

Equity and Accountability: The Impact of State Accountability Systems on School Finance

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Using an 11-year panel data set containing information on revenues, expenditures, and demographics for every school district in the United States, we examine the effects of state-adopted school accountability systems on the adequacy and equity of school resources. We find little relationship between state implementation of accountability systems and changes in school finance equity, though we do find evidence that states in which courts overturned the school finance system during the decade exhibited significant equity improvements. Additionally, while implementation of accountability per se does not appear linked to changes in resource adequacy, states that implemented *strong* accountability systems did experience improvements.

INTRODUCTION

In the last decade, much of education policy has focused on concerns over the adequacy of educational resources and accountability for student performance, joining more

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traditional school finance concerns about the equity of resource distributions. While accountability reached the national stage with the passage of the 2001 *No Child Left Behind Act*, during the 1990s addressing concerns about both adequacy and accountability rested in the domain of state policy makers. The resulting variation in policies across states spurred a steadily accumulating body of research examining the effects of accountability policies on student performance,¹ and a separate body of research examining the adequacy of school financing.² There has, however, been no research linking the two, nor examining their relationship to equity in school finance. Yet these relationships are important; as a growing number of states have made public, *No Child Left Behind's* failure to provide the new resources necessary for states to achieve Adequate Yearly Progress³ could combine with increases in local resources to affect the overall equity of resource distributions within states.

Are there trade-offs between accountability and the adequacy or equity of school finance? Is the implementation of an accountability system associated with more adequate resources or, perhaps with less school finance equity? This study provides some answers by examining trends in educational resource adequacy and resource equity, using an 11-year panel data set containing information on revenues, expenditures, and demographics for every school district in the United States. In particular, we look at the effect of state-adopted accountability systems on measures of adequacy and equity of resources, controlling for other likely determinants of changes in these measures. We find little relationship between state implementation of accountability systems and changes in school finance equity, though we do find evidence that states in which courts overturned the school finance system during the decade exhibited significant improvements in resource equity. Additionally, while implementation of accountability per se does not appear linked to changes in adequacy, states that implemented *strong* accountability systems did experience improvements in resource adequacy.

1. See, for example, M. Carnoy and S. Loeb, "Does External Accountability Affect Student Outcomes? A Cross-State Analysis," *Education Evaluation and Policy Analysis* 24, no. 4 (2003): 305–331; E. Hanushek and M. Raymond, "Does School Accountability Lead to Improved Student Performance?," *Journal of Policy Analysis and Management* 24, no. 2 (2005): 297–327; H. Ladd, "The Dallas School Accountability and Incentive Program: An Evaluation of Its Impacts on Student Outcomes," *Economics of Education Review* 18, no. 1 (1999): 1–16.

2. W. D. Duncombe and J. M. Yinger, "School Finance Reform: Aid Formulas and Equity Objectives," *National Tax Journal* 51, no. 2 (1998): 260–297; W. D. Duncombe and J. M. Yinger, "Performance Standards and Educational Cost Indexes: You Can't Have One without the Other," in *Equity and Adequacy in Education Finance: Issues and Perspectives*, eds. H. F. Ladd, R. Chalk, and J. S. Hansen (Washington, DC: National Academy Press, 1999): 260–297; W. D. Duncombe and J. M. Yinger, "Financing Higher Student Performance Standards: The Case of New York State," *Economics of Education Review* 19, no. 4 (2000): 363–386; J. W. Guthrie and R. Rothstein, "Education Finance in the New Millennium," in *A New Millennium and a Likely New Era of Education Finance*, eds. S. Chaikind and W. J. Fowler, Jr. (Larchmont, NY: Eye on Education, 2001): 99–119; R. Rubenstein, "Providing Adequate Educational Funding: A State-by-State Analysis of Expenditure Needs," *Public Budgeting and Finance* 22, no. 4 (2002): 73–98.

3. C. Hendrie, "NCLB Transfer Policy Seen as Flawed," *Education Week* 24, no. 32 (2005): 1–3.

The next section provides background on school finance adequacy and equity and state accountability efforts. The following section describes the data used in the analyses, the measures used to capture resource adequacy and equity, and the empirical methods. In the next section, we discuss theoretical linkages between education accountability and school finance and the contribution of the present study. In the penultimate section we present results of our analyses. We conclude in the last section with a discussion of policy implications and avenues for future research.

REVIEW OF THE LITERATURE

Resource Adequacy and Equity

Since the landmark *Serrano versus Priest* decision in California in 1971, virtually every state in the United States has faced litigation challenging the constitutionality of its system for funding public elementary and secondary education.⁴ While early cases used education and equal protection clauses in state constitutions to argue that funding was inequitably distributed across school districts, a “third wave” of litigation focused on the adequacy of resources, particularly in property-poor districts.⁵ This shift is meaningful conceptually because, while equity is concerned with fairness in the distribution of funding, adequacy is concerned with the extent to which funding is sufficient to provide students the opportunity to achieve specified learning outcomes.⁶

Equity-based litigation typically focuses on inequalities in the distribution of resources across districts. While these inequalities are sometimes measured strictly as per-pupil expenditures (horizontal equity), litigation more frequently considers differences in costs of education across school districts and the higher levels of resources required in districts serving large numbers of students from low-income families, students for whom English is not their first language, and students with learning and physical disabilities (vertical equity). Adequacy and vertical equity are not entirely distinct, however. Underwood,⁷ for example, writes that adequacy is a form of vertical equity and King, Swanson, and Sweetland⁸ argue that adequacy is “the ideal state of vertical equity.”

4. Y. Huang, A. Lukemeyer, and J. Yinger, “Appendix B: A Guide to State Operating Aid Programs for Elementary and Secondary Education,” in *Helping Children Left Behind: State Aid and the Pursuit of Educational Equity*, ed. John Yinger (Cambridge, MA: MIT Press, 2004): 317–330.

5. H. Ladd and J. S. Hansen, eds., *Making Money Matter: Financing America’s Schools* (Washington, DC: National Academy Press, 1999); P. A. Minorini and S. D. Sugarman, “Educational Adequacy and the Courts: The Promise and the Problems of Moving to a New Paradigm,” in *Equity and Adequacy in Education Finance: Issues and Perspectives*, eds. H. F. Ladd, R. Chalk, and J. S. Hansen (Washington, DC: National Academy Press, 1999): 175–208.

