that disadvantaged students benefit more from high-quality teaching than more advantaged students (see Sanders & Rivers, 1996).

Economists who have estimated the costs of raising student achievement through class-size reductions compared with teacher salary increases conclude that it is more cost-effective—possibly *twice* as effective—to raise student achievement through teacher salary increases (see Grissmer, 2002; Harris, 2002; Harris & Plank, 2000). For the same cost as a national policy that reduces primary-grade class sizes to 18, districts could raise teacher salaries in these grades by roughly $10,000 (Brewer et al., 1999). Of course, this alternative is also vulnerable to criticism. First, the link between teacher pay and teacher quality—however "quality" is defined—remains contested. Successful teachers may value working conditions—such as smaller class sizes—as much as they do salaries in selecting schools. Permitting low-income schools to offer smaller classes may assist their efforts to attract successful teachers. Second, the few definitions of "teacher quality" we do share are difficult to quantify. Unlike teacher certification and undergraduate major, measurable characteristics that accurately reflect teacher quality remain elusive.[14] Third, researchers have not conducted randomized experiments that explore whether higher salaries will actually

attract higher-quality teachers to the profession. Non-experimental studies of the link between teacher salary and teacher quality likely suffer from serious selection and unmeasured variable bias.

Summary

Class-size reduction is a seemingly straightforward educational policy. This apparent transparency largely explains its intuitive appeal. However, the costs associated with these initiatives vary widely depending on their specific parameters, including how they define "small," which students receive smaller classes, and the level at which class size is measured. Even when local policymakers agree on these program specifics, one question inevitably remains: is the creation of smaller classes the most efficient means to improve public schooling and enhance educational equity? As with all educational policies and practices, the potential benefits of class-size reduction must be weighed against competing alternatives. In light of the limited fiscal resources currently available, what opportunities are lost when districts and states implement large-scale class-size reduction policies? Would other policies better serve the needs of traditionally disadvantaged children? I address and expand these broader questions regarding the links between policy priorities and educational equity with my final comments below.

Conclusion and Discussion

Unlike many educational reform strategies, the public has expressed a strong belief that smaller classes benefit children's social and academic development. But why does class-size reduction enjoy such widespread popularity, while equally costly efforts—such as improving teacher quality—fail to attract public backing? Four characteristics of class-size reduction may shed light on its popularity. First, class-size reduction is intuitively appealing, and enjoys tremendous face validity. Its greatest political strength may be that the causal link between class size and student performance makes sense to parents, teachers, and communities. Second, unlike many other aspects of schooling, policymakers and elected officials have the authority and capacity to influence class sizes directly. Compared with the legislation and oversight required to transform teaching and learning, class-size reduction can be executed quickly. Moreover, successful implementation is easily measured and conveyed to the public; legislators can provide solid evidence of their efforts to voters. In this respect, class-size reduction policies are unique, in that program "success" is often defined as program implementation, regardless of the actual outcomes. For many stakeholders, creating smaller classes is an end in itself.

A third explanation is that class-size initiatives have been implemented in nontargeted programs—all schools and districts are allowed (in California) or required (in Florida) to participate. In the 1960s, congressional approval of the original Title I legislation rested upon eligibility rules that provided funds to most school districts, not just those serving predominantly low-income students. Although Title I funding is certainly more targeted than the major class-size programs currently operating in California and Florida, these programs share one element that accompanies virtually all programs that distribute public funds widely across constituencies: broad popular and political support. For example, districts in both California and Florida that offered small classes *prior* to class-size reduction were entitled to the new funds. Class-size reduction would likely receive reduced support were the attendant funds available only to traditionally disadvantaged children and schools. Indeed, educational initiatives that explicitly target disadvantaged students generally garner the most scrutiny.

Fourth, and perhaps most importantly, class-size reduction efforts generally do not question deeply embedded notions of teaching and learning. Rather, implementation entails structural rather than instructional change (Cohen et al., 2003). Class-size reduction assumes that current processes of teaching and learning are adequate; students must simply engage these processes with fewer classmates. We again find similarities with Title I, which has traditionally involved small-group, pull-out instruction focusing on basic skills—approaches and content with which teachers are generally quite comfortable. In this sense, Title I and class-size reduction are popular in part because neither stipulates what must occur "inside" the program. In fact, neither approach represents a coherent "reform."

