EXPLORING THE RELATIONSHIP BETWEEN ILLINOIS DISTRICTS' ESSER SPENDING AND STUDENT ACHIEVEMENT

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Exploring the Relationship Between Illinois Districts' ESSER Spending and Student Achievement

Executive Summary

This report provides a first look at how Illinois school districts' uses of Elementary and Secondary School Emergency Relief (ESSER) funds were related to their test score outcomes in the years following the onset of the COVID-19 pandemic. Using data on districts' ESSER expenditures as of November 2023, we analyze test score trends across districts that received different amounts of ESSER funds and across districts that spent ESSER funds in different ways.

From these analyses, our **key findings** are as follows:

1) After receiving ESSER funding, low-achieving districts recovered at a similar pace compared to high-achieving districts, on average.
    a. Districts with lower pre-pandemic achievement and greater pandemic-related learning loss were allocated and spent more ESSER funds.
    b. Elementary and middle grades students in districts that were allocated more ESSER funding recovered slightly more quickly from school year 2020-21 (SY21) test score lows than students in higher-achieving districts that were allocated less. High school students in districts that were allocated more ESSER funding experienced similar losses (i.e. lack of recovery) compared to higher-achieving districts that were allocated less.
2) No broad categories of expenditures districts made with ESSER funds (e.g., instructional salaries, construction services, etc.) were statistically significantly related to test score outcomes.

Our findings show that the infusion of funding from ESSER may have prevented pandemic-related achievement disparities between districts from widening further. However, it is unclear whether or how district choices about *what* to spend on mattered. We offer several interpretations of our null findings related to the time horizon of our study, the nature of the ESSER policy and its implementation, and data limitations. In particular, we did not have data on how districts implemented the programs, services, and other interventions that they funded with their ESSER grants or the quality of their implementation, which may have been key to whether or not interventions succeeded. As districts spend the remainder of ESSER funds and decide on spending priorities moving forward, they must continue to make choices without clear evidence on which broad categories of spending are most likely to improve student achievement.

Exploring the Relationship Between Illinois Districts' ESSER Spending and Student Achievement

The Elementary and Secondary School Emergency Relief (ESSER) Fund, awarded by Congress in three rounds from March 2020 to March 2021, provided state and local educational agencies with emergency financial assistance to respond to the COVID-19 pandemic, safely reopen schools, and address the learning loss that occurred due to the pandemic's disruptions. Nationally and in Illinois, elementary and middle school districts have shown improvement from the test score declines observed the first year following the pandemic onset, though they have not fully recovered to pre-pandemic achievement, on average (Barragan Torres, Cashdollar, et al., 2024; Fahle et al., 2024). Meanwhile, high school districts in Illinois have yet to see recovery (Barragan Torres, Cashdollar, et al., 2024). Recent studies have found that ESSER spending helped support recovery (Dewey et al., 2024; Goldhaber & Falken, 2024), yet little research has examined which types of spending were related to higher test scores.

This report, part of IWERC's Learning Renewal series, provides a first look at the relationship between ESSER spending and average district achievement in Illinois. Using data on district ESSER expenditure from the outset of the spending period through November 2023, we describe test score trends across districts that received different amounts of ESSER funding and across districts that spent funds in different ways. As we showed in part 2 of the Learning Renewal series (Barragan Torres, Bates, et al., 2024), districts that differed in their types of ESSER spending also differed in other important ways, including size, student demographics, and pre-pandemic achievement. To disentangle ESSER spending from other factors that may impact achievement, we used Hierarchical Linear Models (HLM) that controlled for observable student, school, and district characteristics. These models estimate how differing types of spending (e.g. instructional salaries, construction services, etc.) were related to district achievement outcomes, all else equal.

In what follows, we review context on ESSER funding and the relationship between funding and student outcomes. We go on to explain our methods and findings, and we close with our interpretations and their implications for policy and practice.

Background

The Relationship Between Spending and Outcomes in Education

Rigorous causal studies have consistently found that increases in school spending are related to positive educational outcomes. These outcomes, summarized in a meta-analysis by Jackson and Mackevicius (2021), include higher test scores (Abott et al., 2020; Baron, 2022; Gigliotti & Sorensen, 2018; Jackson et al., 2021; Rauscher, 2020), higher high school graduation rates (Abott et al., 2020; Jackson et al., 2021), higher postsecondary enrollment (Baron, 2022; Hyman, 2017; Jackson et al., 2021), and lower school dropout rates (Baron, 2022; Lee & Polachek, 2014). Overall, Jackson and Mackevicius estimated that an additional $1,000 in per-pupil expenditure annually for four years will increase math and reading test scores by 0.03 standard deviations, on average, and that benefits are largest for economically disadvantaged students.

Two recent studies (Dewey et al., 2024; Goldhaber & Falken, 2024) have estimated the impacts of ESSER spending in particular on elementary and middle school student achievement. Each study drew on data from the majority of states nationwide, exploiting small state-to-state and district-to-district differences in Title I funding formulae, on which ESSER allocations were based. The research teams analyzed these variations in ESSER funding among districts with similar demographics to estimate how ESSER spending differences were related to student outcomes. Both studies found positive impacts on learning recovery in SY23, with estimates similar in magnitude to those reported by Jackson and Mackevicius (2021). Dewey et al. (2024) estimated that every additional $1,000 in ESSER funds per pupil improved math scores by 0.0086 standard deviations and reading scores by 0.0049 standard deviations. Goldhaber and Falken (2024) similarly found a 0.008 standard deviation increase in math scores for every $1,000 increase in ESSER spending, but no statistically significant improvements in ELA. Both studies pointed out that the ESSER funds helped to close achievement gaps between high- and low-poverty districts that the pandemic had exacerbated, but that the funds were not sufficient to support districts in fully recovering to pre-pandemic achievement.

Since consensus is that "money does matter" (Jackson & Mackevicius, 2021, p. 50), the next line of inquiry for policymaking shifts to understanding the types of spending responsible for positive impacts. No studies have yet examined how differing types of ESSER spending related to student achievement, given wide variation across states in how spending has been reported and school budget fungibility (Goldhaber et al., 2024). Yet prior research can shed light on achievement outcomes for some of the most common types of expenditures made with ESSER funds.

For example, districts in Illinois and nationally commonly spent ESSER funds on capital expenditures, such as construction of new facilities or improvements of existing facilities (Barragan Torres, Bates, et al., 2024; Silberstein & Roza, 2024). Such expenditures were especially common among high-poverty districts (Barragan Torres, Bates, et al., 2024; Brooks & Springer, 2024). In their meta-analysis, Jackson and Mackevicius (2021, p. 18) found that capital spending improves student achievement, though impacts are about half as large as those for non-capital expenditures such as teacher salaries or new curricula. Because many capital spending projects take place over several years, their positive impacts on achievement also take longer to measure – approximately four to six years, according to the Jackson and Mackevicius study.

Another common target of ESSER expenditure—teacher salaries (Barragan Torres, Bates, et al., 2024; Silberstein & Roza, 2024)—has also been studied in relation to student achievement. This body of work, summarized by Ordway (2020), has shown mixed results. Some studies have found that more spending on salaries predicts higher test scores (Childs & Shakeshaft, 1986; Hanushek et al., 1999; Leigh, 2012; Pham et al., 2021) and decreased dropout rates (Loeb & Page, 2000). Other research has found that higher teacher compensation may be associated with higher teacher retention, but not with higher student achievement (Cowan & Goldhaber, 2018; Feng & Sass, 2018; Hough et al., 2012).

The unique circumstances of the pandemic resulted in equally unique, expedited spending on technology and connectivity for remote learning. Many districts spent ESSER funds on Wi-Fi hotspots, one-to-one device

initiatives, and other technologies, aiming to close the "digital divide" (Barkey & Barragan Torres, 2024; State of Illinois, 2020). This spending was essential for continuity of operations. Earlier evidence suggests no relationship between information technology expenditures and achievement (Beuermann et al., 2015; Peslak, 2004), but current evidence—including evidence under conditions involving school closures—is limited.

The educational spending literature offers limited evidence into how expenditure on other common targets of ESSER funds, such as tutoring and summer learning programs, relates to achievement. Guryan et al. (2023) found that high-dosage tutoring in Chicago high schools improved test scores by an estimated 0.18 to 0.40 standard deviations, and also increased course grades, at a cost of $3,500 per student. This effect size is much larger than those estimated for school spending in general (Jackson & Mackevicius, 2021). Another, international study reported a 10% increase in expenditures related to tutoring that resulted in a small 1.1% increase in test scores (Ryu & Kang, 2013). Even though there is little research specifically on how spending on these programs relates to outcomes, these studies build on a wide body of research has established tutoring as an effective intervention for positive learning outcomes (Dietrichson et al., 2017; Nickow et al., 2020). Likewise, a number of studies have found positive relationships between summer learning programs and academic achievement (Cooper et al., 2000; Kim & Quinn, 2013; Lynch et al., 2022; McCombs et al., 2021).