6. See Guthrie and Rothstein (2001) for more on this.

7. J. Underwood, “School Finance Adequacy as Vertical Equity,” *University of Michigan Law Reform* 28 (1995): 493–519.

8. R. A. King, A. D. Swanson, and S. R. Sweetland, “Designing Finance Structures to Satisfy Equity and Adequacy Goals,” *Education Policy Analysis Archives* 13, no. 15 (2005): 1–26.

Much of the research on school finance equity has focused on the conceptual and methodological underpinnings of equity⁹ or on empirical analyses of equity within individual states,¹⁰ comparisons across states¹¹ or across schools within large districts.¹² While the majority of research on equity has been descriptive, some has aimed at identifying causal relationships. As an example, Evans, Murray, and Schwab's¹³ study of the distribution of school resources between 1971 and 1992 found that within-state inequality was reduced by 19–34 percent because of the implementation of court-ordered finance reforms. They also found that while state aid to districts increased in these states, local funding was relatively unchanged.

Much of the research on adequacy has focused on methods to measure adequate funding,¹⁴ often examining individual states facing legal challenges (such as Ohio, New York, and Texas). A more limited body of research has studied adequacy across states.¹⁵ We know of no previous research, though, that has explored correlates of adequacy in school finance.

State Accountability Research. While *No Child Left Behind* represented a dramatic increase in the federal government's role in setting education policy,¹⁶ individual states have been implementing accountability standards and assessment systems for well over a decade. "Accountability" has become a buzzword in education circles in recent years, but the term may refer to a wide array of policies and procedures. At their core, accountability policies

9. R. Berne and L. Stiefel, *The Measurement of Equity in School Finance: Conceptual, Methodological, and Empirical Dimensions* (Baltimore, MD: Johns Hopkins University Press, 1984).

10. For example, W. D. Duncombe and J. Johnston, "The Impacts of School Finance Reform in Kansas: Equity Is in the Eye of the Beholder," in *Helping Children Left Behind: State Aid and the Pursuit of Educational Equity*, ed. John Yinger (Cambridge, MA: MIT Press, 2004): 145–158; A. Flanagan and S. Murray, "A Decade of Reform: The Impact of School Reform in Kentucky," in *Helping Children Left Behind: State Aid and the Pursuit of Educational Equity*, ed. John Yinger (Cambridge, MA: MIT Press, 2004): 195–214.

11. Berne and Stiefel (1984); M. Moser and R. Rubenstein, "The Equality of Public School District Funding in the US: A National Status Report," *Public Administration Review* 62, no. 1 (2002): 63–72.

12. L. Stiefel, R. Rubenstein, and R. Berne, "Intra-District Equity in Four Large Cities: Methods, Data, and Results," *Journal of Education Finance* 23, no. 4 (1998): 447–467; R. Rubenstein, A. E. Schwartz, L. Stiefel, and H. Bel Hadj Amor, "From Districts to Schools: The Distribution of Resources across Schools in Big City School Districts," *Economics of Education Review* 26 (2007): 532–545.

13. W. N. Evans, S. E. Murray, and R. M. Schwab, "Schoolhouses, Courthouses, and Statehouses after Serrano," *Journal of Policy Analysis and Management* 16, no. 1 (1997): 10–31.

14. J. Chambers, "Geographic Variations in Public Schools' Costs," Working Paper No. 98–04 prepared for the U.S. Department of Education, National Center for Education Statistics (Palo Alto, CA: American Institutes for Research, 1998); Guthrie and Rothstein (2001); W. D. Duncombe and J. M. Yinger, "Why Is It So Hard to Help Central City Schools?," *Journal of Policy Analysis and Management* 16, no. 1 (1997): 85–113; A. Reschovsky and J. Imazeki, "Achieving Educational Adequacy through School Finance Reform," *Journal of Education Finance* 26, no. 4 (2000): 373–396.

15. Rubenstein (2002); R. S. Vesely and F. E. Crampton, "An Assessment of Vertical Equity in Four States: Addressing Risk Factors in Education Funding Formulas," *Journal of Education Finance* 30, no. 2 (2004): 111–122.

16. G. L. Sunderman and J. S. Kim, "The Expansion of Federal Power and the Politics of Implementing the No Child Left Behind Act," *Teachers College Record* 109, no. 5 (2004): 1057–1085.

require states or school systems to define standards and goals for student performance, and to measure this performance.¹⁷ Student achievement is most commonly measured through standardized assessments of student performance in a variety of subject areas and at various grade levels, though standards may also include other outcomes such as graduation rates and school climate measures (e.g., violent incidents). Before *No Child Left Behind*, states varied widely in the details of their accountability systems, with some using a “low-stakes” system in which performance measures are simply publicly reported, while other implemented a “high-stakes” system of rewards for high or improving performance and/or sanctions for low performance or declining performance.¹⁸

A growing body of literature has examined various aspects of state accountability systems, in particular their effects on student performance. For example, Carnoy and Loeb¹⁹ use a 0–5 index of accountability strength in 50 states and find a positive relationship between stronger accountability systems and student performance. Their study also explores characteristics of states that might lead to adoption of an accountability system, finding that states with larger populations, higher proportions of minority students, and lower-achieving white students are more likely to adopt stronger accountability systems. Hanushek and Raymond²⁰ also use national data and include state fixed effects to examine the impact of state accountability systems on student performance and test-taking exemptions. They find that introduction of state accountability regimes significantly increase overall performance on the National Assessment of Educational Progress (NAEP), but that the gains are primarily among white and Hispanic, but not black, students. Lee and Wong²¹ directly examine the effects of state accountability policies on both resources and performance using data on expenditures, class size, and teacher qualifications, as well NAEP mathematics test scores. They generally find no significant relationships between accountability policies and the resource variables, and that accountability policies neither reduce nor exacerbate achievement gaps between black and white students.