Educational Equity: Policy Context Matters

The evidence from the randomized class-size experiments suggests that young children learn more in smaller classes, and that the benefits are even larger for traditionally disadvantaged children. As this review demonstrates, however, the efficacy of social policies often depends on the contexts in which they are implemented. This is particularly true when we consider the relationship between education policy and educational equity. The availability of human and fiscal resources, and the capacity and will of those charged with policy implementation, strongly influence how public programs affect those who are traditionally not well-served by public institutions (see Lipsky, 1980). These considerations are clearly salient to class-size reduction initiatives, which are enacted within intricate webs of pre-existing social and economic relations. As such, their effects on low-income and minority students depend on where and how they are implemented.

The Tennessee and Wisconsin experiments were conducted under very favorable conditions. Schools in

both experiments enjoyed sufficient numbers of qualified teachers, and had adequate facilities to accommodate new classrooms. Although large by the standards of educational research, the limited scope of these field trials meant that low-income schools were not adversely affected. Indeed, the results of these experiments suggest that disadvantaged students benefited academically. However, reproducing the results from these foundational studies in practice requires comparable conditions. To date, however, large-scale policies have been unable to replicate either the favorable conditions or positive findings of these controlled experiments, especially as they relate to academic development among low-income and children of color. The programs currently operating in California and Florida have confronted challenges that the Tennessee and Wisconsin experiments did not. As such, despite solid research designs and compelling findings, results of the Tennessee and Wisconsin experiments may not be generalizable to large-scale class-size reduction policies.

Importantly, the relationship between class-size reduction efforts and educational equity is not simply a matter of local fiscal resources—other contextual factors may be equally important. For example, a large-scale class-size initiative in New York City would face facilities challenges that comparable efforts in Kansas City or Baltimore would not. Similarly, states with stable student enrollments—such as Michigan and Ohio—are less likely to encounter teacher shortages than states with expanding populations, such as Arizona and Nevada. In these instances, real estate and labor markets are as important to educational equity as access to public funds.

Directions for Future Research

Due to the substantial variability that exists across policy contexts, it is unlikely that the class-size question will be "settled." It is difficult to imagine a single study—or even a group of studies—with sufficient internal validity *and* credible external generalizability to convince those on both sides of the debate. Rather, it is likely that class-size research will continue, with each side of the debate championing studies that confirm their position, and condemning those whose conclusions dissent. Forgetting for a moment the enormous costs, even a national, randomized class-size experiment would not provide definitive results, as the effects would likely vary across local and state contexts. One possible solution is for states or even school districts to conduct their own randomized class-size experiments that take into account local teacher labor markets and school capacities. Such initiatives could be framed to voters in terms of potential cost savings, in that the benefits of such programs would be established *before* public tax dollars are allocated for universal class-size reduction efforts.

Another consideration is that empirical findings are often inadequate to settle disputes burdened with emotional sentiment and affective attachment. Indeed, the craft of public policymaking is a "social process, rather than a purely logical activity" (Majone, 1989, p. 44). Given this, rather than simply relying on the results of extant empirical studies, policymakers must consider the social and historical contexts in which a class-size initiative would be implemented. Indeed, research to date does not provide evidence that a particular district or state should (or should not) adopt a class-size reduction program. Rather, local policy actors must prioritize policy goals, and consider how local conditions will influence the effectiveness of class-size reduction. Even *within* Tennessee and Wisconsin, the consequences of a large-scale class-size initiative are unknown, as the experiments involved such a small number of schools that neither facilities nor teacher labor markets were affected. As such, although some research suggests potential benefits of smaller classes, existing (or even future) research cannot "solve" the class-size debate. Fortunately, if there is any consensus surrounding the academic effects of class-size reduction, it is that low-income and children of color may be most likely to benefit. This finding alone warrants our continued interest in the topic.

Notes

1. Several considerations complicate even the conceptualization and measurement of class size. Student-teacher ratios calculated at the school or district level generally underestimate average class sizes. Due to the presence of non-classroom-based instructional staff, such as special education, ESL, fine arts, physical education, and Title I specialists, calculations that divide the number of students by the number of full-time equivalent teachers will produce figures that are lower than actual classroom enrollments (Ehrenberg, Brewer, Gamoran, & Willms, 2001; Odden, 1990). As such, virtually all class-size reduction programs conceptualize "class size" as the number of children in an individual, self-contained general education classroom. Moreover, within middle and high schools, students commonly experience multiple teachers (and thus multiple class sizes), meaning class size has a within-school component (i.e., class sizes vary across classes within schools) as well as a between-school component (i.e., school-average class sizes also vary across schools). For these reasons, studies of middle and high schools generally focus on school rather than class size.