ESSER Funding in Illinois

Illinois received a total of $7.8 billion in ESSER funds over three rounds. The Illinois State Board of Education (ISBE) was required to distribute at least 90% of these funds to Local Education Agencies (LEAs) including school districts using the Title I funding formula defined in the Elementary and Secondary Education Act (ESEA). Title I provides additional federal funding to state education agencies and LEAS to support children from low-income families, and LEAs distribute the funds to schools based on the proportion of children eligible for free or reduced-price lunch (FRPL) or another measure of school poverty (National Center for Education Statistics, 2024). Starting with ESSER III (or ARP ESSER), state agencies were required to spend the remaining funds on activities to promote learning recovery (at least 5%) and evidence-based summer enrichment (at least 1%) and afterschool programs (at least 1%) (*Elementary and Secondary School Emergency Relief Fund*, 2021). After reserving 0.5% for administrative costs, ISBE allocated a significant portion of its remaining 9.5% in grant funding for targeted uses such as developing community partnerships and promoting digital equity (*ESSER Spending Dashboard*, 2024). We refer to these allocations as "9.5% grants."

School districts and other LEAs were charged with using ESSER funds to address the impacts of the pandemic on students, and they had high discretion for how to do so. Districts were required to obligate funds for the first round of ESSER (ESSER I) by September 2022 and for the second round (ESSER II) by September 2023. The third and largest round of ESSER (ESSER III) required that districts allocate at least 20% of funds to measure and address learning loss. Districts have until September 2024 to obligate this final round of funding.

In part 2 of the Learning Renewal Series (Barragan Torres, Bates, et al., 2024), we documented how districts spent ESSER funds as of November 2023, by which point they had spent 71% of all ESSER funds allocated to them. While some spending categories—such as those related to instructional salaries, supplies, and materials—were common across many districts, other types of spending varied substantially by district characteristics. For example, small districts spent statistically significantly more than medium or large districts on stipends for school personnel, while large districts spent more on budget codes related to the enhancement of academic, pedagogical, and social-emotional experiences, and medium districts spent more on codes related to infrastructure for teaching and learning. We also found statistically significant spending differences between elementary, high school, and unit districts, and between districts that differ in local funding capacity (Evidence-Based Funding (EBF) Tiers).

Research Questions

Given the variation in spending across Illinois districts documented in our previous study, we now seek to understand whether and how ESSER expenditure was related to learning recovery. Using data on districts' total ESSER expenditures from all rounds of funding (ESSER I-ESSER III), we ask:

1. How did a district's *amount* of ESSER spending per pupil relate to their average change in test scores from SY19 to SY23?
2. How did the *types* of expenditures districts made using ESSER funds relate to their average change in test scores from SY19 to SY23, controlling for student, school, and district characteristics?

Methods

Data

Our study draws on two publicly available datasets (the Illinois ESSER Spending Dashboard and the Illinois Report Card), a student-level dataset, and budget details for ESSER III that we received through a partnership with ISBE. These datasets are described below.

Illinois ESSER Spending Dashboard

ISBE's ESSER Spending Dashboard provides publicly available data on how each LEA in Illinois has allocated and spent their ESSER funds. ISBE categorizes expenditures into functions, which describe the purpose of spending, and objects, which describe the type of expenditure. Each budget item is reported with a combination of a function and an object code, which are defined in ISBE's Administrative Code. The ESSER Spending Dashboard categorizes LEA expenses according to 28 functions and 8 objects, for a total of 224 possible function-by-object codes. The data used in this report were received in November 2023, at which time districts had spent 100% of their funds allocated in ESSER I, 98% of funds allocated in ESSER II, and 57% of ESSER III allocations, totaling $5.4 billion spent out of $7.8 billion allocated.

Illinois Report Card

The Illinois Report Card is released annually by ISBE and provides publicly available data on district and school characteristics and performance across a wide variety of metrics. We used Report Card data from

SY19, SY21, SY22 and SY23 to control for specific school and district characteristics in our analysis. These characteristics included three of the *5Essentials* indicators of school climate in SY19, which are measures based on a survey administered annually to all Illinois teachers and all students in grades 4-12.

Student-Level Data

Through a data partnership with ISBE, we received test score, demographic, program, and SY21 monthly attendance data for all students who were in grades 3-8 and 11 for each year between SY19 and SY23 (with SY20 omitted due to the suspension of testing at the outset of the COVID-19 pandemic). For students in grades 3-8, we received scaled scores from the standardized state test, the Illinois Assessment of Readiness (IAR) in English Language Arts (ELA) and Math. For students in grade 11, we received scaled scores from the Reading and Math portions of the SAT, which Illinois requires all 11th graders to take for accountability purposes. Demographic data included race/ethnicity and gender, while program data included English Learner (EL) status, participation in an Individualized Education Program (IEP), and eligibility for free/reduced-price lunch (FRL). Attendance data for SY21 included the number of days each month that students attended in-person, remotely, or were absent.

Illinois Budget Details

ISBE provided IWERC with budget descriptions for each expense made by districts in ESSER III across three fiscal years (FY22-FY24). We received a total of 93,229 text descriptions of expenses in Illinois districts. To limit the sample to those expenses that were most common across districts, we selected the expenses corresponding to the top 16 function-by-object combinations, which resulted in analysis of 68,007 text descriptions. From these we derived the types of spending categories (see Barragan Torres, Bates, et al., 2024 for details). We note that this dataset, and subsequent analyses, are only as accurate as what districts provided to ISBE. These data are the data of record to the state and represent the state's understanding of each district's data at the time of data receipt.

Sample

Our sample included cross-sections of students in grades 3-8 and 11 from SY19 to SY23 (SY20 omitted). Each cross-section included all students who had non-missing test score data and attended a traditional district included on the Illinois Report Card. From SY19 to SY23, the total number of Illinois districts declined from 865 to 852. Missing IAR data ranged from 4% in SY23 to 31% in SY21, while missing SAT data ranged from 8% in SY19 to 12% in SY21. Missing test score data was consistently highest in SY21 due in part to the prevalence of remote instruction that year. Students had to attend school in-person in order to participate in testing, even if they were otherwise instructed remotely. In turn, rates of missing data were highest among schools with more remote instruction in SY21, which served higher proportions of Black, Hispanic/Latino, low-income, and EL students (Cashdollar et al., 2022). Finally, we removed districts that were outliers in terms of their ESSER expenditure patterns, as described in the Measures section. In total, our sample included 2,986,497 3rd-8th grade observations in 772 districts, and 529,577 11th grade observations in 484 districts.

For our regression models, we further limited the sample to students who had non-missing data on each of our student-level controls and who attended schools and districts with non-missing data on school- and district-level controls. Missing data for each variable is shown in Appendix A. Because our sample was made up of annual cross-sections of students, it is possible for individual students to appear in more than one or even all years of our data (e.g. grade 3 in SY19, grade 5 in SY21, grade 6 in SY22 and grade 7 in SY23). In total, our regression sample for grades 3-8 included 2,812,464 unique student observations in 2,774 schools across 652 districts while our regression sample for grade 11 included 492,308 unique student observations in 678 schools across 443 districts. These samples each represent 84% of their respective populations.

Measures

Our dependent variable was student achievement as measured by IAR scores for grades 3-8 and SAT scores for grade 11. We ran regression models using two different sets of ESSER spending variables as our primary independent variables, controlling for student, school, and district characteristics. These measures are described below.

Proportion of ESSER Spending: Function-by-Object Codes

Our first set of spending variables were based on the top 20 most commonly used function-by-object codes used by districts over all rounds of ESSER. We created variables to represent a district's proportion of expenditure under each code out of their total ESSER expenditure as of November 2023 (all rounds of ESSER and 9.5% grants included). As a hypothetical example, imagine a district that was allocated a total of $1.1 million in ESSER funds and spent $1 million by November 2023. If the district spent $250 thousand on instructional supplies and materials (function-by-object code 1000-400), we would classify them as spending 25% of all ESSER expenditures on this code. Due to high Pearson correlations ($r > 0.78$) between expenditures in function-by-object codes that included salaries or benefits as object codes (100 and 200, respectively), we combined these when they appeared within the set of top 20 function-by-object codes. For example, we combined the function-by-object codes for Instruction—Salaries (1000-100) and Instruction—Benefits (1000-200) to create an Instruction—Salaries & Benefits category (1000-100 & 1000-200). Additional combined codes are shown in Table 1. All other correlations were less than 0.29. This resulted in 16 function-by-object categories.

