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Applied Research Methods

Exploring district-level expenditure-to-performance ratios

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Summary

State education budgets have shrunk since the economic recession of 2007–09. During the 2012/13 school year 35 states provided less funding for education than they had five years earlier (Leachman, Albares, Masterson, & Wallace, 2016; Levin et al., 2012; Oliff, Mai, & Leachman, 2012). As a result, districts across the country are seeking ways to increase their efficiency by using fewer resources while maintaining or even improving education outcomes.

This study examines the expenditure-to-performance ratio, a measure that can be used along with other information to examine districts' use of resources as a proxy measure of efficiency. District expenditure-to-performance ratios offer a simple descriptive method of simultaneously assessing spending and student outcomes using publicly available data. However, expenditure-to-performance ratios can use different measures of expenditure and performance, and research has not always explicitly considered how variability in the choice of measures and of district characteristics (such as locale, student enrollment size, and student poverty status) can affect outcomes.

Conducted by Regional Educational Laboratory (REL) Northeast & Islands in partnership with the REL Northeast & Islands Northeast Rural Districts Research Alliance, this study used state department of education of data to create six expenditure-to-performance ratios, each calculated by dividing one of three district-level measures of per pupil expenditures by one of two district-level measures of performance. (For guidance on how to calculate these ratios, see this study's companion report, Ryan, Lavigne, Zweig, & Buffington, 2017). The six ratios were then used to rank the 98 sample districts in the example REL Northeast & Islands Region state.

Key findings:

- The rank of each district varied according to which of the six expenditure-to-performance ratios was being considered. A district might rank among the top 25 districts on one ratio but not on another.
- In the example state a district's rank on any ratio was often influenced more by the performance measure used—one was a measure of growth in student achievement and the other a static measure of student achievement—than by the expenditure measure. In other words, districts' ranks may show more movement when comparing ratios calculated using different measures of performance than when comparing ratios using different measures of expenditures.
- Nearly half (43) of the 98 districts ranked among the top 25 districts on at least one ratio, but only 8 districts ranked among the top 25 on all six ratios.

This study demonstrates how, at least within one state, conclusions about district efficiency may vary depending on which measures of expenditure and performance are considered. These findings provide states and districts with evidence about the extent to which any single expenditure-to-performance ratio alone can inform perceptions about district efficiency.

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Why this study?

State policymakers often want to know which districts are achieving the best student outcomes given their level of spending. Districts across the country are seeking ways to increase efficiency by maintaining or even improving education outcomes while using fewer resources. State education budgets have decreased, on average, since the U.S. economic recession of 2007–09 (Leachman, Albares, Masterson, & Wallace, 2016; Levin et al., 2012). During the 2012/13 school year 35 states provided less funding for education than they had five years earlier (Oliff, Mai, & Leachman, 2012).

One tool for comparing how efficiently districts within a state use resources in producing student outcomes is the expenditure-to-performance ratio (Boser, 2014).[1] This type of analysis has also been used to estimate the potential savings that could be achieved through school district consolidation, an issue of particular importance for small and rural districts (Jimerson, 2007; Rooney & Augenblick, 2009).

District expenditure-to-performance ratios allow for the simultaneous consideration of district spending and student outcomes through a simple descriptive method that uses publicly available data

District expenditure-to-performance ratios allow for the simultaneous consideration of district spending and student outcomes through a simple descriptive method that uses publicly available data. However, research about these types of ratios does not always explicitly consider how variability in the measures used to calculate the ratios and variability in district characteristics (such as locale, student enrollment size, and student poverty status) may lead to different conclusions about a district's ability to use resources efficiently to achieve student outcomes.

This question was raised by members of the Regional Educational Laboratory Northeast & Islands Northeast Rural Districts Research Alliance, who wanted to better understand whether the selection of some measures of expenditure and performance over others might influence the rankings of districts within a state. Thus, this study investigated how a district's perceived efficiency based on expenditure-to-performance ratios may vary with the measures used to calculate the ratios (see box 1 for definitions of key terms). Understanding such differences in how districts are perceived is relevant to both district practice and state policy.

Box 1. Key terms

Efficiency

Efficiency. The maximization of educational outcomes for a given quantity of inputs.

Enrollment

Student enrollment. An average of the headcount of students living within district boundaries during the 2012/13 school year (based on totals collected by districts on October 1 and April 1).

Measures of expenditures

Constructed per pupil expenditures. Total spending on 7 of the 11 expenditure categories reported by districts in the example state in 2012/13, divided by student enrollment. This measure includes spending on regular instruction, other instruction (including summer school and extracurricular instruction), student and staff support, system administration, school administration, operations and maintenance, and other expenditures and excludes spending

(continued)

Box 1. Key terms *(continued)*

on transportation, special education instruction, career and technical education instruction, and debt service and other commitments. This measure reflects interest among Northeast Rural District Research Alliance stakeholders in creating an expenditure-to-performance ratio that excludes expenditures that vary widely across districts—particularly across districts in different locales (for example, rural and urban).