2. Recent declines in overall classroom enrollments mask historical differences in the class sizes experienced by black and white children. In 1915 in segregated states, the average black child sat in a classroom with over 60 other students; the average white student attended a classroom with fewer than 40 students (Krueger & Whitmore, 2002). Over the past century, racial differences in class sizes converged considerably. By the 1950s, the average black student attended a class that enrolled four students more than the class experienced by the average white student. Today, racial differences in class size have declined to an average of one or two students.

3. A considerable body of research has confirmed academic and behavioral peer effects on student learning (see Barber, 1961; Hanushek, Kain, Markman, & Rivkin, 2003; Henderson, Miezkowski, & Sauvageau, 1978; Hoxby, 2000; Mayer, 2002; Rumberger & Palardy, 2005; Summers & Wolfe, 1977; Wilson, 1959; Zimmer & Toma, 2000).

4. See in particular Hanushek, 1998, 1999, 2002; Hoxby, 2000. Schanzenbach, 2007, and Krueger, 1999, offer responses to several common methodological criticisms of STAR.

5. However, Krueger (1999) notes that roughly one-third of STAR classes actually enrolled between 17 and 22 children; many "small" classes included between 18 and 20 students, while many "large" classes enrolled between 18 and 21 children. A few large classes were even in the "small" range, with only 16 or 17 children.

6. Although they also lack random assignment, compared with nonexperimental designs, quasi-experimental designs are considerably more able to approximate random assignment (see Shadish, Cook, & Campbell, 2002).

7. Among the hundreds of available class-size studies, these two meta-analyses have produced a disproportionate amount of antagonism and even hostility. Indeed, the academic vitriol that surrounds these meta-analyses is quite remarkable, with advocates and detractors of class-size reduction charging one or the other sets of authors with everything from incompetence to purposeful deception. Readers interested in these battles can see Mishel and Rothstein (2002), which provides a full account of the substantive and methodological disagreements between Krueger and Hanushek. Other reviews often cite Odden's (1990) and Slavin's (1989) critiques of the Glass and Smith meta-analysis.

8. The political genesis of California's class-size reduction efforts can be traced to Proposition 98, which California voters narrowly approved in 1988. This constitutional amendment requires that a specific portion of excess state tax revenues be allocated to public education. During the mid-1990s, the California Teachers Association supported a media campaign blaming then-Governor Pete Wilson for California's large class sizes. In early 1996, Wilson responded that reducing class sizes would not improve education, and,

moreover, the state could not afford it. As California's economy improved during the 1990s, the state found itself with surplus funds. Rather than allowing these funds to go directly to school districts, Wilson called the teacher union's bluff on class-size reduction. Wilson asked the state legislature to craft class-size reduction legislation that could be financed through Proposition 98 funds. The teachers association had little political recourse but to support the bill, and ultimately, not one California state representative or senator voted against the measure (Senate Bill 1777). Legislators from high-income districts championed the bill, as even wealthy districts that already enjoyed small class sizes would receive class-size reduction funds.

9. One recent study attempted to overcome the limitations of the California data by using a variety of methodological approaches and data sources (including data from the National Assessment of Educational Progress [NAEP]). Unlu (2005) estimates that mathematics scores among California fourth graders increased by between 0.2 and 0.3 standard deviations as a result of the class-size initiative. Importantly, Unlu contends that black students benefited more than other students.

10. However, 25% of Florida's 358 charter schools were initially identified as noncompliant (OPPAGA, 2007).

11. Although surely a consequence of the class-size initiative, these successes are also related to recent declines in Florida's student population. After years of tremendous growth, Florida public-school enrollments fell by almost 11,000 students between the 2005-06 and 2006-07 school years. Interestingly, California is also experiencing a brief reprieve from burgeoning enrollments. California public schools enrolled over 25,000 fewer students during the 2006-07 school year compared with the previous year.

12. Clearly, many teachers are committed to serving low-income, low-performing schools. However, labor-market studies suggest that on average, teachers prefer to work in higher-income, higher-performing schools.