The distributions of these categories were not normal and were highly skewed. Often, many districts spent little or no ESSER funding in a particular category while a handful of districts spent a very large proportion of funds in that category. To prevent spurious associations (i.e., associations that do not represent the majority of observations) (Aguinis et al., 2013), we removed outlier districts from each expenditure category, which we identified in the following way: We first took the natural log of each category, which created normal distributions. We classified outliers as observations greater than 1.96 standard deviations above the mean in these natural log distributions. With this method, we identified and removed between 0 and 11 district observations per category. Results excluding outliers are displayed in the main body of this report, while results including outliers are displayed in Appendix D.

Proportion of ESSER Spending: Aggregating Budget Codes into 5 Categories

One limitation of using budget codes to understand spending patterns is that different districts may use the same budget code in different ways. For example, while some districts reported hiring tutors in the Instruction-Salaries categories, others did so in the Improvement of instruction services-Salaries category. Instructional curricula in a wide range of modalities such as software, textbooks and/or licenses were reported as Instruction-Purchased services, or Instruction-Supplies and materials, or Educational media services-Purchased services, or Educational media services-Supplies and materials, just to name a few. To address this limitation, in a prior study (Barragan Torres, Bates, et al., 2024) we analyzed districts' written budget descriptions for ESSER III, the largest round of funding, to better understand how each function-by-object code was most frequently used and identify expenditures that were often referred to with a variety of different codes across districts. From this analysis, we developed five broader categories that group similar types of expenditures. The methods we used in this analysis, as well as the codes contained in each category and descriptions of the types of expenses each category encompasses, are described by Barragan Torres, Bates, and colleagues (2024, pp. 7, 13–14). We used these five categories as our second set of spending variables for predicting student achievement. Like with the function-by-object codes, we calculated each district's proportion of expenditure in each category out of their total ESSER expenditure as of November 2023. We identified and removed outliers in the same way as described for the 16 object-by-function categories. We identified between 0 and 6 district outliers per category, and results including outliers are included in Appendix D.

Table 1 shows descriptive statistics for the 16 function-by-object codes across all districts, including the median district proportion of expenditure for each variable and the median dollar amount of expenditure. It also breaks each proportion of expenditure variable into quartiles, showing the mean proportion of expenditure in each quartile. For example, the median (50th percentile) proportion of ESSER funds that districts spent on Instruction – Purchased services (1000-300), shown in row 1, was 4% of all ESSER funds, representing a median district expenditure of $56,563. Districts in the lowest quartile of expenditure (at or below the 25th percentile) spent an average of 0% of their ESSER funds in this category, while districts in the highest quartile of expenditure (above the 75th percentile) spent an average of 14% of their ESSER funds in this category. Table 2 shows these descriptives for the 5 aggregated spending categories.

Table 1. *District ESSER expenditure across function-by-object codes*

Budget code(s) (Function-Object)	Budget code name ("Function"-"Object")	Median expenditure (proportion)	Median expenditure ($)	Mean expenditure by quartile (Q) (proportion)			
				Q1	Q2	Q3	Q4
1000-300	Instruction - Purchased services	4%	$56,563	0%	2%	5%	14%
1000-400	Instruction - Supplies & materials	12%	$187,301	3%	9%	16%	32%
1000-500	Instruction - Capital outlay	3%	$38,298	0%	1%	5%	16%
2120-100	Guidance services - Salaries	0%	$0	0%	0%	0%	4%
2130-400	Health services - Supplies & materials	0%	$1,633	0%	0%	0%	2%
2210-300	Improvement of instruction services - Purchased services	0%	$837	0%	0%	1%	5%
2220-300	Educational media services - Purchased services	0%	$0	0%	0%	0%	3%
2540-100	Operation and maintenance - Salaries	0%	$0	0%	0%	1%	7%
2540-400	Operation and maintenance - Supplies and Materials	1%	$21,153	0%	1%	2%	7%
2560-400	Food services - Supplies & materials	0%	$0	0%	0%	0%	1%
2540-500	Operation and maintenance - Capital outlay	2%	$29,674	0%	1%	7%	37%
2540-300	Operation and maintenance - Purchased services	0%	$8,000	0%	0%	3%	28%
1000-100 & 1000-200	Instruction - Salaries & benefits	16%	$247,264	3%	11%	21%	42%
2110-100 & 2110-200	Attendance and social work services - Salaries & benefits	0%	$0	0%	0%	0%	5%
2130-100 & 2130-200	Health services - Salaries & benefits	0%	$0	0%	0%	0%	6%
2210-100 & 2210-200	Improvement of instruction services - Salaries & benefits	0%	$0	0%	0%	0%	4%

Table 2

District ESSER expenditure across aggregated spending categories

Aggregated Category	Median expenditure (proportion)	Median expenditure ($)	Mean expenditure by quartile (Q) (proportion)			
			Q1	Q2	Q3	Q4
Physical buildings	23%	$310,432	2%	14%	35%	62%
Infrastructure for teaching & learning	18%	$274,571	6%	14%	23%	42%
Enhancement of academic, pedagogical, and social-emotional learning	6%	$101,938	1%	4%	9%	20%
Stipends for school personnel	18%	$283,416	3%	13%	24%	45%
Wellness & safety	4%	$61,017	1%	3%	6%	16%

Student Attendance in SY21

Our regression models for grades 3-8 controlled for students' instructional modality in SY21, a year in which most districts held instruction remotely for part or all of the year. We used student-level attendance data to construct variables for proportion of school days that a student attended in-person or remotely in SY21 and proportion of school days that a student was absent in SY21.

District Per Pupil ESSER Expenditure

Our models also controlled for the total amount of ESSER dollars districts spent per pupil, which varied according to the ESEA Title I funding formula (*Elementary and Secondary School Emergency Relief Fund*, 2021). We calculated per pupil ESSER expenditure by totaling all of the ESSER funds each district received across all rounds, then dividing by district enrollment in SY23. The median per pupil ESSER spending across districts as of November 2023 was $2,166, with a standard deviation of $2,124. Spread out over three years, this amounts to approximately $722 per pupil per year. Compared to the median district per pupil expenditure in SY19 of $13,672, this represents an increase of approximately 5%. Our descriptive analyses divide districts into quartiles based on district per pupil ESSER expenditure, with 202-203 districts per quartile. Districts in the lowest quartile of expenditure averaged $773 in total ESSER expenditure per pupil, which was spent over three years. Districts in the second quartile averaged $1,675 per pupil, districts in the third quartile averaged $2,735 per pupil, and districts in Q4 averaged $5,395 per pupil.

Analysis

We first describe trends in achievement across districts that varied in amount and type of ESSER spending. We group districts into quartiles based on their overall amount of per pupil ESSER expenditure as well as their proportion of expenditure in each of our 16 function-by-object codes and our 5 aggregated

spending categories. Across quartiles, we show district average scaled scores in SY23 compared to SY19 and SY21 on the IAR Math and ELA exams and the SAT Math and Reading exams. We also show the percent change in scores over this time frame to make changes across tests more comparable. We calculated percent change for each exam using its minimum score as the true zero. For each IAR subject, this meant transforming the range of scores from 650-850 to 0-200. For each SAT subject, we transformed the range from 200-800 to 0-600. Our calculation using the transformed scale scores to find percent change was as follows (substituting SY21 for SY19 when appropriate):

$$Percent\ change = \frac{SY23\ scale\ score - SY19\ scale\ score}{SY19\ scale\ score} \times 100$$

Because districts received ESSER funds according to the Title I formula, their amount of ESSER spending was strongly correlated with the proportion of students eligible for FRPL and other related characteristics. This meant we were unable to separate amount of spending from differences between districts that are strongly predictive of achievement (Breger, 2017).

However, districts had discretion over the types of expenditures they made using ESSER funds. As we showed in part 2 of the Learning Renewal series (Barragan Torres, Bates, et al., 2024), districts varied tremendously in the categories on which they spent ESSER funds. We used this variation to analyze relationships between districts' types of ESSER spending and their achievement, controlling for differences across students, schools, and districts. With HLM, we isolated district spending patterns from other observable characteristics that may have influenced achievement, allowing us to better understand whether and how differences in type of spending were related to learning recovery across districts, all else equal. However, it is possible—even likely—that there were district differences we could not observe with the data available that also influenced both spending patterns and test scores. Additionally, most districts spent on multiple categories simultaneously, and our models do not tell us whether or how each category's relationship with achievement may interact with expenditure in other categories. In turn, findings from these models should not be interpreted causally.