CONTRIBUTION OF THIS STUDY

This study builds on the previous work to examine the impact of state accountability systems on school funding. Theory suggests several possible connections between resource adequacy or equity and accountability policies. First, accountability policies designate explicit state student performance standards, facilitating the measurement and identification of resource (in)adequacy. In early adequacy litigation, states had rarely set explicit performance targets and often argued that existing resource and performance

17. Ladd (1999).

18. Hanushek and Raymond (2005) categorize high-stakes systems as “consequential” and low stakes as “report card.”

19. Carnoy and Loeb (2003).

20. Hanushek and Raymond (2005).

21. J. Lee and K. K. Wong, “The Impact of Accountability on Racial and Socioeconomic Equity: Considering Both School Resources and Achievement Outcomes,” *American Educational Research Journal* 41, no. 4 (2004): 797–832.

levels were adequate to meet constitutional obligations.²² We might therefore hypothesize that states with explicit performance targets for districts and schools would be more likely to provide the requisite resources to ensure that all districts can meet these standards. Lee and Wong²³ term this effect an “input driven” policy-outcome path in which accountability policies affect the level of school resources, which in turn affect student achievement. Additionally, they suggest an “equity-related” path in which accountability policies induce states to take steps to reduce racial and socioeconomic resource inequalities.²⁴

Second, accountability systems often focus on the population of students scoring below designated performance benchmarks. To the extent that accountability efforts induce states to target additional resources to students with the lowest performance levels, we might expect to find improvements in resource adequacy over the period. Conversely, if accountability measures lead states to focus additional resources on districts with students most likely to meet new standards, resource equity could worsen.

Third, the increased emphasis on measuring and reporting student performance could result in a funding “arms race” as districts increase spending to achieve or maintain high levels of performance. Because not all school districts will be equally capable of increasing spending, we might expect accountability efforts to worsen equity as wealthier districts compete to provide additional programs aimed at improving test scores, and by providing a disincentive for teachers to work in high-need districts.²⁵

Finally, accountability regimes may have indirect effects on school finance, by enhancing calls for fiscal accountability along with performance accountability,²⁶ or by increasing housing prices in districts reporting high test scores,²⁷ potentially worsening housing segregation and therefore school resource inequality.²⁸

Given the unanswered questions in the literature, we address three primary research issues: First, how did the equity and adequacy of education funding change during the 1990s? Second, what is the relationship between state accountability implementation and educational resource adequacy and equity? Third, what other factors are related to changes in resource adequacy and equity?

22. Ladd and Hansen (1999).

23. Lee and Wong (2004).

24. Note that while *No Child Left Behind* requires states to report student performance by subgroups, states were not required to do so before the federal law.

25. William S. Koski and Rob Reich, “When ‘Adequate’ Isn’t: The Retreat from Equity in Educational Law and Policy and Why It Matters” (Palo Alto, CA: Stanford University, unpublished manuscript, 2006); C. T. Clotfelter, H. F. Ladd, J. L. Vigdor, and R. A. Diaz, “Do School Accountability Systems Make It More Difficult for Low-Performing Schools to Attract and Retain High-Quality Teachers?,” *Journal of Policy Analysis and Management* 23, no. 2 (2004): 251–271.

26. D. J. Hoff, “States to Get New Options on NCLB,” *Education Week* 24, no. 31 (2005): 1, 38.

27. D. N. Figlio, “School Funding and School Accountability,” in *Helping Children Left Behind: State Aid and the Pursuit of Educational Equity*, ed. John Yinger (Cambridge, MA: MIT Press, 2004): 87–110.

28. Koski and Reich (2006)

DATA AND MODELS

Data Sources

The primary data for our analyses come from the *Unified Fiscal-Nonfiscal* (UFNF) data set, which combines 11 years (1989–1990 to 1999–2000) of fiscal and nonfiscal data from the National Center for Education Statistics (NCES) Common Core of Data (CCD). The fiscal data include information on per-pupil expenditures and revenues for every school district by source and function. The nonfiscal data include information on student characteristics such as race, special education eligibility, and free lunch eligibility. The UFNF file is particularly useful for panel data analysis because it contains a “pseudo-district” variable. For nonunified districts (i.e., elementary or secondary schools only), NCES combines data from elementary districts with the secondary districts to which they are linked to form a unified K–12 pseudo-district. To create comparable district- and state-level observations, we exclude Hawaii and the District of Columbia (which each have only a single school district), as well as districts reporting enrollments below 50 pupils or per-pupil expenditures < \$500. The latter set of exclusions results in elimination of between 155 districts (1990) and 427 districts (1998) per year. Most of the deleted school districts were not open in that particular year.²⁹

The analyses focus on the distribution of per-pupil expenditures for elementary and secondary education. To adjust for differences in purchasing power over time we deflate all expenditures using the Consumer Price Index for urban consumers (CPI-U) from the Bureau of Labor Statistics for each school year.³⁰ To adjust for differences in input prices across districts that affect school district spending, we adjust each district’s expenditures by a district-specific Comparable Wage Index (CWI). The CWI uses hedonic models to estimate the cost of hiring teachers and purchasing other supplies, controlling for teacher characteristics and factors, such as amenities and labor market conditions, outside the control of school districts. A year-specific CWI is available only for 1997 and later years. In the interest of simplicity and to facilitate interpretation, we use the 1997 CWI to adjust for geographic differences for all years.³¹

Accounting for differential student needs is critical to the analysis of vertical equity and resource adequacy. Vertical equity examines the inequality in resources across districts, considering the extent to which higher per-pupil spending is found in districts serving higher proportions of students with special needs.³² Similarly, adequacy requires that resources be sufficient to meet the needs of each student, which may vary consid-

29. Note that due to district consolidations and closings, the data contain different numbers of school districts each year. Our regression analyses aggregate data to the state level, resulting in a balanced panel of 48 states each year.

30. The base year is 1989–1990.

31. To the extent that differentials in the cost of education have changed unevenly across districts over time, the index may over- or underestimate cost differences in some districts.

32. Berne and Stiefel (1984).

erably across districts.³³ To account for these cost differences, we create weighted student counts reflecting estimated differences in the cost of educating students with special needs. Specifically, the UFNF includes data on students with an individualized education plan (IEP) to indicate eligibility for special education services, and the percentage of students eligible for free or reduced price lunch, indicating that the student is from a low-income household.