13. However, based on the disproportionate benefits STAR afforded black and low-income children, the state did implement a targeted class-size reduction policy. The relatively modest initiative, "Project Challenge," used matching funds to encourage over one dozen low-income school districts to allocate Title I and local resources to reduce average K-3 class sizes to 15 (see Kim, 2007).

14. The links between teacher background and student learning also remain in dispute (see Ballou & Podgursky, 2000; Podgursky, Monroe, & Watson, 2004).

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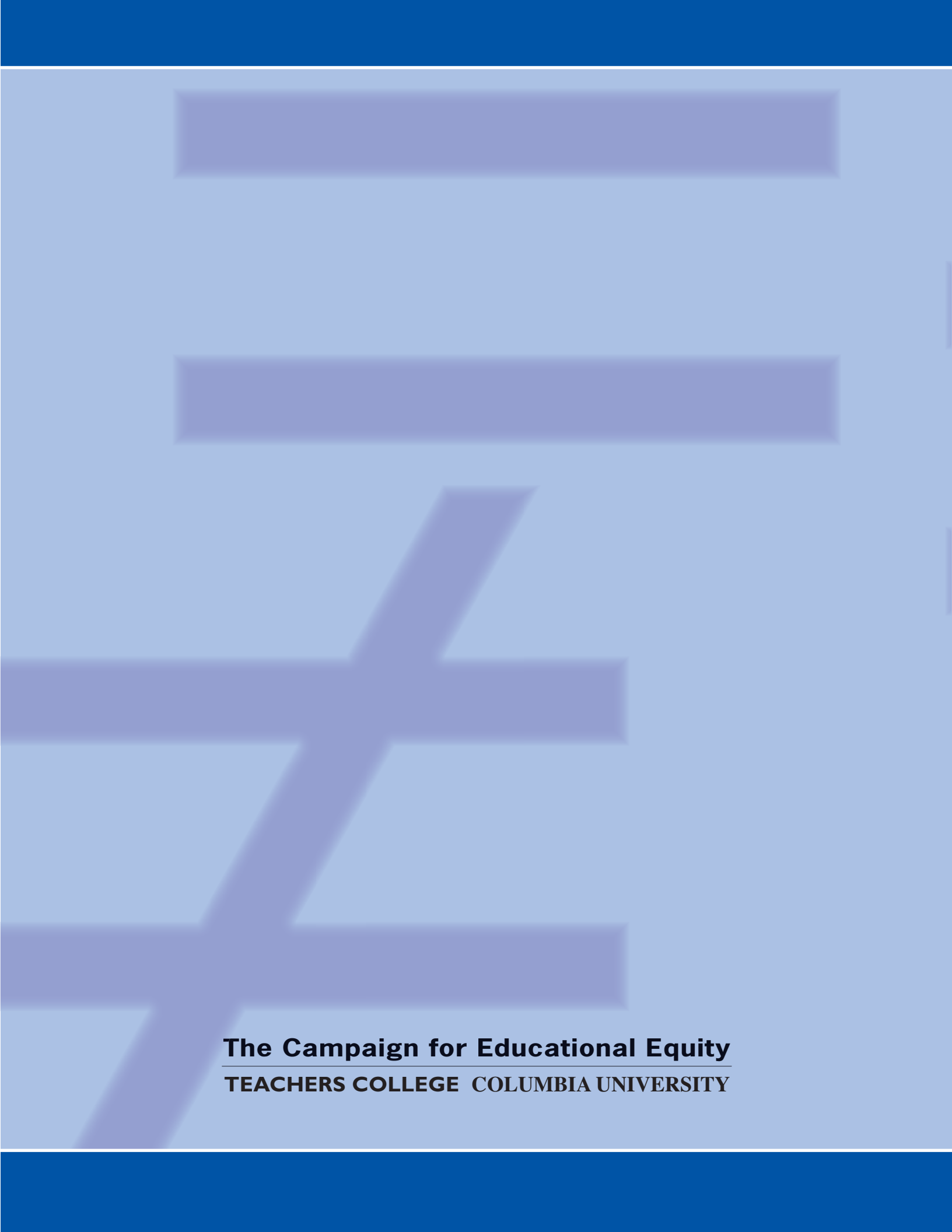
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