We ran our analyses using HLM 8 software (Raudenbush & Congdon, 2021) with restricted maximum likelihood estimation (REML). We first ran an intercept-only model (unconditional) with test scores as outcomes (IAR ELA, IAR Math, SAT Reading, SAT Math). These models allowed us to explore how much of the variance in student achievement occurs between students, schools, and districts and confirm the necessity of hierarchical models. Finding significant variation at all three levels (see Table 5), we then developed three-level conditional models.

Our conditional models predicted test scores using repeated cross-sections, which allowed us to contrast test scores of post-pandemic cohorts to those enrolled in SY19. We estimated how outcomes of students in SY23 (as well as SY22 and SY21) compared to outcomes of same-grade students in SY19 and how district-level ESSER spending patterns were related to these between-cohort differences, all else equal. At level 1

(students), we included indicator variables for year with SY19 as our reference. We controlled for student characteristics including race/ethnicity, gender, EL status, IEP participation, and FRL status. In the models for students in grades 3-8, we also controlled for the proportion of SY21 each student had spent in remote instruction and the proportion of SY21 that they were absent, each of which were significantly related to achievement outcomes. Indicators for year were uncentered; all other variables were grand-mean centered.

At level 2 (schools), we controlled for a range of Illinois Report Card measures of school characteristics in SY19, using *t* ratios to determine which controls to keep in our final models. We controlled only for school characteristics pre-pandemic, theorizing that subsequent changes in characteristics could be due in part to district ESSER spending patterns. Our final set of controls included SY19 school enrollment, student mobility rate, average attendance rate, and total per-pupil expenditure. We also controlled for SY19 school climate using school scores on the *5 Essentials Survey* indicators of Effective Leaders, Involved Families, and Ambitious Instruction. Based on the result of chi-square testing, we included school random effects on the slopes for SY19 for all models and for SY23 in models predicting outcomes for students in grades 3-8. We then tested for potential confounding between our level 1 controls and any omitted level 2 controls by also including the aggregated school mean of each level 1 variable in each level 2 equation. Finding no indication of confounding (Raudenbush & Bryk, 2002, p. 262), we did not retain these aggregated variables in our final model.

At level 3 (districts), we controlled for SY19 average student mobility and Evidence-Based Funding (EBF) capacity, a measure of how closely a district's local funding sources meet its financial needs. Our predictors of interest were ESSER spending patterns, which we modeled as predictors of the SY23 slope. We operationalized ESSER spending patterns in two ways. The first set of models used district proportion of spending on the 20 function-by-object codes that were most commonly used statewide as predictors (with salaries and benefits object codes combined, for a total of 16 predictor variables). The second set of models used district proportion of spending on the five aggregated spending categories. We ran both sets of models separately by grade band (3-8 or 11) and test subject (Math or ELA/Reading), including only students with non-missing data on all variables. We set significance level α to 0.05, and we corrected for multiple comparisons (16 function-by-object codes + 5 aggregated categories = 21 comparisons total) using the Bonferroni correction. This resulted in a statistical significance threshold of $\alpha_{adjusted} = 0.002$ for each individual comparison. We report results using robust standard errors. Models are shown in full in Appendix B.

Findings

Descriptive Findings

Amount of ESSER Expenditure

Figure 1A shows district average achievement for grades 3-5 on the IAR Math exam from SY19 to SY23 (excluding SY20) by quartile of per pupil ESSER expenditure. Districts that received the most ESSER funds per pupil (quartile four; Q4) had the lowest average math scores at the outset of our study period in SY19, potentially reflecting the way ESSER funds were distributed according to the Title I funding formula. Q4

districts experienced greater average achievement declines in SY21, the first year of assessment data following the onset of the pandemic. While districts in Q1 through three averaged declines of 7.2 to 7.7 scaled score points from SY19 to SY21, Q4 districts declined by 9.4 points on average.[1] However, Q4 districts recovered from SY21 lows more quickly than districts in other quartiles, averaging growth of 4.7 scaled score points. Q3 districts had similar growth, averaging 4.3 points. By SY23, Q4 districts were achieving 6.5% (4.7 points) lower than their SY19 scores on the Math IAR, which put them more behind their pre-pandemic achievement than any other quartile, as shown in Table 3. This increased achievement gap reflects Q4's greater initial declines in SY21, which districts were unable to fully recover from despite their relatively rapid growth in the following years.

Districts serving grades 3-8 followed similar trends on the IAR ELA exam (Figure 1B). Districts that received the most ESSER funding per pupil started with the lowest achievement and declined the most between SY19 and SY21, though differences in achievement declines between quartiles were smaller than what we observed on the IAR Math exam. Q4 districts then recovered slightly more quickly than districts in other quartiles, resulting in an overall SY19-SY23 change on par with other quartiles (see Table 3).

Figure 1. *IAR scores by quartile of district ESSER per pupil expenditure*

Figure 1A

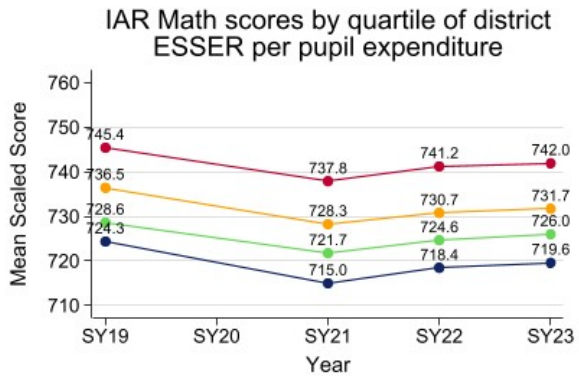
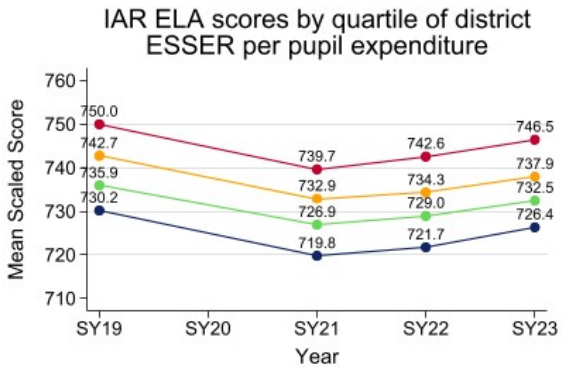
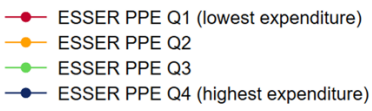


Figure 1B





As shown in Figure 2, high school districts that received the most ESSER funds per pupil also had the lowest pre-pandemic SAT scores, on average. In Math (Figure 2A), Q4 districts lost less than other quartiles from

[1] In our previous study (Cashdollar et al., 2022), we explained that these declines likely underestimate the true extent of learning loss given low SY21 participation rates in districts that spent the most time remotely (which were disproportionately Title I districts).

SY19 to SY21 and from SY21 to SY23, resulting in the lowest overall achievement declines. However, there was not a consistent relationship between per pupil ESSER expenditure and achievement characterizing the other quartiles. In Reading (Figure 2B), there were no clear patterns between quartile of per pupil ESSER expenditure and achievement declines. As shown in Table 3, Q4 districts declined more from SY19 to SY23 than districts in Q1 and Q2 but less than districts in Q3.

Figure 2. *SAT scores by quartile of district ESSER per pupil expenditure*

Figure 2A

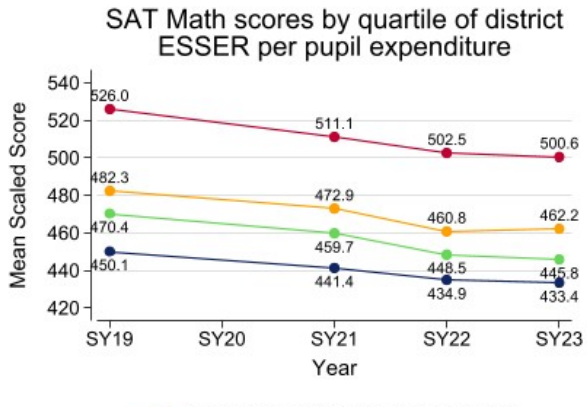
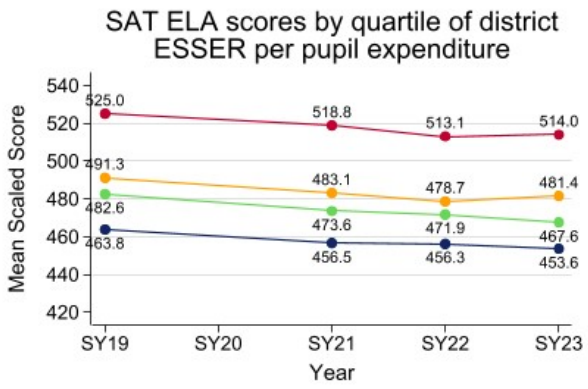