Instructional per pupil expenditures. Total spending on 4 of the 11 expenditure categories reported by districts in the example state in 2012/13, divided by student enrollment. This measure includes spending on regular instruction, special education instruction, career and technical education instruction, and other instruction (including summer school and extracurricular instruction) and excludes spending on student and staff support, system administration, school administration, transportation, operations and maintenance, debt service and other commitments, and other expenditures.

Total per pupil expenditures. Total spending on all 11 expenditure categories reported by districts in the example state in 2012/13, divided by student enrollment. The 11 expenditure categories are regular instruction, special education instruction, career and technical education instruction, other instruction (including summer school and extracurricular instruction), student and staff support, system administration, school administration, transportation, operations and maintenance, debt service and other commitments, and other expenditures.

Measures of performance

Median student growth percentile in math. A summary of the median student growth rate in math in the district relative to the median growth rate in math in the state. For example, a median student growth percentile of 60 indicates that the performance of the median student in the district grew as much as or more than that of 60 percent of his or her peers in the state who had similar assessment score histories. Median student growth percentile is not an equal interval variable.

Percentage of students scoring proficient or above in math. The percentage of a district's students scoring proficient or above on the state standardized achievement assessment in math. Students are assigned to one of four proficiency categories (below basic, basic, proficient, or advanced) based on their assessment score.

State standardized achievement assessment. A statewide assessment used to measure students' academic knowledge and skills relative to the grade-level expectations for the state.

District characteristics

Locale. Census-defined classification system used to describe a school district's location. Codes are assigned based on the location of the district's central office and its proximity to an urbanized area (U.S. Department of Education, 2012).

City or suburb. City is a census-defined territory inside an urbanized area and inside a principal city that can be small (population less than 100,000), midsize (population less than 250,000 but greater than or equal to 100,000), or large (population greater than 250,000). Suburb is a census-defined territory inside an urbanized area and outside a principal city that can be small (population less than 100,000), midsize (population less than 250,000 but greater than or equal to 100,000), or large (population greater than 250,000).

(continued)

Box 1. Key terms *(continued)*

Town. Census-defined territory inside an urban cluster that is at least 10 miles outside of an urbanized area (can also be subcategorized as fringe, distant, or remote).

Rural. Any district falling within the three census-defined rural locale categories: rural fringe (rural territory that is less than or equal to 5 miles from an urbanized area or less than or equal to 2.5 miles from an urban cluster), rural distant (rural territory that is more than 5 miles but less than or equal to 25 miles from an urbanized area or more than 2.5 miles but less than or equal to 10 miles from an urban cluster), or rural remote (rural territory that is more than 25 miles from an urbanized area or more than 10 miles from an urban cluster).

District enrollment size. A district with a student enrollment of under 1,000 was considered small.

Student poverty status. The percentage of students in the district who are eligible for the federal school lunch program (a proxy for low-income status) as reported in the state data for 2012/13 and grouped in three categories: below 40 percent, 40–60 percent, and above 60 percent.

Source: Houck, Rolle, & He, 2010; Phan & Glander, 2008.

Understanding how a district's perceived efficiency based on expenditure-to-performance ratios may vary with the measures used to calculate the ratios is relevant to both district practice and state policy

What the study examined

The following research question guided this study:

- Do rankings of a state's districts based on expenditure-to-performance ratios vary when different measures of district expenditures or of district student performance are used to calculate the ratios? If so, how do they vary?

Six ratios were calculated using expenditure and performance data for the 2012/13 school year for each of the 98 K–12 districts with complete data in an example state in the REL Northeast & Islands Region. These six ratios were created from three measures of expenditures per pupil based on district enrollment[2] and two measures of performance (see box 2 for a summary of the study data and methods and appendix A for a detailed description). This study's companion guide offers additional guidance on how to calculate these ratios (Ryan et al., 2017).

Three measures of expenditures

The example state for this study reports 11 expenditure categories overall for each district: regular instruction, special education instruction, career and technical education instruction, other instruction (including summer school and extracurricular instruction), student and staff support, system administration, school administration, transportation, operations and maintenance, debt service and other commitments, and other expenditures. These 11 state expenditure categories were used to calculate three measures of expenditures per pupil.

Two of the measures are commonly used to examine district spending:

- Total per pupil expenditures, which includes all 11 expenditure categories, in dollars.

Box 2. Data and methods

The study used publicly available data from the state department of education's data warehouse on expenditures, performance, and district characteristics from K–12 districts in a state in the Regional Educational Laboratory Northeast & Islands Region for the 2012/13 school year. District locale data came from the National Center for Education Statistics' Common Core of Data for the 2011/12 school year, the most recent year available at the time of the analysis (U.S. Department of Education, 2012). Data on per pupil expenditures were gathered directly from the state data warehouse.

Data on expenditures, performance, and district characteristics were merged, based on a unique district identification number, into one dataset to generate descriptive statistics (see appendix A for further details about data processing; see appendix B for more information on the characteristics of the sample).

The percentage of district students scoring proficient or above on the state achievement assessment was calculated as the number of students who scored proficient or above divided by the number of students who took the assessment.