The appropriate additional funding required to educate students with special needs has been the subject of considerable controversy in litigation, policy, and academic research.³⁴ While 16 states use pupil weights in their formulas to distribute state aid to districts, these weights are often derived on an ad hoc basis and are typically well below the weights estimated through cost studies.³⁵

Our data include no information on student test scores or other performance measures; therefore we cannot independently estimate student weights. Evidence on the additional costs of educating students with special needs has accumulated from numerous empirical studies, though, and we draw on these analyses for our adjustments. Ideally, we would have a district-specific cost index estimating the relative costs facing each district in the country, accounting for both geographic and student-need differences. No such comprehensive national index currently exists. Instead, we combine the CWI created by Taylor and Fowler,³⁶ with student-need weights estimated by Duncombe and Yinger.³⁷ Duncombe and Yinger estimate a cost function for New York State districts, using a weighted average of pass rates on elementary and secondary math and reading tests as output measures and setting the performance target at New York State's average performance in 2000.^{38,39} We use a weight of 1.55 for students eligible for free lunch and 1.88 for students receiving special education services, as estimated by Duncombe and Yinger, to create cost-adjusted per-pupil expenditures for each district.⁴⁰

33. Duncombe and Yinger (1997); W. D. Duncombe and J. M. Yinger, "How Much More Does a Disadvantaged Student Cost?," *Economics of Education Review* 24, no. 5 (2005): 513–532.

34. See, for example, J. M. Yinger, ed., *Helping Children Left Behind: State Aid and the Pursuit of Educational Equity* (Cambridge, MA: MIT Press, 2004); Duncombe and Yinger (2005); Chambers (1998); Guthrie and Rothstein (2001).

35. Yinger (2004).

36. L. L. Taylor and W. J. Fowler, Jr., *A Comparable Wage Approach to Geographic Cost Adjustment* (NCES 2006–321) (Washington, DC: United States Department of Education, National Center for Education Statistics, 2006).

37. Duncombe and Yinger (2005).

38. See Duncombe, Lukemeyer, and Yinger (2003) and Duncombe and Yinger (2005) for more details on construction of the cost index.

39. Average performance implies, of course, that many districts failed to meet the standard. The lower performing districts were largely concentrated in the state's urban areas.

40. Duncombe and Yinger's estimate of special education costs identifies special education students as students receiving services outside their classroom for more than 60 percent of the day. Our analyses identify special education students as those having IEPs. To the extent that some students in our data have lower costs than those identified by Duncombe and Yinger, our data may overestimate the costs associated

Using the cost-adjusted district-level expenditure data, we calculate dispersion measures and an adequacy measure for each state in each year. To measure dispersion, we focus on the Gini coefficient, with additional sensitivity checks using the coefficient of variation (CV) and McLoone index. The Gini coefficient is the ratio of the area between a 45 degree line reflecting a perfectly equal distribution and the area below a Lorenz curve measuring the actual distribution. The Gini varies from 0 (perfect equality) to 100 (complete inequality). The CV is calculated by taking the square root of the variance of per-pupil expenditures divided by the mean per-pupil expenditure.⁴¹ Like the Gini coefficient, lower values indicate greater resource equality across districts. The McLoone index is defined as the ratio of the total amount spent on students below each state's median expenditure level relative to spending on these students if they received the median funding level. The underlying assumption in the case of the McLoone index is that perfect equity would be achieved if every student below the median received the same per-pupil expenditure amount as the median student. The index ranges from a value of 0–100 with higher values indicating greater equity.

To measure adequacy we use the Odden-Picus Adequacy Index (OPAI). The OPAI measures how far a school finance system is from achieving an “adequate” level of spending. It is constructed as the ratio of spending on students in districts below a given adequacy benchmark divided by spending required to achieve the adequacy benchmark.⁴² To achieve an OPAI of 100 requires that all districts in the state spend at or above the benchmark, taking into account differential costs across districts.

There is no generally accepted benchmark to define an “adequate” level of spending. The benchmark we adopt for our analyses is the cost-adjusted national median of elementary and secondary expenditures for each year. A review of various methods to assess adequacy suggest that the estimates are often very close to the national spending median and that raising spending to the median could result in innovative school reform initiatives being adequately funded.^{43,44} Because there is no generally accepted benchmark, though, we also conduct sensitivity analysis at a variety of other spending levels.

(footnote Continued)

with special education. As described below, however, we also test the sensitivity of the results to other weights.

41. Berne and Stiefel (1984).

42. A. R. Odden and L. O. Picus, *School finance: A Policy Perspective*, 2nd ed. (New York: McGraw-Hill, 2000).

43. A. R. Odden and C. Busch, *Financing Schools for High Performance: Strategies for Improving the Use of Educational Resources* (San Francisco: Jossey-Bass, 1998); A. R. Odden and W. Clune, “School Finance Systems: Aging Structures in Need of Repair,” *Educational Evaluation and Policy Analysis* 20, no. 3 (1998); Rubenstein (2002); R. Rubenstein, “National Evidence on Racial Disparities in School Finance Adequacy,” in *Developments in School Finance, 2001–03*, ed. William J. Fowler, Jr. (prepared for the National Center for Education Statistics). (Washington, DC: National Center for Education Statistics, 2003).

44. All dispersion and adequacy measures are weighted by district enrollment, i.e., we use a student level of analysis, as is the norm in the measurement of school finance equity and adequacy.

In most states, distribution of aid to school districts is through a foundation grant program, guaranteeing every district a minimum spending “floor” provided they levy a minimum property tax rate.⁴⁵ Adjustments for cost of living and student needs may be included to produce a higher foundation in districts facing higher costs. In theory, the OPAI measures a concept similar to a foundation formula—whether the resources in all districts are sufficient to provide a base level of educational services, accounting for differences in educational costs across districts.

In the context of a national study with relatively aggregate measures of student and district characteristics, it may not be possible to fully capture all costs that lead to higher or lower district spending. The weights used in this study represent the best available estimates of the effects of common cost factors affecting school district spending. Similarly, the OPAI reflects an estimated benchmark for districts to achieve adequacy, adjusted for these cost factors. Achieving the cost-adjusted OPAI does not, however, guarantee high performance for all students. Because our models are dependent on cost estimates and expenditure benchmarks derived in previous literature, we test the sensitivity of our results to numerous cost-factor estimates and adequacy benchmarks.

For each state in each year we include a dichotomous “accountability” variable, indicating whether the state had an accountability system in that year. The information is obtained from a survey conducted by the Center for Research on Education Outcomes (CREDO) in 2001. This survey reports information on the year in which states implemented their accountability systems. The variable takes a value of “0” for each year in which a state had not implemented an accountability system and “1” for the year in which a state implements the accountability system.