Figure 2B



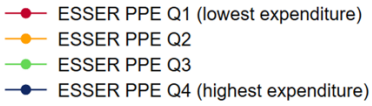


Table 3. *District average test scores by quartile of ESSER per pupil expenditure*

		Per Pupil Expenditure (Quartile)			
		1 (lowest)	2	3	4 (highest)
Math IAR	SY19	745.4	736.5	728.6	724.3
	SY21	737.8	728.3	721.7	715
	SY23	742	731.7	726	719.6
	% Change from height of pandemic (SY21-SY23)	5.5%	4.6%	6.5%	7.6%
	% Change from pre-pandemic (SY19-SY23)	-3.9%	-4.9%	-4.0%	-6.5%
ELA IAR	SY19	750	742.7	735.9	730.2
	SY21	739.7	732.9	726.9	719.8
	SY23	746.5	737.9	732.5	726.4
	% Change from height of pandemic (SY21-SY23)	10.0%	6.1%	7.8%	9.9%
	% Change from pre-pandemic (SY19-SY23)	-3.6%	-5.1%	-4.4%	-4.7%
Math SAT	SY19	526	482.3	470.4	450.1
	SY21	511.1	472.9	459.7	441.4
	SY23	502.3	462.2	445.8	433.4
	% Change from height of pandemic (SY21-SY23)	-2.6%	-3.8%	-5.4%	-3.1%
	% Change from pre-pandemic (SY19-SY23)	-7.0%	-6.9%	-8.8%	-6.3%
ELA SAT	SY19	525	491.3	482.6	463.8
	SY21	518.8	483.1	473.6	456.5
	SY23	514.9	481.4	467.6	453.6
	% Change from height of pandemic (SY21-SY23)	-1.0%	-0.3%	-2.1%	-0.9%
	% Change from pre-pandemic (SY19-SY23)	-3.0%	-3.2%	-5.2%	-3.6%

Note: Percent change was calculated after transforming each scale to have a minimum of 0. The IAR scale was transformed from 650-850 to 0-200. The SAT scale was transformed from 200-800 to 0-600.

Overall, our descriptive findings on how districts' amount of ESSER expenditure per pupil related to achievement show that districts in the highest quartile of ESSER funding had the lowest pre-pandemic achievement. Elementary and middle grades students in these districts had greater declines on the IAR at the outset of the pandemic, but they recovered more quickly than students in other, higher-achieving quartiles.

High school (i.e. grade 11) students in these districts experienced similar losses on the SAT to other quartiles that were higher achieving, on average. We now turn to how type of ESSER expenditure related to achievement.

Type of ESSER Expenditure

Figures 3 and 4 display IAR and SAT achievement, respectively, across districts divided into quartiles based on the proportion of their ESSER funds that they spent on the aggregated spending category of "stipends for school personnel." Districts in the highest quartile of expenditure on this category (spending, on average, 45% of all their ESSER funds) had the highest pre-pandemic achievement across subjects on both the IAR and SAT, while districts that spent the least in this category (averaging 3% of ESSER funds) had the second-lowest pre-pandemic achievement. Achievement declines from SY19 to SY21 and recovery from SY21 to SY23 looked similar across quartiles for IAR scores in Math and ELA. On the SAT, districts that spent the most on stipends (Q4 districts) improved on both Reading and Math from SY22 to SY23, while all other quartiles declined. As shown in Table 4, Q4 districts experienced smaller SAT score declines from both SY19-SY23 and SY21-SY23 relative to other quartiles. There was no clear relationship among other quartiles, however, of proportion of expenditure on stipends for school personnel and change in SAT scores.

Figure 3

IAR scores by quartile of district proportion of ESSER spending on stipends for school personnel

Figure 3A

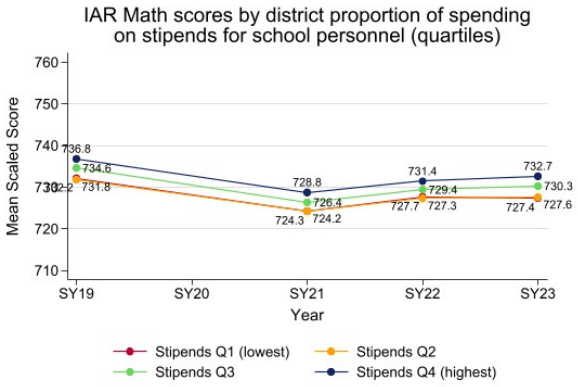
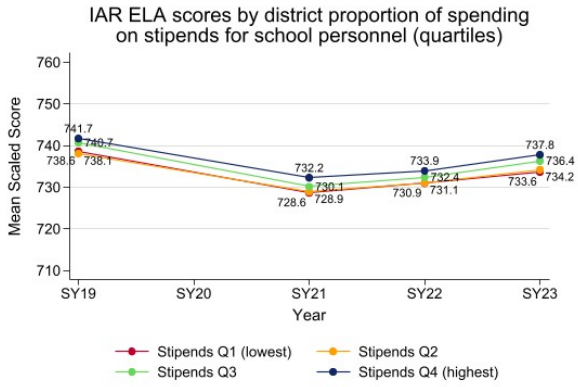


Figure 3B



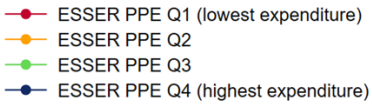


Figure 4

SAT scores by quartile of district proportion of ESSER spending on stipends for school personnel

Figure 4A

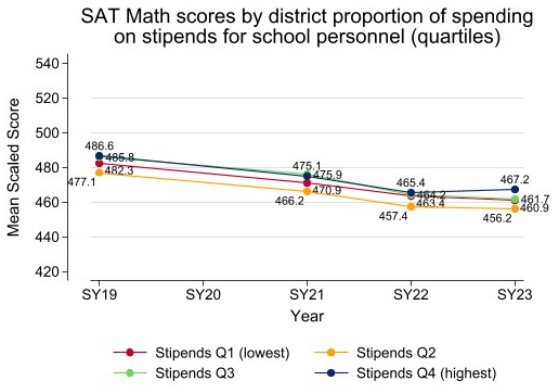
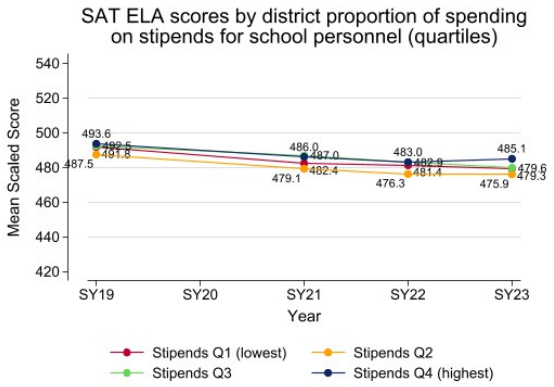


Figure 4B



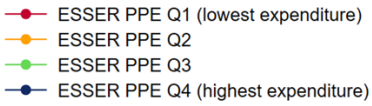


Table 4. *District average scaled score by quartile of ESSER expenditure on stipends for school personnel*

		Per Pupil Expenditure (Quartile)			
		1 (lowest)	2	3	4 (highest)
Math IAR	SY19	731.9	731.6	734.6	736.9
	SY21	724.0	724.0	726.3	728.8
	SY23	727.3	727.6	730.3	732.7
	% Change from height of pandemic (SY21-SY23)	5.7%	6.2%	6.7%	5.7%
	% Change from pre-pandemic (SY19-SY23)	-5.3%	-5.2%	-4.8%	-4.3%
ELA IAR	SY19	738.4	737.9	740.7	741.7
	SY21	728.4	728.7	730.1	732.2
	SY23				
	% Change from height of pandemic (SY21-SY23)	7.7%	8.3%	10.4%	7.4%
	% Change from pre-pandemic (SY19-SY23)	-4.9%	-3.9%	-4.7%	-4.3%
Math SAT	SY19	481.6	476.9	485.7	486.8
	SY21	470.3	466.1	475.7	475.4

Table 4 (continued).

	SY23	459.7	456.2	461.7	467.2
	% Change from height of pandemic (SY21-SY23)	-3.8%	-3.4%	-5.1%	-3.0%
	% Change from pre-pandemic (SY19-SY23)	-7.3%	-7.1%	-8.0%	-6.9%
ELA SAT	SY19	491.2	487.5	492.3	493.8
	SY21	481.8	479.0	486.8	486.3
	SY23	478.2	475.9	479.6	485.1
	% Change from height of pandemic (SY21-SY23)	-0.8%	-0.8%	-2.3%	-0.5%
	% Change from pre-pandemic (SY19-SY23)	-4%	-3.9%	-4%	-3.2%

Note: Percent change was calculated after transforming each scale to have a minimum of 0. The IAR scale was transformed from 650-850 to 0-200. The SAT scale was transformed from 200-800 to 0-600.