The study used ratios expressed as units of expenditures to performance outcomes. For each district each of the three measures of expenditures was divided by each of the two measures of performance, producing six expenditure-to-performance ratios. Districts were then rank ordered for each of the six ratios, where a rank of one is assigned to the highest ranked district. This report focuses on comparing the top 25 districts on each of the six rankings. A sensitivity analysis examined whether findings were sensitive to use of a smaller (top 20) or larger (top 30) set of highest ranking districts, but results are consistent regardless of which set is used (see appendix A).

- Instructional per pupil expenditures, which represents spending directly related to regular instruction, special education instruction, career and technical education instruction, and other instruction, in dollars.

Expenditure-to-performance ratios may have different implications depending on which expenditure measure is used

The third measure was constructed after guidance from the Northeast Rural Districts Research Alliance to represent expenditures that alliance members expected would vary less by locale (city, town, or rural), enrollment size, or students' poverty status:

- Constructed per pupil expenditures, which represents total expenditures excluding four types that tend to be higher in rural than in urban or suburban districts: special education instructional expenditures, transportation expenditures, technical education expenditures, and debt service expenditures, in dollars (Silvernail, 2006; Killeen & Sipple, 2000; Terman & Behrman, 1997).

Expenditure-to-performance ratios may have different implications depending on which expenditure measure is used. Ratios based on total per pupil expenditures reflect how much districts are spending in total to produce one unit of performance outcome. Ratios based on instructional per pupil expenditures address expenditure over which districts may have more control than they do over total expenditures (which include relatively fixed expenditures for transportation and special education instruction; Ladd, Chalk, and Hansen, 1999). Ratios based on constructed per pupil expenditures reflect the amount of district spending that may be less related to district locale (stakeholders in other locations may not find these two ratios useful under their own circumstances if the types of expenditures included in the constructed expenditure measure tend to vary less by district characteristics

than they do in the example state). By examining the three measures of expenditures, this study tests whether states and districts should consider the implications of using different types of expenditure measures when calculating expenditure-to-performance ratios.

Two measures of performance

The study used two performance measures to calculate expenditure-to-performance ratios:

- Median student growth percentile in math.
- Percentage of a district's students scoring proficient or above in math.

The measures were chosen from the publicly available measures of student performance used for state accountability purposes and in response to Northeast Rural Districts Research Alliance member input. These two performance measures were used to identify what difference in district ranking on the expenditure-to-performance ratio would result from using a growth measure or a proficiency measure (see box 1 for a more extensive definition and appendix A for a detailed description). To limit the number of ratios analyzed, the study used measures for only one subject, math. Math was selected because research using models of educator effectiveness suggest that math assessments may lead to more reliable measures of growth than assessments for other subject areas (Measures of Effective Teaching Project, 2012).

The two performance measures were used to identify what difference in district ranking on the expenditure-to-performance ratio would result from using a growth measure or a proficiency measure

District characteristics

Three district characteristics were examined:

- Locale (city/suburb, town, or rural).
- Student enrollment size. A district with student enrollment under 1,000 was considered small.
- Student poverty status, which is the percentage of students eligible for the federal school lunch program (a proxy for low-income status). Districts were grouped into three categories: below 40 percent, 40–60 percent, and above 60 percent.

District locale, student enrollment size, and student poverty status were chosen as district characteristics of interest because districts that are more rural, smaller in size, or with more poverty are commonly perceived by researchers and by policymakers as less efficient (Baker & Weber, 2016; Sipple, 2011). To test this perception, the study looked at whether districts in rural locales, districts with small student enrollment, and districts with high student poverty are systematically absent from among the most efficient districts in the state across all six expenditure-to-performance ratios.

Interpreting the expenditure-to-performance ratios

Each ratio is interpreted to mean that X dollars in spending are associated with a unit gain in the performance measure (see table 1 for all six calculations; see table B2 in appendix B for medians of each expenditure-to-performance ratio). As an example, for ratio A assume that a district has a total per pupil expenditure of $10,000 and a median student growth percentile of 50. The expenditure-to-performance ratio would then be $200 ($10,000/50), meaning that $200 in total per pupil spending is associated with a one-percentile point increase in the district's median student growth percentile. These ratios do not indicate cause and effect, but they provide a basis for comparing how conclusions about the relative efficiency of districts in a state may vary depending on the measures of expenditure and performance employed.

Table 1. Calculation of six expenditure-to-performance ratios

Ratio label	Expenditure measure	Performance measure	Ratio calculation
A	Total per pupil expenditures (dollars)	Median student growth percentile in math	Total per pupil expenditures (dollars) / Median student growth percentile in math
B	Total per pupil expenditures (dollars)	Percentage of district students scoring proficient or above in math	Total per pupil expenditures (dollars) / Percentage of district students scoring proficient or above in math
C	Instructional per pupil expenditures (dollars)	Median student growth percentile in math	Instructional per pupil expenditures (dollars) / Median student growth percentile in math
D	Instructional per pupil expenditures (dollars)	Percentage of district students scoring proficient or above in math	Instructional per pupil expenditures (dollars) / Percentage of district students scoring proficient or above in math
E	Constructed per pupil expenditures (dollars)	Median student growth percentile in math	Constructed per pupil expenditures (dollars) / Median student growth percentile in math
F	Constructed per pupil expenditures (dollars)	Percentage of district students scoring proficient or above in math	Constructed per pupil expenditures (dollars) / Percentage of district students scoring proficient or above in math

Note: See box 1 and appendix A for description of expenditure and performance measures.