Model

At the heart of our empirical work is a model that relates the equity or adequacy of spending in state s in time t to the introduction of an accountability system. The model includes a vector of state demographic characteristics, other state policies, and state and time fixed effects, to control for time invariant characteristics of the states and common macroeconomic shifts affecting all states:

$$Y_{st} = f(A_{st}, S_{st}, L_{st}, d_s, g_t) \quad (1)$$

where s indexes states and t indexes years, Y is a measure of dispersion or adequacy, A is a dichotomous variable where 1 = accountability system implemented in state s in year t , S the statewide student and other demographic characteristics, L the successful school finance litigation in state s in year t , d the state fixed effects, and g the time fixed effects.

The goal of this model is to isolate the impact of accountability standards on the equity and adequacy of spending within states. The fixed-effects design is used to minimize potential bias from omitted variables. The state fixed effects capture time-invariant

45. Yinger (2004).

but unobserved characteristics of states that may affect adequacy and equity (e.g., a state political culture that places a high value on equity), while the time fixed effects capture changes over time that affect all states (e.g., changes in the national economy).

While the literature examining the demand for education is fairly well developed (particularly at the district level), there is relatively little research examining the determinants of state-level equity or adequacy. Murray, Evans, and Schwab⁴⁶ estimate a reduced-form model to explain within-state spending inequalities that includes state and year effects along with measures of school finance reform and litigation. Alternative specifications of their model include within-state dispersion in district demographic variables such as median income, race, educational attainment, age, and enrollment.⁴⁷ Stiefel and Berne⁴⁸ include state-level measures of personal income and educational attainment as determinants of equity. Moser and Rubenstein⁴⁹ examine correlates of funding inequality, including the number districts in each state, funding level and percentage of funding from the state.

Drawing on this work, we control for other observable state demographic characteristics that could be linked to funding equity and adequacy. Three variables—the percentage of students who are black, Hispanic, and eligible for free and reduced price lunch (which serves as a proxy for poverty) are available in each year at the district level. Thus, we include a measure of the statewide dispersion across districts of these characteristics (coefficient of variation) on the theory that an unequal distribution of student characteristics may be related to an unequal distribution of resources. Other demographic characteristics that could affect equity and adequacy (the percentage of housing units that are owner-occupied, the percentage of households with income below the national poverty line, the percentage of the population over 65 years old, state median household income) and the size of the education system (elementary and secondary enrollment) are available from the Census Bureau only at the state level for each year.⁵⁰ While our primary interest is in the effects of accountability, the control variables may also shed light on other correlates of equity and adequacy. Because court-imposed education finance reforms have previously been found to significantly reduce inequalities in funding within states,⁵¹ we estimate an additional model that includes a dichotomous variable representing court-ordered finance reform in each state in each year.

46. S. E. Murray, W. N. Evans, and R. M. Schwab, "Education-Finance Reform and the Distribution of Education Resources," *The American Economic Review* 88, no. 4 (1998): 789–812.

47. District demographic variables are available only from the decennial census, therefore their alternative models use only three years of data (1970, 1980, and 1990).

48. L. Stiefel and R. Berne, "The Equity Effects of State School Finance Reforms: A Methodological Critique and New Evidence," *Policy Sciences* 13, no. 1 (1981): 75–98.

49. Moser and Rubenstein (2002).

50. Thus dispersion of these measures across districts in each state cannot be calculated. As is conventional, we include the latter two variables in logarithmic form.

51. Evans, Murray, and Schwab (1997); Murray, Evans, and Schwab (1998).

TABLE 1
State Descriptive Statistics—Demographic and Financial Measures: All States 1989–1990 to 1999–2000 (N = 480)

Variable	Mean	Standard deviation
Black students (%)	14.19	13.21
Hispanic students (%)	7.57	10.50
Free-lunch students (%)	27.09	9.23
Home ownership rates (%)	67.77	5.08
Enrollment (#)	905,789	969,363
Household income	\$36,161	\$6,002
Below poverty (%)	12.92	3.83
Over 65 years (%)	12.81	1.73
Per-pupil expenditure, nominal	\$5,412	\$1,317
Per-pupil expenditure, cost and inflation adjusted	\$3,434	\$721
Accountability (y/n)	0.331	0.471
Gini coefficient	8.73	3.09
McLoone index	89.36	4.60
Odden-Picus Adequacy Index (OPAI)	94.44	7.77

Note: Cost adjustments were made using the CWI from NCES; inflation adjustments use the CPI_U, with 1989–1990 the base year.

Source: Authors' calculations from UFNF CCD and Census data.

Table 1 displays means and standard deviation for the variables in our models over 11 years. The dispersion measures are calculated using expenditures that have been adjusted for geographic cost differences, inflation, and differential student needs. The value of this variable is comparatively low not only because all the expenditure variables are in 1990 dollars, but also because weighting for student needs increases the student count, which in turn decreases average per-pupil expenditures.

EMPIRICAL RESULTS

Adequacy and Equity Trends

Table 2 summarizes the adoption of accountability systems in states during the 1990s. Up to 1992, only one state (Connecticut) had a formal accountability system in place, as characterized by the CREDO data. The drive to adopt and implement such systems gained momentum after 1995 and by the year 2000, nonaccountability states numbered only 10.⁵²

Figure 1 presents a comparison of the Gini coefficient by state in 1990 and 2000. The 45° line indicates equivalent values across the two years. As evident from the graph,

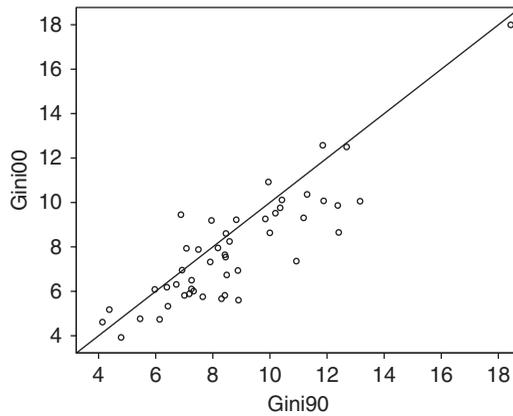
52. The states are—AL, HI, ID, IL, IA, NE, NM, ND, SD, and UT.

TABLE 2
Number of States with Accountability Systems by Year

Year	States with accountability	States without accountability
1989–1990	1	49
1990–1991	1	49
1991–1992	1	49
1992–1993	4	46
1993–1994	6	44
1994–1995	10	40
1995–1996	14	36
1996–1997	19	31
1997–1998	27	23
1998–1999	37	13
1999–2000	40	10

Source: CREDO (2001).