As with proportion of expenditure on stipends for school personnel, there were unclear and inconsistent patterns between districts' proportion of expenditure on the other five aggregated spending categories and achievement and between proportion of expenditure on the 16 function-by-object codes and achievement. Tables displaying achievement by quartile of expenditure for each of these categories and function-by-object codes are displayed in Appendix C, Tables C1-C20.

These findings suggest that type of ESSER expenditure, as measured by our five aggregated categories or the most common function-by-object codes, may have been related to districts' learning recovery on specific exams. It is possible that clearer relationships are obscured in our descriptive findings by variation in trends between students, schools, or districts with differing characteristics. For example, we wondered whether proportion of expenditure on a given category was related to achievement only among districts that met a certain threshold of expenditure in dollars. In turn, we used HLM controlling for student, school, and district characteristics (including total ESSER expenditure in dollars) to further analyze how type of expenditure related to achievement.

HLM Findings

Table 5 displays intraclass correlation coefficients obtained from the covariance estimates of our intercept-only models. As shown, the vast amount of variation in achievement across tests (between 79% and 83%) occurred between students. The remaining variation in IAR achievement was approximately split between schools and districts, while most of the remaining variation on the SAT occurred between schools, with 3-4% attributable to districts. These findings indicate that a relatively small amount of the overall variation in achievement will be explicable with our predictors of interest, which are at the district level.

Table 5. *Proportion of total variance between students, schools, and districts (intercept-only models)*

	IAR ELA	IAR Math	SAT Reading	SAT Math
ICC students	.82	.79	.83	.81
ICC schools	.09	.10	.14	.15
ICC districts	.09	.11	.03	.04

Note: *ICC* refers to intraclass correlation coefficient. Models show ICC for intercept-only models based on covariance estimates.

Findings from our models using proportions of spending on each function-by-object code as predictors are displayed in Table 6. Each coefficient represents the change in scaled score from SY19 to SY23 for a 10-percentage point increase in the proportion of expenditure on its associated code. For example, row 1 shows that a 10-percentage point increase in the proportion of ESSER expenditures a district spent on "Instruction – Purchased services" was associated with a 0.32 point increase in IAR ELA scaled scores, a 0.07 point increase in IAR Math scores, a 1.66 point increase in SAT Reading scores, and a 0.19 point decrease in SAT Math scores. While there are some codes with consistently positive or consistently negative coefficients across tests, none are statistically significant. Results including outliers are shown in Appendix D, Table D1, and they do not differ in terms of statistical significance.

Table 6. *Hierarchical linear model estimates of district average change in student achievement from SY19 to SY23 by top 20 ESSER budget codes*

Budget code(s) (function-object)	Budget code name	IAR ELA	IAR Math	SAT Reading	SAT Math
1000-300	Instruction - Purchased services	0.32	0.07	1.66	-0.19
1000-400	Instruction - Supplies & materials	0.02	0.22	0.26	0.39
1000-500	Instruction - Capital outlay	0.06	0.39	0.50	1.20
2120-100	Guidance services - Salaries	0.53	-0.15	0.98	1.01
2130-400	Health services - Supplies & materials	-0.22	-0.63	1.09	7.61
2210-300	Improvement of instruction services - Purchased services	1.45	0.50	-1.13	-3.33

Table 6 (continued).

2220-300	Educational media services - Purchased services	-0.32	-0.23	-2.95	-3.20
2540-100	Operation and maintenance - Salaries	0.32	0.38	2.87	1.68
2540-400	Operation and maintenance - Supplies and Materials	0.44	0.24	1.63	0.67
2560-400	Food services - Supplies & materials	6.12	2.93	9.22	5.23
2540-500	Operation and maintenance - Capital outlay	0.18	0.21	0.06	0.30
2540-300	Operation and maintenance - Purchased services	0.20	0.26	0.14	0.31
1000-100 & 1000-200	Instruction - Salaries & benefits	0.22	0.10	0.25	0.46
2110-100 & 2110-200	Attendance and social work services - Salaries & benefits	-0.37	-0.27	-2.46	-1.38
2130-100 & 2130-200	Health services - Salaries & benefits	-1.14	-1.06	-0.52	1.52
2210-100 & 2210-200	Improvement of instruction services - Salaries & benefits	-4.73	-0.62	0.49	1.28
SY23 difference from SY19 (intercept)		-3.61**	-4.42**	-7.79**	-21.62**
Constant		736.50**	731.10**	478.01**	474.64**
N students		2,812,464	2,812,464	492,308	492,308
N schools		2,774	2,774	678	678
N districts		652	652	443	443

**p<.002, **p<.001*

Note: P-value threshold of 0.002 reflects overall α=0.05, corrected for multiple hypothesis tests (n=21) using Bonferroni correction. Controls included student race, gender, grade level, FRPL status, EL status, IEP status, proportion of SY21 spent remotely (grades 3-8 only), proportion of SY21 spent absent (grades 3-8 only); school SY19 characteristics including enrollment, attendance, mobility, per-pupil expenditure, and *5Essentials* measures of Effective Leaders, Involved Families, Ambitious Instruction; district SY19 characteristics including student mobility and funding capacity; and district total per pupil ESSER expenditure.

Table 7 shows findings from our models that used our five aggregated spending categories as predictors. Coefficients represent the change in scaled scores from SY19 to SY23 for a 10-percentage point increase in the proportion of expenditure in each category. Like with the function-by-object codes, none of the aggregated categories showed significant relationships with changes in achievement. Results including outliers are shown in Appendix D, Table D2, and they also are not statistically significant for any of the categories.

Table 7. *Hierarchical linear model estimates of district average change in student achievement from SY19 to SY23 by top 5 ESSER spending categories*

Category	*IAR ELA*	*IAR Math*	*SAT Reading*	*SAT Math*
Physical buildings	0.22	0.26	0.30	0.27
Infrastructure for teaching & learning	0.13	0.38	0.57	0.60
Enhancement of academic, pedagogical, and social-emotional learning	0.58	0.18	1.18	-0.11
Stipends for school personnel	0.35	0.24	0.54	0.51
Wellness & safety	-0.29	-0.30	-0.24	-0.67
SY23 difference from SY19 (intercept)	-3.64**	-4.45**	-8.00**	-21.75**
Constant	730.25**	735.56**	478.05**	474.64**
N students	2,812,464	2,812,464	492,308	492,308
N schools	2,774	2,774	678	678
N districts	652	652	443	443

**p<.002, **p<.001*

Note: P-value threshold of 0.002 reflects overall α=0.05, corrected for multiple hypothesis tests (n=25) using Bonferroni correction. Controls included student race, gender, grade level, FRPL status, EL status, IEP status, proportion of SY21 spent remotely (grades 3-8 only), proportion of SY21 spent absent (grades 3-8 only); school SY19 characteristics including enrollment, attendance, mobility, per-pupil expenditure, and *5Essentials* measures of Effective Leaders, Involved Families, Ambitious Instruction; district SY19 characteristics including student mobility and funding capacity; and district total per pupil ESSER expenditure.

Interpretations & Limitations

In the wake of the largest one-time infusion of federal funds into public schools in U.S. history, we explored how districts' amount and type of ESSER spending as of November 2023 related to their changes in test scores from pre-pandemic (SY19) to the most recent year of data available (SY23). Analyzing descriptive trends, we showed that districts that spent the most ESSER funding per pupil had the lowest pre-pandemic (SY19) achievement on the IAR and SAT. In the elementary and middle grades (grades 3-8), districts in the highest quartile of ESSER expenditure had experienced the greatest achievement declines at the outset of the pandemic, but they recovered slightly more quickly than districts with lower ESSER funding. In high school (grade 11), districts in higher quartiles of expenditure experienced achievement declines at rates similar to districts in quartiles of lower expenditure.

While we cannot attribute test score trends to ESSER spending directly, it is noteworthy that elementary and middle school students in districts with the lowest pre-pandemic achievement, who were most vulnerable to the pandemic's negative impacts on learning (as evidenced by their greater losses from SY19 to SY21), did not continue to lose ground relative to higher achieving districts during the recovery period. Instead, they outperformed other districts in their growth from SY21 to SY23, closing some of the gaps that had widened at the outset of the pandemic. This outsize recovery suggests that receiving and spending more ESSER funds may have supported student achievement in these lower-performing districts. This explanation is consistent with existing research showing a positive relationship between district spending and achievement in general (Jackson & Mackevicius, 2021) and between ESSER spending and achievement in particular (Dewey et al., 2024; Goldhaber & Falken, 2024). However, many other differences between districts that received different amounts of ESSER funds could have contributed to the trends we observed, including differences in the timing of remote instruction and the return to in-person learning. Districts that fell furthest behind had the most room to grow upon resumption of more typical educational activities after SY21.