Source: Authors' compilation.

The districts were then rank ordered on each of the six ratios, and the correlations between district rankings on the six ratios were calculated. A rank correlation measures the statistical dependence between two district rankings. A perfect rank correlation of 1 indicates that the rank-order of districts is identical across the two ratios being compared.

The six expenditure-to-performance ratios analyzed were positively but not perfectly correlated, and each ratio returned a different set of district rankings

What the study found

Each of the six expenditure-to-performance ratios resulted in a different ranking of districts. The rankings of these 98 districts were influenced more by the measures of performance than by the measures of expenditures. Only 8 of the 98 districts were ranked in the top 25 districts on all six ratios, and those 8 did not vary systematically from the other districts in characteristics related to locale, enrollment size, or student poverty status.

The six expenditure-to-performance ratios were not perfectly correlated, and each yielded a different ranking of districts

The six expenditure-to-performance ratios were positively but not perfectly correlated, and each ratio returned a different set of district rankings. It was hypothesized that ratios sharing a numerator (measure of expenditures) or a denominator (measure of performance) would be strongly, although not perfectly, correlated (that is, a correlation > .5 but less than 1; Cohen, 1988). As anticipated, the correlations between ratios were strong and positive, ranging from .47 to .93 (table 2). Nevertheless, these ratios were not perfectly correlated, so each provides somewhat different information about district expenditures as they relate to performance and yields a different ranking of districts.

In the example state the measure of performance influences districts' rankings more than the measure of expenditures does

The correlations between ratios that shared the measure of performance (denominator) were stronger than the correlations between ratios that shared the measure of expenditures (numerator). Ratios that share a measure of performance but have different measures of expenditures were highly correlated (coefficients from .79 to .91; see table 2). Ratios that have different measures of performance but the same measure of expenditures were more weakly correlated (coefficients from .61 to .65). So in this state, the choice of performance measure had a stronger influence on a district's rank than did the choice of expenditure measure.

Although nearly half of the districts examined ranked in the top 25 districts on at least one ratio, only 8 districts consistently ranked in the top 25 districts on all six ratios

In the example state the choice of performance measure had a stronger influence on a district's rank than did the choice of expenditure measure

To illustrate how different expenditure-to-performance ratios could lead to different conclusions about district efficiency, the study team examined how many districts that ranked among the top 25 on at least one ratio did so on all six ratios. Of the 98 districts 43 were ranked in the top 25 on at least one ratio, but only 8 were ranked in the top 25 on all six ratios (figure 1).

The eight districts ranking high on all six ratios differed in district characteristics (locale, enrollment, and poverty status), but they did not appear to vary systematically from the other districts in the study. Five of the eight districts were rural, with less than 60 percent of students eligible for the federal school lunch program (table 3). Only one of the eight districts had more than 60 percent of students eligible for the federal school lunch program (see appendix table B1 for the total number of districts in each locale, student enrollment

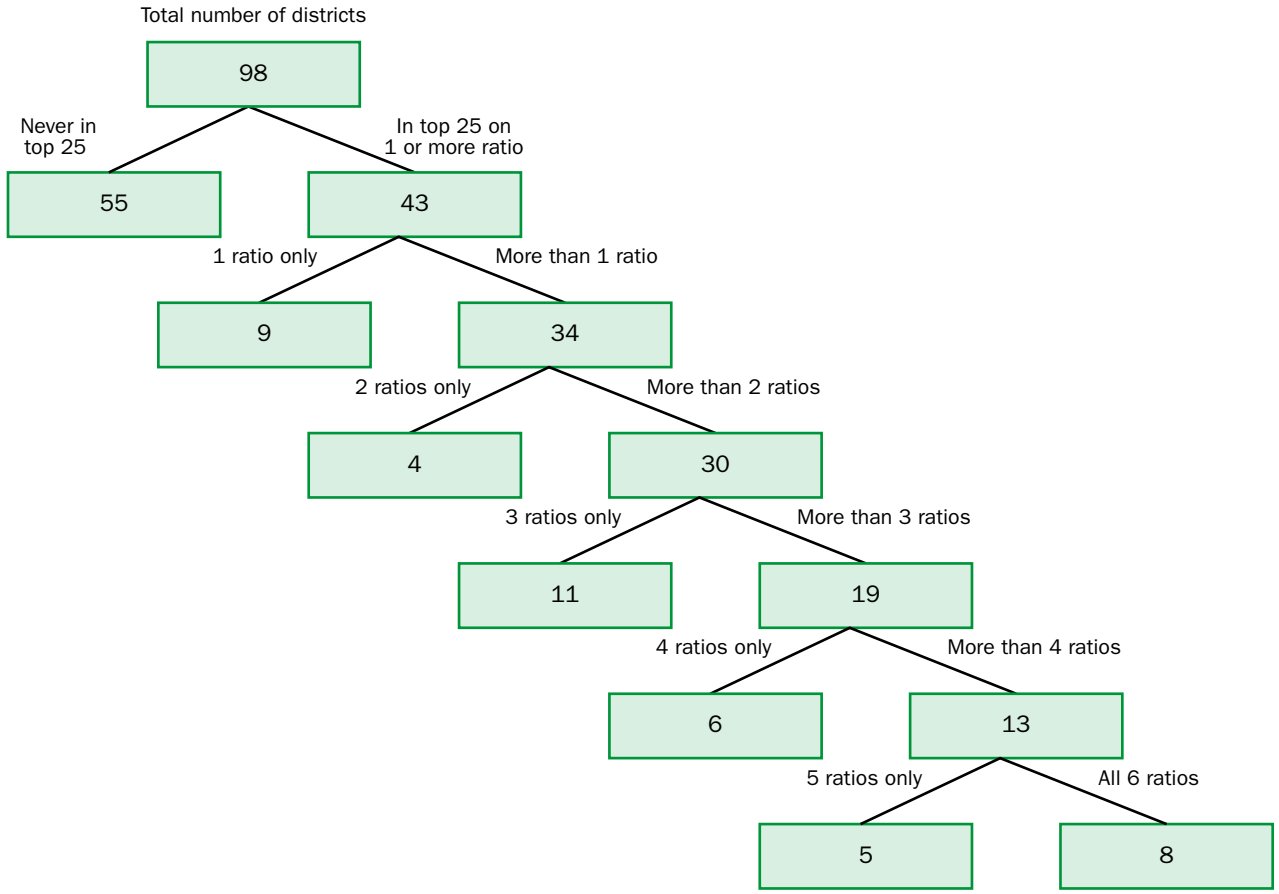
Table 2. Rank correlations for six expenditure-to-performance ratios, 2012/13