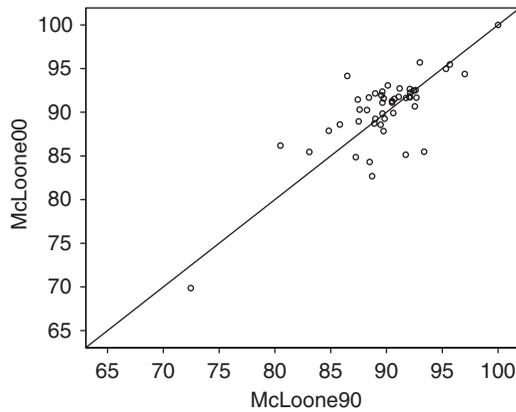
FIGURE 1
Comparison Graph of the Gini Coefficient—1990 and 2000



Note: Gini ranges from 0 to 100. Lower values indicate greater equity. The 45° line indicates no change in the Gini between years.

equity improved in 32 of the 48 states over the decade (states below the 45° line), as measured by the Gini coefficient. Of the 16 states showing declining equity over the 11 years, three (ID, IA, and UT) had no accountability system in place by 2000. Also note the stark differences in measures across states. For example, Nevada’s Gini coefficient was below 5 in each year, while New York is close to 21 in each year. Values in a majority of the states lie within 5 and 12 in most years. To examine the sensitivity of the results to

FIGURE 2
Comparison Graph of the McLoone Index—1990 and 2000



Note: McLoone index ranges from 0 to 100. Higher values indicate greater equity. The 45° line indicates no change in the index between years.

other measures of equity, we also calculate the coefficient of variation (CV) for each of the states from 1990 to 2000.⁵³ The trends for the coefficient of variation over 11 years mirror in most cases the trends exhibited by the Gini coefficient with 37 of 48 states exhibiting declining disparities.

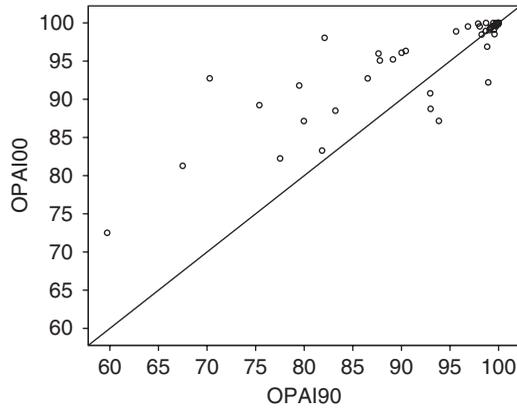
Figure 2 presents the McLoone index for each state in 1990 and 2000 and presents a similar trend. Slightly more than half of the states (27) display an improvement in equity over the decade as measured by this indicator. The remaining states generally show only slight declines.

Figure 3 presents adequacy statistics for each state using adjusted per-pupil expenditures. An OPAI value of 100 indicates that all the districts in the state have an adjusted per-pupil spending at or above the national median.⁵⁴ The graph indicates a clustering of states in both 1990 and 2000 at the upper end of the scale, signifying a relatively high degree of adequacy. In 1990, three states have an OPAI of 100 whereas, in 2000, the number rises to 10. For example, both Wisconsin and Wyoming have an OPAI value of 100 in both 1990 and 2000, indicating that cost-adjusted current per-pupil expenditures for all the school districts in Wisconsin and Wyoming were higher than the national medians in 1990 and 2000, respectively. The two states with the lowest OPAI values in 1990—Tennessee and Mississippi with values of 67.49 and 59.72—both made large improvements by 2000, but remained at the bottom of the list with values of 81.29 and 72.51, respectively.

53. Figure not shown but available from the authors.

54. The cost-adjusted national median for 1990 and 2000 are \$2,974 and \$3,246, respectively.

FIGURE 3
Comparison Chart of the Odden-Picus Adequacy Index—1990 and 2000



Note: Odden-Picus Adequacy Index ranges from 0 to 100. Higher values indicate greater adequacy. The 45° line indicates no change in the index between years.

Regression Results

Table 3 shows parameter estimates from four different specifications of the model with the Gini coefficient as the dependent variable.⁵⁵ All regression models use least squares regression weighted by state student enrollment. Column 1 presents a parsimonious model that includes a time trend variable, state fixed effects, and the accountability indicator.⁵⁶ The results show that the Gini coefficient decreased over the decade, indicating a greater degree of interdistrict equity within states. The implementation of state accountability systems, however, had no significant effect. Column (2) reports results from our complete model with control variables. While accountability is again insignificant, the estimates on the controls provide some interesting insights. The dispersion across districts for two of the three student characteristic variables are significantly related to lower levels of equity; that is, increases in the dispersion of black students and low-income students are all related to widening inequity. We also test this specification using the statewide means rather than the CVs of the control variables (not shown in tables). The coefficients on the controls are smaller and only the Hispanic variable is significant, suggesting that the distribution of students across districts is a stronger predictor of school funding equity within states than are average statewide student characteristics. This pattern may not be surprising—while we might not expect, a priori, to find greater resource inequality within a state with a high percentage of African-Amer-

55. All tables report robust standard errors.

56. Home ownership rates are unavailable in 1991 therefore we delete the 48 observations for this year leaving a balanced panel with $N = 480$ in all the regressions.

TABLE 3
Correlates of State Level Interdistrict Equity Measured with Gini Coefficient, 1990–2000
(N = 480)

	(1)	(2)	(3)	(4)
Time trend	-0.055*** (0.016)	-0.026 (0.022)	-0.034* (0.020)	-0.010 (0.023)
Accountability	-0.008 (0.110)	-0.075 (0.111)	N	-0.097 (0.111)
Accountability strength		N	0.010 (0.127)	N
Litigation			N	-0.414** (0.199)
Participant black (CV)		0.657** (0.285)	0.614** (0.284)	0.729** (0.296)
Participant Hispanic (CV)		0.330 (0.281)	0.340 (0.281)	0.300 (0.287)
Participant free lunch eligible (CV)		3.121** (1.060)	3.092** (1.067)	3.243** (1.041)
Home ownership rate		-0.015 (0.019)	-0.016 (0.019)	-0.015 (0.019)
Participant below poverty		0.021 (0.023)	0.021 (0.023)	0.027 (0.023)
Participant population over 65 years		0.488** (0.174)	0.482** (0.173)	0.587*** (0.173)
Household income (log)		0.535 (0.709)	0.436 (0.720)	0.611 (0.702)
Student enrollment (log)		0.429 (0.982)	0.426 (0.992)	0.395 (0.999)
R ²	0.9542	0.9567	0.9567	0.9578

Notes: Robust standard errors in parentheses. All regressions include state and time fixed effects and are weighted by district enrollment.