As districts approach the "fiscal cliff" in September 2024—by which point remaining ESSER funds must be obligated—education practitioners and policymakers are making decisions around which programs, materials, staff, and other ESSER-supported recovery interventions to sunset and which to continue with non-ESSER funds. Our descriptive analyses showed unclear achievement trends across districts by the proportion of ESSER funds districts spent on different types of expenditures, and our HLM models showed no statistically significant relationships between achievement and expenditure type. These findings contrast with previous research that has found positive relationships between achievement and spending on capital expenses (Jackson & Mackevicius, 2021), teacher salaries (Childs & Shakeshaft, 1986; Hanushek et al., 1999; Leigh, 2012; Pham et al., 2017), and tutoring (Guryan et al., 2023; Ryu & Kang, 2013). Possible explanations for these null findings relate to the limitations of our measures, the limitations of our analytic method, and the nature of the ESSER intervention, each discussed below.

First, our measures of district spending were imprecise and broad. Different districts often used the same function-by-object codes in different ways in their budgeting (Barragan Torres, Bates, et al., 2024). Our five aggregated categories were meant to ensure that similar types of expenditures were grouped in similar ways, but this resulted in categories that were perhaps too expansive to uncover specific interventions that were positively related to achievement. For example, one district that spent a high proportion of funds on salaries and benefits for improvement of instruction services (codes 2210-100 & 2210-200) may have used them to provide professional development on social-emotional learning, while another may have used them to pay substitute teachers. Relatedly, we do not have data on *how* districts implemented the programs, services, and other interventions that they funded with their ESSER grants or the quality of their implementation. We also were limited to data on spending using ESSER funds alone; we do not know how districts used their regular (non-ESSER) funds in this period of time. These unknown expenditures may have attenuated or confounded relationships between ESSER expenditures in certain categories and achievement.

Second, our analysis attempted to identify correlations between spending type and achievement by controlling for student, school, and district characteristics, but there may have been unobserved variables that influenced relationships. The timespan of our analysis may also have limited the relationships we were able to observe. At the time that our data was collected, districts had spent just 71% of their ESSER funds, and many of their expenditures were quite recent. Research shows that capital expenditures, which were common ESSER expenditures, take an average of five years to show positive impacts on student achievement (Jackson & Mackevicius, 2021). For these and other types of ESSER spending, it may be too early to measure relationships with test scores.

The design of the ESSER funding policy itself may have made it unlikely that district spending decisions would have measurable relationships with student achievement. As we saw from the result of our intercept-only models, little variation in student achievement occurred between districts, limiting the prospect for differences in district-level interventions to show large achievement impacts. Further, ESSER funds were distributed with few guidelines or requirements for how districts should spend their funds. Initially, ESSER funds were disbursed with the purpose of school re-openings, which is not necessarily related to student achievement. This explanation is related to our discussion of measure limitations; we do not have data on implementation of ESSER-funded interventions in part because districts were not required to report this information. The discretion afforded to districts reflects the nature of the emergency at the time, when expediency was a priority above many other considerations. However, this wide latitude meant that districts may have varied widely in how much of their expenditures were on interventions to support the return to in-person learning and learning recovery. This variation, combined with our measures that group many expenditure types together regardless of implementation quality, makes it difficult to disentangle effective from ineffective expenditures.

Furthermore, we note that test scores are not the only or even the most important outcome of ESSER spending. Students' ability to foster positive relationships, engage in learning, and maintain mental health; teachers' capacity to communicate with families, grow professionally, and resist burnout; and schools leaders' success at cultivating supportive school communities are all possible outcomes of district spending decisions. Yet as achievement measures that are common across schools and districts, state test scores are useful for understanding how districts compare with their own prior achievement and with each other. Using this outcome, we find support for the theory that ESSER expenditure may have supported recovery for low-achieving districts (acknowledging many other factors were simultaneously at play). However, we are unable to pinpoint which types of spending may have been most effective. Future research may consider a longitudinal analysis of how individual students' scores changed over time in response to ESSER funding. Future research should also examine variation in districts' implementation of specific ESSER-funded interventions and measure outcomes beyond test scores.

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Appendix A

Table A1. *Missing data, HLM samples (grades 3-8, grade 11)*

Variable	% Missing	
	Grades 3-8	Grade 11
Student variables		
IAR ELA	11.11	
IAR Math	11.35	
SAT Reading		9.66
SAT Math		9.73
District assignment	0	0
School assignment	0	0
Homeless indicator	0	0
IEP indicator	0	0
EL indicator	0	0
FRL indicator	0	0
Gender	0	0
Race	0	0
Grade level	0	0
SY21 % in-person	4.62	
SY21 % remote	4.62	
SY21 % absent	4.62	
School variables		
School attendance rate	0.34	1.94
School mobility rate	3.17	2.73
School enrollment	0.14	1.72
5Essentials Survey Measures (school level)		
Effective leaders	6.00	10.53
Involved families	6.21	10.80
Ambitious instruction	5.60	11.38
Per pupil instructional expenditure (school)	0.20	2.05
District variables		
District mobility	0.33	0.15
District EBF % capacity to meet expectations	0.32	0.50
Per pupil ESSER expenditure	3.32	2.53

Table A1 (cont.).

District ESSER Expenditures (proportion)		
Physical buildings	0.27	0.38
Infrastructure for teaching & learning	0.27	0.38
Enhancement of academic, pedagogical, and social-emotional learning	0.27	0.38
Stipends for school personnel	0.27	0.38
Wellness & safety	0.27	0.38
Instruction - Purchased services (1000-300)	0.27	0.38
Instruction - Supplies & materials (1000-400)	0.27	0.38
Instruction - Capital outlay (1000-500)	0.27	0.38
Guidance services - Salaries (2120-100)	0.27	0.38
Health services - Supplies & materials (2130-400)	0.27	0.38
Improvement of instruction services - Purchased services (2210-300)	0.27	0.38
Educational media services - Purchased services (2220-300)	0.27	0.38
Operation and maintenance - Salaries (2540-100)	0.27	0.38
Operation and maintenance - Supplies and Materials (2540-400)	0.27	0.38
Food services - Supplies & materials (2560-400)	0.27	0.38
Operation and maintenance - Capital outlay (2540-500)	0.27	0.38
Operation and maintenance - Purchased services (2540-300)	0.27	0.38
Instruction - Salaries & benefits (1000-100 & 1000-200)	0.27	0.38
Attendance and social work services - Salaries & benefits (2110-100 & 2110-200)	0.27	0.38
Health services - Salaries & benefits (2130-100 & 2130-200)	0.27	0.38
Improvement of instruction services - Salaries & benefits (2210-100 & 2210-200)	0.27	0.38

Appendix B

Figure B1. *Hierarchical Linear Models, Grades 3-8*

Level 1 (student level)

$Y_{ijk} = \pi_{0jk} + \pi_{1jk}Remote21_{ijk} + \pi_{2jk}Absent21_{ijk} + \pi_{3jk}2021_{ijk} + \pi_{4jk}2022_{ijk} + \pi_{5jk}2023_{ijk} + \Theta_{kjk}\mathbf{X}_{ijk} + e_{ijk}$

Where Y_{ijk} is the test score (IAR ELA or IAR Math) for student *i* in school *j* in district *k*, while e_{ijk} captures the difference in outcome from the school *j* mean for student *i*;

π_{0jk} is the intercept, which corresponds to the average test score for school *j* in district *k* in 2019;

π_{1jk} is the coefficient on proportion of time spent in remote instruction in 2021 for student *i* in school *j* in district *k*;

π_{2jk} is the coefficient on proportion of time spent absent in 2021 for student *i* in school *j* in district *k*;

$\pi_{3jk} - \pi_{5jk}$ are coefficients on dummies for year for student *i* in school *j* in district *k*;

$\mathbf{X}_{ijk}$ is a vector of student controls (race, gender, grade level, FRPL, English Learner, IEP) for student *i* in school *j* in district *k*.