Ratio label	Expenditure to performance ratio	Ratio A	Ratio B	Ratio C	Ratio D	Ratio E	Ratio F
A	Total per pupil expenditures (dollars)/ Median student growth percentile in math			**.61**	**.84**	.58	**.91**	.59
B	Total per pupil expenditures (dollars)/ Percentage of district students scoring proficient or above in math			.47	**.90**	.54	**.93**
C	Instructional per pupil expenditures (dollars)/ Median student growth percentile in math				**.63**	**.79**	47
D	Instructional per pupil expenditures (dollars)/ Percentage of district students scoring proficient or above in math					.54	**.87**
E	Constructed per pupil expenditures (dollars)/ Median student growth percentile in math						**.65**
F	Constructed per pupil expenditures (dollars)/ Percentage of district students scoring proficient or above in math						

Note: Bolded green correlation coefficients share a common numerator. Bolded black correlation coefficients share a common denominator. Correlation coefficients are based on Spearman rank correlations. Tests of significance are not reported because correlations were calculated using the population of 98 K–12 districts with complete data.

Source: Authors' analysis of 2012/13 data for 98 K–12 districts with complete data from the website of the department of education of a state in the Regional Educational Laboratories Northeast & Islands Region.

Figure 1. Forty-three districts were ranked in the top 25 districts on at least one expenditure-to performance ratio, but only 8 were ranked in the top 25 on all six ratios, 2012/13



Source: Authors' analysis of 2012/13 data for 98 K–12 districts with complete data. Data on expenditure and performance, enrollment, and eligibility for the federal school lunch program from the website of the department of education of a state in the Regional Educational Laboratory Northeast & Islands Region; data on locale from U.S. Department of Education (2012).

Table 3. Characteristics of districts in the top 25 districts on all six expenditure-to-performance ratios, 2012/13

District	Average rank over six ratios	Locale	Student enrollment	Poverty status (percentage of students eligible for the federal school lunch program)
1	6	Town	2,000+	40–60
2	7	Rural	250–999	< 40
3	9	Town	2000+	> 60
4	13	Rural	1,000–1,999	< 40
5	15	Rural	2,000+	< 40
6	15	City or suburb	2,000+	40–60
7	17	Rural	250–999	40–60
8	21	Rural	2,000+	40–60

Source: Authors' analysis of 2012/13 data for 98 K–12 districts with complete data. Data on expenditure and performance, enrollment, and eligibility for the federal school lunch program from the website of the department of education of a state in the Regional Educational Laboratory Northeast & Islands Region; data on locale from U.S. Department of Education (2012).

size, and student poverty status category). The eight districts also varied in student enrollment, although none had enrollment below 250 students. Nevertheless, although the eight districts varied in the characteristics for which data were publicly available, it is possible that the eight districts varied systematically from other districts in ways that were not captured by this study.

Implications of the study findings

Conclusions about how efficiently districts use expenditures in relation to performance will likely vary depending on which measures of expenditure and performance are used. A common question from policymakers is "Which districts in the state are using resources most efficiently?" However, this study's findings suggest that a more appropriate question may be "Which districts are using specific types of resources (expenditures) most efficiently to produce particular student outcomes (performance)?" In other words, state policymakers may want to select the measures of expenditure and performance that are most relevant to the issues they are interested in.