*Significant at the 0.10 level.

**Significant at the 0.05 level.

***Significant at the 0.001 level.

ican students, we might expect to find greater resource inequality in a state with a more unequal distribution of African-American students across districts. States with growing percentages of senior citizens also exhibit declining equity (higher Gini coefficient).

To test the sensitivity of our results to the inclusion of other possible determinants of equity and adequacy, we present two alternate specifications. In column (3) we distinguish between stronger and weaker accountability systems. As noted above, Hanushek

and Raymond⁵⁷ categorize accountability regimes into two types: consequential and report card. We create a new variable named “strength” and code it “1” for consequential accountability states and “0” for all others. The results for the regression with the Gini coefficient as the dependent variable (column 3 in Table 5) are similar to those in the first two model specifications. While the accountability coefficient becomes positive, it remains insignificant. The same control variables remain significantly negatively related to equity.

In column (4) we add a “litigation” variable to test the impact of court-ordered finance reform.⁵⁸ The litigation variable is coded “0” for a state with no litigation, pending litigation, or a decision in favor of the state, and “1” for states in which the state lost a challenge to its funding system in the highest state court. Similar to Evans, Murray, and Schwab⁵⁹ and Murray, Evans, and Schwab,⁶⁰ we find that successful school finance litigation is related to improved equity. The effect is relatively small, however, with a coefficient of $-.414$, or approximately one-seventh of a standard deviation. This result is noteworthy, though, because the previous work examined the years 1972–1992, while this analysis examines 1990–2000, suggesting that litigation continued to be an effective tool for addressing inequities across districts. As a further test for the robustness of our results, we estimate these four models using the coefficient of variation rather than the Gini coefficient as the dependent variable. The results, available from the authors, are qualitatively similar to those using the Gini coefficient; all significant coefficients remain significant with identical signs.

Table 4 presents results from four identical specifications using the McLoone index as the dependent variable. Note that in this table a positive coefficient indicates a higher level of equity. In this case, we see no significant trend in equity until we include the covariates. The results in column (2) show worsening equity over the period, as measured by the McLoone index. Greater inequality in the distribution of Hispanic students and students eligible for free lunch is related to greater inequity in funding. Among the other control variables, home ownership rates are significantly related to improved equity while the percent of population above 65 years is again related to greater inequity. The results in column (3) are largely the same as in column (2). While the “consequential accountability” variable is positive and larger than the accountability variable in column (2), it is not significant. Finally, column (4) presents the results from the complete model with the litigation variable. Unlike the analyses using the Gini coefficient and coefficient of variation, we find no significant relationship between successful litigation and equity as measured by the McLoone index.

Table 5 presents the parameter estimates from four specifications using the OPAI as the dependent variable. The time trend in column (1) is positive and significant, indi-

57. Hanushek and Raymond (2005).

58. Evans, Murray, and Schwab (1997).

59. *Ibid.*

60. Murray, Evans, and Schwab (1998).

TABLE 4
Correlates of State Level Interdistrict Equity Measured with McLoone Index, 1990–2000
(N = 480)

	(1)	(2)	(3)	(4)
Time trend	–0.041 (0.038)	–0.101** (0.047)	–0.122** (0.045)	–0.120** (0.051)
Accountability	–0.093 (0.025)	–0.077 (0.260)	N	–0.051 (0.260)
Accountability strength			0.226 (0.259)	N
Litigation			N	0.485 (0.430)
Participant black (CV)		1.295 (0.867)	1.120 (0.864)	1.209 (0.889)
Participant Hispanic (CV)		–1.895** (0.750)	–1.863** (0.744)	–1.866** (0.754)
Participant free lunch eligible (CV)		–6.460** (2.621)	–6.417** (2.573)	–6.598** (2.593)
Home ownership rate		0.147** (0.048)	0.148** (0.047)	0.147** (0.048)
Participant below poverty		0.038 (0.054)	0.037 (0.053)	0.031 (0.055)
Participant population over 65 years		–0.636* (0.381)	–0.653* (0.377)	–0.753** (0.380)
Household income (log)		–0.916 (1.494)	–1.235 (1.509)	–1.014 (1.487)
Student enrollment (log)		–1.051 (2.176)	–1.142 (2.181)	–1.019 (2.231)
R^2	0.9158	0.9210	0.9209	0.9215

Notes: Robust standard errors in parentheses. All regressions include state and time fixed effects and are weighted by district enrollment.

*Significant at the 0.10 level.

**Significant at the 0.05 level.

cating improving adequacy over the period. Column (2) reports results from our complete model with all control variables and shows no significant relationship between accountability and adequacy. A wider dispersion of black students is related to greater adequacy, as is the state’s home ownership rate, while poverty, the size of the state’s school enrollment, household income, and more senior citizens are all related to lower levels of adequacy. The third column of Table 5 suggests, though, that the definition of

TABLE 5
Correlates of State Level Adequacy Measured with Odden-Picus Adequacy Index,
1990–2000 (N = 480)

	(1)	(2)	(3)	(4)
Time trend	0.273*** (0.054)	0.388*** (0.078)	0.330*** (0.074)	0.373*** (0.081)
Accountability	0.531 (0.351)	0.156 (0.325)	N	0.177 (0.330)
Accountability strength			1.178** (0.484)	N
Litigation			N	0.388 (0.630)
Participant black (CV)		6.198*** (1.719)	5.560*** (1.580)	6.133*** (1.721)
Participant Hispanic (CV)		–2.247 (1.609)	–2.142 (1.554)	–2.218 (1.592)
Participant free lunch eligible (CV)		1.956 (2.891)	2.424 (2.873)	1.853 (2.876)
Home ownership rate		0.187** (0.094)	0.193** (0.093)	0.188** (0.094)
Participant below poverty		–0.220*** (0.061)	–0.225*** (0.062)	–0.226*** (0.062)
Participant population over 65 years		–2.145*** (0.657)	–2.192*** (0.674)	–2.239*** (0.673)
Household income (log)		–6.135** (2.999)	–7.124** (3.051)	–6.209** (2.989)
Student enrollment (log)		–17.921*** (4.186)	–18.460*** (4.104)	–17.914*** (4.232)
R ²	0.9100	0.9256	0.9269	0.9257

Notes: Robust standard errors in parentheses. All regressions include state and time fixed effects and are weighted by district enrollment.