The eight districts ranking high on all six ratios differed in district characteristics (locale, enrollment, and poverty status), but they did not appear to vary systematically from the other districts in the study

Two implications of this study stand out:

- The selection of performance measures may be especially important and could range from scores on achievement assessments (as used in this study) to school attendance and high school graduation rates.
- Descriptive evidence indicates that the 8 districts that appeared in the top 25 districts on all six expenditure-to-performance ratios varied in locale, enrollment size, and student poverty status. These 8 districts included one or more districts that were rural in locale, had a small enrollment size, or had a high percentage of student poverty. Thus, the most efficient districts do not appear to be determined solely by any of the district characteristics examined in this study. This study demonstrates that rural, small enrollment, and high-poverty districts do rank among the most efficient districts in their state, regardless of the expenditure-to-performance ratio that is used. So in addition to examining district rankings, it is equally important to look at what districts of all kinds are doing to achieve efficiency. Recent research has begun to examine how small, rural districts may be improving efficiency and success through such practices as community collaboration, creative leadership, and frugality (Roza & Heyward, 2015). Additional research, including site visits and interviews, might be helpful in discovering other practices related to resource use that are unique to these consistently high ranking districts.

To the extent that differences in district rankings appear to reflect contextual differences rather than differences in how districts are spending resources, it may be misleading to draw conclusions on the basis of any single ratio. Particularly when the results will be used for high-stakes decisionmaking, states should move beyond this type of descriptive analysis to analyses that statistically account for contextual differences among districts. Some states already create district reference or benchmark groups based on student and district characteristics. Comparing expenditure-to-performance ratios of districts within these groups could help determine how efficiently districts are spending resources.

Limitations of the study

This study has three main limitations.

- The districts included in the study were limited to K–12 districts, and the study relied on publically available data from a department of education website in a state in the REL Northeast & Islands Region and data from the Common Core of Data (U.S. Department of Education, 2012). Because expenditures tend to vary depending on the school district type (K–8 versus K–12), the study team did not include all districts from the example state and instead focused on K–12 districts. While this study may help state and district leaders think about which measures of expenditure and performance are most relevant for policy decisions and consider whether to explore how the use of different data affects the results, it does not represent an analysis of complete data from the example state and thus should not be seen as an assessment of statewide efficiency.
- The analyses reported here provide states and districts with an example of a straightforward approach to calculating expenditure-to-performance ratios and comparing the results using a ranking procedure. However, there are many systematic approaches to analyzing expenditure and performance (for example, see Lafortune, Rothstein, & Schanzenbach, 2016). If states or districts have the goal of using estimates for decisionmaking, they might consider using more formal modeling approaches and evaluating the sensitivity of the estimates obtained through those analyses before using them as a basis for high-stakes decisions (see Boardman, Greenberg, Vining, and Weimer, 2011; Hanushek, 2006; and Levin et al., 2012 for additional information).
- The analyses for this study are descriptive and cannot disentangle the influences of the use of different expenditure and performance measures from the district characteristics that were examined. Thus, causal conclusions cannot be drawn from this work. It should not be inferred that a district's expenditure-to-performance ranking is attributable to the components of any one ratio calculation or to one district characteristic (for example, that some districts can spend less for the same student outcomes because of their locale). However, these descriptive analyses illustrate the potential relevance of different measures in addressing research questions of interest. This type of analysis also shows states how they may use existing data to compare the ranking of districts on different expenditure-to-performance ratios.

The analyses for this study are descriptive; thus, causal conclusions cannot be drawn from this work

Appendix A. Data and methodology

This appendix describes the data and methodology used to address the research question.

Study population

The study included all 98 K–12 school districts in a state in the Regional Educational Laboratory Northeast & Islands Region for which expenditure and performance data was available from the state's department of education.

Data sources and measures

All data used in the study were publicly available from the state's department of education and the National Center for Education Statistics' Common Core of Data (U.S. Department of Education, 2012). Researchers used a district identification number as a unique identifier to merge data from the department of education and the Common Core of Data. To ensure that the merge had succeeded, the resulting data set was examined by district name.

Measures of expenditures. Per pupil expenditures by district enrollment for 2012/13 came from the state's education website, which reports per pupil expenditures by budget category. Eleven categories of expenditures are reported: regular instruction, special education instruction, career and technical education instruction, other instruction (including summer school and extracurricular instruction), student and staff support, system administration, school administration, transportation, operations and maintenance, debt service and other commitments, and other expenditures.

Researchers considered three expenditure measures based on the categories available: total per pupil expenditures, instructional per pupil expenditures, and constructed per pupil expenditures, each based on district enrollment. Total per pupil expenditures is equal to the sum of per pupil expenditures across all 11 reported categories for each district. Instructional per pupil expenditures refers to the categories related to instruction: regular instruction, special education instruction, career and technical education instruction, and other instruction. Constructed per pupil expenditures is the sum of expenditures for regular instruction, other instruction, student and staff support, system administration, school administration, operations and maintenance, and other expenditures based on the number of students within the district, excluding expenditures associated with transportation, special education, technical education, and debt service—costs that have been found to vary according to locale (Terman & Behrman, 1997).

Measures of performance. The state-based assessment system provides measures of growth and proficiency that the study used as performance measures: median student growth percentile in math for grades 4–8 and the percentage of students in grades 3–8 who scored proficient or above on the state math achievement assessment. Both performance measures were for 2012/13. The measures were chosen based on publicly available measures of student performance used for state accountability purposes and in response to Northeast Rural Districts Research Alliance member input. This study included both performance measures in order to identify any descriptive differences in rankings of districts that might emerge from the use of a growth measure compared with the use of a proficiency measure in calculating expenditure-to-performance ratios. The study used performance measures

for only one subject, math, to limit the number of ratios analyzed to six; including a second subject would have doubled the number of ratios. Math was selected rather than literacy because research from models of educator effectiveness suggests that math assessments may lead to more reliable measures of growth (Measures of Effective Teaching Project, 2012).

Student growth percentiles are based on performance over two consecutive years and are reported for each school and district in math and reading beginning with grade 4. A student growth percentile represents how much a student improved compared with a particular group of students with the same initial score. For example, a student growth percentile of 60 indicates that the student performed better, on average, than 60 percent of peers with the same previous score. The median student growth percentile for each district was obtained directly from the state's department of education website.

The percentage of students who scored proficient or above in math is equal to 100 times the total number of students who scored proficient or above in grades 3–8 divided by the total number of students who took the math assessment.

District characteristics. The study reported expenditure-to-performance ratios according to district characteristics including locale, student enrollment size, and student poverty status. District locale was categorized based on the Common Core of Data's 2011/12 locale codes, which are consistent with the locale codes used by the U.S. Census Bureau: city or suburb, town, rural fringe, rural distant, and rural remote (U.S. Department of Education, 2012). Rural fringe, rural distant, and rural remote categories were collapsed into a single rural locale category (see box 1 in the main report). The number of students in the district was also gathered from the state department of education for 2012/13; the categories for enrollment were based on the National Center for Education Statistics categories: less than 250, 250–999, 1,000–1,999, 2,000–4,999, and 5,000 or more. The top two categories were collapsed into a 2,000+ category because few districts in the state enroll 5,000 or more students (U.S. Department of Education, 2012).

District poverty status was determined based on the percentage of students eligible for the federal school lunch program, as reported by the state department of education. Districts were categorized into three poverty levels based on percentage of students eligible for the federal school lunch program: below 40 percent, 40–60 percent, and above 60 percent.

Data processing and analysis

This section describes the analyses that were used to address the research question on whether district rankings based on expenditure-to-performance ratios vary when different expenditure or student performance measures are used.

Computing expenditure-to-performance ratios. Each ratio was calculated as one measure of expenditures per pupil divided by a measure of performance. To address the research question, three pairs of ratios were computed. The first pair used total per pupil expenditures by enrollment, the second pair used instructional per pupil expenditures by enrollment, and the third pair used the constructed measure of expenditures per pupil by enrollment. Each pair used one of the three measures of expenditures and two measures of performance —district median student growth percentile in math and district percentage of students scoring proficient or above in math as measured by the state achievement assessment.

After the six ratios were calculated for districts with complete expenditure and performance data, districts were ranked based on each ratio (N = 98), and Spearman's rank correlation coefficients were calculated for the relationships among the six ratios, which resulted in 15 correlations (see table 2 in the main report). Finally, the study team identified the extent to which the same districts appeared among the 25 highest ranking districts ranked by each of the six expenditure-to-performance ratios.

Conducting sensitivity analysis. To examine the sensitivity of the findings to the use of 25 as the cutoff for identifying the highest ranking districts, the study team conducted two additional sets of rank-order analyses, producing a top 20 and top 30 for each of the six expenditure-to-performance ratios. Characteristics of the schools—rural/not rural, enrollment under/over 1,000, and more/less than 60 percent of students eligible for the federal school lunch program—were consistent regardless of whether a top 20, top 25, or top 30 was considered (table A1). There were no instances in which the discrepancies between the top 25 and top 20 or top 30 was greater than 10 percentage points. There were only four instances where the discrepancies between the top 20 and top 30 were greater than 10 percentage points.

Table A1. Sensitivity analysis reporting the percentage of districts with particular characteristics that appear among the top 20, 25, and 30 districts based on each expenditure-to-performance ratio in the example state in the Regional Educational Laboratory Northeast & Islands Region, 2012/13

		Rural			Student enrollment under 1,000			Student enrollment under 250			Above 60 percent of students eligible for the federal school lunch program		
Ratio label	Expenditure to performance ratio	Top 20	Top 25	Top 30	Top 20	Top 25	Top 30	Top 20	Top 25	Top 30	Top 20	Top 25	Top 30
A	Total per pupil expenditures (dollars)/ Median student growth percentile in math	50	56	53	30	24	23	5	4	3	25	24	23
B	Total per pupil expenditures (dollars)/ Percentage of district students scoring proficient or above in math	60	60	57	25	28	23	0	4	3	25	24	20
C	Instructional per pupil expenditures (dollars)/ Median student growth percentile in math	70	68	70	45	36	37	10	8	10	25	28	27
D	Instructional per pupil expenditures (dollars)/ Percentage of district students scoring proficient or above in math	80	72	63	45	40	33	15	12	10	25	20	17
E	Constructed per pupil expenditures (dollars)/ Median student growth percentile in math	50	60	60	15	20	27	5	8	7	25	24	23
F	Constructed per pupil expenditures (dollars)/ Percentage of district students scoring proficient or above in math	55	56	57	20	16	17	0	0	0	15	12	17
	Percentage of districts in the sample		67			37			12			22	

Source: Authors' analysis of 2012/13 data for 98 K–12 districts with complete data. Data on expenditure and performance, enrollment, and eligibility for the federal school lunch program from the website of the department of education of a state in the Regional Educational Laboratories Northeast & Islands Region; data on locale from U.S. Department of Education (2012).