**Significant at the 0.05 level.

***Significant at the 0.001 level.

accountability matters. When accountability states are defined only as those with consequential accountability systems, accountability is significantly positively related to adequacy even when the model includes the control variables. The size of the coefficient (1.178) suggests a moderate effect on adequacy of approximately one-sixth of a standard deviation. The signs and coefficients on the control variables are largely unchanged from the specification in column (2).

Given the recent focus on adequacy in state court challenges, it is surprising to note that we find no relationship between litigation and funding adequacy (column (4)).

Inclusion of the litigation variable also has little effect on the size of the accountability coefficient as compared with results without the litigation variable in column (2).⁶¹

We also test the sensitivity of the results to a variety of definitions of adequacy and student weights.⁶² We estimate four additional sets of regression analyses for the OPAI setting the adequacy level at the 25th percentile, the national mean and the 75th percentile of per pupil expenditures. The results from all the equations mirror the results presented in Table 5, though the distribution of free lunch students is positive and becomes significant when the adequacy level is set at the 75th percentile. To test the sensitivity of these results to alternative student weights, we estimate additional models for the Gini, McLoone, and the OPAI using adjustments of 1.2 for poverty and 2.3 for special education, as suggested by Parrish, Hikido, and Fowler.⁶³ We also estimate additional models using the 1.2 poverty weight from Parrish, Hikido, and Fowler⁶⁴ and 2.59 special education weights estimated by Reschovsky and Imazeki.⁶⁵ The results from the alternative weights largely mirror the results from our original analysis, with no changes in the significance of any variables.

DISCUSSION

This paper provides an analysis of the possible relationship between important school reform efforts of the 1990s and 2000s: school finance equity/adequacy and school accountability systems. We find that vertical equity and adequacy in school finance systems generally improved during the 1990s, particularly in the latter half of the decade. These trends were not uniform across the country though, as many of the states with the lowest OPAI values are in the South, even after adjusting for geographic cost differences. We do not find relationships between school finance equity and the implementation of ac-

61. The state fixed effects capture all unobserved unchanging state policies that may affect equity and adequacy. New policies enacted during the 1990s pose the threat of omitted variable bias if not included in the model. To assess this possibility, we estimated alternative models with dichotomous variables for states that enacted revenue limitations or expenditures limitations (TELS) during the 1990s (see D. R. Mullins and B. Wallin, "Tax and Expenditure Limitations: Introduction and Overview," *Public Budgeting and Finance* 24, no. 4 (2004): 2–15). The results from these alternative models are very similar to those presented in Tables 3–5. The accountability variable and the demographic control variables do not change sign or significance in any of the regressions that include the TEL variables. In most of these models, the size of the coefficients is almost identical to those in Tables 3–5. While the inclusion of the TEL variable does not account for all policy changes that have occurred during the period, these results suggest that they do not pose the threat of omitted variable bias. The full results are available from the authors.

62. Results are not shown in the tables but are available from the authors.

63. T. B. Parrish, C. S. Hikido, and W. J. Fowler, Jr., *Inequalities in Public School District Revenues* (Prepared for the National Center on Education Statistics), (Washington, DC: U.S. Department of Education, National Center on Education Statistics, 1998).

64. *Ibid.*

65. Reschovsky and Imazeki (2000).

countability policies. Instead, student demographics, particularly the dispersion of minority students and low-income students within states, appear to have a strong negative impact on funding equity. Although accountability appears largely unrelated to equity, we find evidence that successful litigation challenging state education-funding systems is related to a more equitable distribution of funding, as measured by the Gini coefficient and coefficient of variation.

We also find some evidence that the implementation of stronger accountability systems is related to improved resource adequacy. This pattern is similar to Hanushek and Raymond's⁶⁶ finding that consequential accountability had a positive effect on achievement when compared with weaker accountability states.

Why might we find these patterns? A common complaint about the federal *No Child Left Behind Act* is that it amounts to an unfunded mandate on school districts⁶⁷ and student performance is unlikely to improve substantially without improvements in the adequacy of resources. Our results suggest that state accountability efforts may, in fact, have coincided with efforts by states and school districts to improve the sufficiency of resources, particularly for lower-spending districts in states with high-stakes systems.⁶⁸ It is possible that states, recognizing the need to improve resource sufficiency began providing additional funding to low-spending districts following implementation of accountability programs.

It is interesting, though, that changes in accountability did not worsen or improve equity. It is possible that states and districts focused on providing a funding floor, rather than on changing the distribution of resources across districts and that higher-spending districts increased their spending as well. To the extent that additional resources were needed to improve student performance, these results, combined with Hanushek and Raymond's findings of improved performance in consequential accountability states, suggest that these states may have "put their money where their mouth is" by combining higher expectations for student performance with higher funding and let equity take its own course.

A more troubling pattern that emerges from this research is the effect of student demographics on funding equity. Our estimates suggest a strong relationship between unequal distributions of minority and poor students and more inequitable distributions of resources within states. This pattern remains even after controlling for national trends and time-invariant state characteristics. It suggests specific efforts, different from accountability implementation, need to be initiated in order to counter these patterns in inequity of resources.

66. Hanushek and Raymond (2005).

67. A. Reschovsky and J. Imazeki, "School Finance Reform in Texas: A Never Ending Story?," in *Helping Children Left Behind: State Aid and the Pursuit of Educational Equity*, ed. John Yinger (Cambridge, MA: MIT Press, 2004): 251–282.

68. Recall that the OPAI focuses on districts below benchmark spending levels.

The evidence presented in this paper provides an opportunity to examine whether major state education policy initiatives have worked at cross-purposes. The evidence suggests that imposing more stringent accountability for results may be working to provide adequate resources, but that these efforts appear to be providing little change in resource equity. Other initiatives are apparently needed if further reductions in inequity are a goal, but it is good news for many that accountability has not worsened equity.

With the federal government now requiring states to test students and hold schools accountable, it remains to be seen whether such a federal mandate will have a similar effect and spur other states to improve the adequacy of resources. To the extent that finance and accountability policies are formulated in tandem, the possibilities of achieving broad-based opportunities to learn may be greatly enhanced.

NOTES

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