Appendix B. Supplemental statistical tables and figures

The tables and figures below summarize the characteristics of districts included in the study, describe the variables used to calculate expenditure-to-performance ratios, and display how different rankings based on these ratios vary by district characteristics.

Table B1. Number of districts by district locale, enrollment size, and student poverty status, 2012/13

	Student enrollment size				Student poverty status (eligibility for the federal school lunch program)		
District characteristic	< 250	250–999	1,000–1,999	2,000 or more	< 40%	40–60%	> 60%
Locale							
All districts	12	24	25	37	24	50	22
City and suburb	0	0	7	9	10	5	1
Town	0	2	4	10	2	10	4
Rural	12	22	14	18	12	35	17
Student poverty status (eligibility for the federal school lunch program)							
Less than 40 percent	2	2	10	10			
40–60 percent	6	10	13	21			
More than 60 percent	3	12	2	5			

Note: Two of the 98 districts did not provide information about the percentage of students eligible for the federal school lunch program.

Source: Authors' analysis of 2012/13 data for 98 K–12 districts with complete data. Data on locale from U.S. Department of Education (2012); data on enrollment and eligibility for the federal school lunch program from the website of the department of education of a state in the Regional Educational Laboratory Northeast & Islands Region.

Table B2. Median expenditure-to-performance ratios by district locale, enrollment size, and student poverty status, 2012/13

District characteristic	Ratio A (Total per pupil expenditures [dollars]/ Median student growth percentile in math)	Ratio B (Total per pupil expenditures [dollars]/ Percentage of district students scoring proficient or above in math)	Ratio C (Instructional per pupil expenditures [dollars]/ Median student growth percentile in math)	Ratio D (Instructional per pupil expenditures [dollars]/ Percentage of district students scoring proficient or above in math)	Ratio E (Constructed per pupil expenditures [dollars]/ Median student growth percentile in math)	Ratio F (Constructed per pupil expenditures [dollars]/ Percentage of district students scoring proficient or above in math)
All districts (*N* = 98)	234.73	189.48	137.53	108.58	176.90	148.32
Locale						
City/suburb	224.90	168.68	137.83	100.06	159.98	118.36
Town	227.35	186.61	136.63	111.66	161.62	133.03
Rural	241.98	198.49	137.65	109.30	169.05	136.69
Student enrollment size						
Fewer than 250 students (*n* = 12)	263.22	287.16	133.84	143.00	196.91	210.99
250–999 students (*n* = 25)	241.80	201.96	137.42	111.76	175.57	142.96
1,000–1,999 students (*n* = 26)	237.35	192.75	139.75	107.50	167.79	135.00
2,000 or more students (*n* = 35)	227.58	169.17	136.73	101.30	158.26	118.87
Student poverty status (eligibility for the federal school lunch program; *n* = 96)						
Less than 40 percent	234.10	168.68	139.64	99.96	161.61	117.81
40–60 percent	243.58	198.50	136.52	110.68	167.88	138.06
Above 60 percent	244.58	202.82	138.13	125.04	160.57	140.59

Note: Two of the 98 districts did not provide information about the percentage of students eligible for the federal school lunch program.

Source: Authors' analysis of 2012/13 data for 98 K–12 districts with complete data. Data on expenditure and performance, enrollment, and eligibility for the federal school lunch program from the website of the department of education of a state in the Regional Educational Laboratory Northeast & Islands Region; data on locale from U.S. Department of Education (2012).

Notes

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1. In the education literature measures of efficiency are sometimes referred to as measures of cost-effectiveness. However, cost-effectiveness analysis, which is used to assess which among two or more interventions shows the highest effectiveness relative to cost, typically requires accounting for all costs, both tangible (materials, staff salaries) and intangible (parent volunteer hours, donations), involved in each intervention (Levin & Belfield, 2015). A cost-effectiveness analysis also requires a causal estimate of each intervention's impact on the outcome of interest, as opposed to a descriptive outcome measure. The expenditure-to-performance ratios presented in this study do not reflect any causal association between district spending and student performance.
2. Some states report two enrollment counts: enrollment based on district of residence and enrollment based on district of attendance. When applicable, stakeholders should consider calculating expenditure-to-performance ratios using both enrollment counts to explore whether conclusions about district efficiency vary depending on the enrollment count used. For the purposes of this analysis, resident enrollment was used to calculate ratios with total and instructional expenditures, and the state's attending enrollment was used to calculate ratios with the constructed expenditure measure. Correlations were examined between ratios estimated using expenditures for enrollment based on district of residence and enrollment based on district of attendance, and the results suggested that this enrollment distinction, while tracked in this example state, would not influence the current set of findings.

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