Level 2 (school level)

$\pi_{0jk} = \beta_{00k} + \Omega\mathbf{S}_{jk} + r_{0jk}$

$\pi_{1jk} = \beta_{10k}$

$\pi_{2jk} = \beta_{20k}$

$\pi_{3jk} = \beta_{30k}$

$\pi_{4jk} = \beta_{40k}$

$\pi_{5jk} = \beta_{50k} + r_{5jk}$

$\pi_{kjk} = \beta_{k0k}$

β_{00k} represents the school-level intercept, which corresponds to the average outcome across schools in district *k* in 2019, while variance component r_{0jk} captures the difference in average outcome from the district *k* mean for school *j* in 2019;

$\mathbf{S}_{jk}$ is a vector for school characteristics (including average student enrollment, attendance, mobility, school organization, and per-pupil funding) of school *j* in district *k* in 2019;

β_{10k} represents the relationship between average proportion of the year spent in remote instruction in 2021 and test scores for students in schools in district *k*;

β_{20k} represents the relationship between average proportion of the year spent absent in 2021 and test scores for students in schools in district *k*;

β_{30k} represents the average difference in outcomes in 2021 relative to 2019 across schools in district *k;*

β_{40k} represents the average difference in outcomes in 2022 relative to 2019 across schools in district *k;*

β_{50k} represents the average difference in outcomes in 2023 relative to 2019 across schools in district *k;*

r_{5jk} represents the difference from the district average for each school *k* in district *j* in 2023.

β_{k0k} represent the average relationships between student characteristics **X** and test scores across schools in district *j*.

Level 3 (district level)

Figure B1 (cont.).

$\beta_{00k} = \gamma_{000} + \Lambda \mathbf{D}_k + \mu_{00k}$

$\beta_{10k} = \gamma_{100}$

$\beta_{20k} = \gamma_{200}$

$\beta_{30k} = \gamma_{300}$

$\beta_{40k} = \gamma_{400}$

$\beta_{50k} = \gamma_{500} + \gamma_{501} ESSERppe_k + \sum_1^x \gamma_{50x} ESSER_k + \mu_{50k}$

$\beta_{k0k} = \gamma_{k00}$

Where γ_{000} represents the district-level intercept, which corresponds to the average outcome across districts in 2019;

$\mathbf{D}_k$ represents a vector of district characteristics (including average student mobility, funding capacity) of district *k* in 2019; variance component μ_{00k} represents the 2019 difference in average outcome from the state mean after controlling for district characteristics in district *k;*

γ_{100} represents the relationship between average proportion of the year spent in remote instruction in 2021 and test scores for districts in Illinois;

γ_{200} represents the relationship between average proportion of the year spent absent in 2021 and test scores for districts in Illinois;

γ_{300} through γ_{500} represent the average differences in outcomes in 2021, 2022, and 2023 relative to 2019 across districts*;*

γ_{501} represents the coefficient on total per pupil ESSER expenditure for district *k*;

γ_{50x} represent the coefficient on ESSER spending category *x* for district *k,* capturing moderation effects of ESSER spending patterns on average scores relative to 2019 across grade levels. The first set of models included 16 function-by-object code predictors; the second set of models included the 5 aggregated spending categories. Variance component μ_{50k} represents the difference from the statewide average for each district *k* in 2023 after taking into account the spending categories;

γ_{k00} represent the average relationships between student characteristics **X** and test scores across districts.

Figure B2. *Hierarchical Linear Models, Grade 11*

Level 1 (student level)

$$Y_{ijk} = \pi_{0jk} + \pi_{1jk}2021_{ijk} + \pi_{2jk}2022_{ijk} + \pi_{3jk}2023_{ijk} + \Theta_{kjk}\mathbf{X}_{ijk} + e_{ijk}$$

Where Y_{ijk} is the test score (IAR ELA or IAR Math) for student *i* in school *j* in district *k*;
π_{0jk} is the intercept, which corresponds to the average test score for school *j* in district *k* in 2019;
$\pi_{1jk} - \pi_{3jk}$ are coefficients on dummies for year for student *i* in school *j* in district *k*;
$\mathbf{X}_{ijk}$ is a vector of student controls (race, gender, grade level, FRPL, English Learner, IEP) for student *i* in school *j* in district *k*.

Level 2 (school level)

$$\pi_{0jk} = \beta_{00k} + \Omega\mathbf{S}_{jk} + r_{0jk}$$
$$\pi_{1jk} = \beta_{10k}$$
$$\pi_{2jk} = \beta_{20k}$$
$$\pi_{3jk} = \beta_{30k}$$
$$\pi_{kjk} = \beta_{k0k}$$

Where β_{00k} represents the school-level intercept, which corresponds to the average outcome across schools in district *k* in 2019, while variance component r_{0jk} captures the difference in average outcome from the district mean for school *j* in 2019;
$\mathbf{S}_{jk}$ is a vector for school characteristics (including average student enrollment, attendance, mobility, school organization, and per-pupil funding) of school *j* in district *k* in 2019;
β_{10k} represents the average difference in outcomes in 2021 relative to 2019 across schools in district *k;*
β_{20k} represents the average difference in outcomes in 2022 relative to 2019 across schools in district *k;*
β_{30k} represents the average difference in outcomes in 2023 relative to 2019 across schools in district *k;*
r_{5jk} represents the difference from the district average for each school *k* in district *j*.
β_{k0k} represent the average relationships between student characteristics **X** and test scores across schools in district *j*.

Level 3 (district level)

$$\beta_{00k} = \gamma_{000} + \Lambda\mathbf{D}_{k} + \mu_{00k}$$
$$\beta_{10k} = \gamma_{100}$$
$$\beta_{20k} = \gamma_{200}$$
$$\beta_{30k} = \gamma_{300} + \gamma_{301}ESSERppe_{k} + \sum_{1}^{x}\gamma_{30x}ESSER_{k} + \mu_{30k}$$
$$\beta_{k0k} = \gamma_{k00}$$

Where γ_{000} represents the district-level intercept, which corresponds to the average outcome in across districts in 2019;

Figure B2 (cont.).

$\mathbf{D}_k$ represents a vector of district characteristics (including average student mobility, funding capacity) of district *k* in 2019; variance component μ_{00k} represents the difference in average outcome from the state mean after controlling for district characteristics in district *k;*
γ_{100} through γ_{300} represent the average differences in outcomes in 2021, 2022, and 2023 relative to 2019 across districts*;*
γ_{301} represents the coefficient on total per pupil ESSER expenditure for district *k*;
γ_{30x} represent the coefficient on ESSER spending category *x* for district *k,* capturing moderation effects of ESSER spending patterns on average scores relative to 2019 across grade levels. The first set of models included 16 function-by-object code predictors; the second set of models included the 5 aggregated spending categories. Variance component μ_{50k} represents the difference from the statewide average for each district *k* in 2023 after taking into account the spending categories;
γ_{k00} represent the average relationships between student characteristics **X** and test scores across districts.

Appendix C

Table C1. *District average test scores by quartile of ESSER expenditure on physical buildings*

		Per Pupil Expenditure (Quartile)			
		1 (lowest)	2	3	4 (highest)
Math IAR	SY19	739.6	733.8	732.2	729.5
	SY21	731.1	726.3	723.6	722.1
	SY23	734.8	729.6	728.1	725.9
	% Change from height of pandemic (SY21-SY23)	4.5%	5.8%	7.9%	5.9%
	% Change from pre-pandemic (SY19-SY23)	-4.9%	-4.6%	-4.6%	-5.5%
ELA IAR	SY19	744.7	739.3	738.7	736.2
	SY21	734.9	729.7	727.9	726.9
	SY23	740.6	734.7	734.2	732.9
	% Change from height of pandemic (SY21-SY23)	6.7%	7.8%	10.8%	8.3%
	% Change from pre-pandemic (SY19-SY23)	-4.3%	-4.6%	-4.6%	-4.3%
Math SAT	SY19	495.3	487.1	476	473.7
	SY21	485.6	474.6	466.2	462.4
	SY23	475.8	461.4	455.2	454.4
	% Change from height of pandemic (SY21-SY23)	-3.7%	-4.8%	-3.9%	-3%
	% Change from pre-pandemic (SY19-SY23)	-6.5%	-8.7%	-7.2%	-6.8%
ELA SAT	SY19	501.4	493.3	486.7	484.4
	SY21	495.7	485.3	478.3	475.9
	SY23	492.5	481.6	473.6	473.1
	% Change from height of pandemic (SY21-SY23)	-1.1%	-1.1%	-1.4%	-.8%
	% Change from pre-pandemic (SY19-SY23)	-3.1%	-3.7%	-4.4%	-3.9%

Table C2. *District average scaled score by quartile of ESSER expenditure on improvement of infrastructure for teaching and learning*

		Per Pupil Expenditure (Quartile)			
		1 (lowest)	2	3	4 (highest)
Math IAR	SY19	734.9	729.9	732.5	737.9
	SY21	726.0	721.8	725.6	729.8
	SY23	729.1	725.7	729.6	733.7
	% Change from height of pandemic (SY21-SY23)	7.2%	6.5%	5.6%	5.2%
	% Change from pre-pandemic (SY19-SY23)	-5.1%	-5.8%	-4.1%	-4.5%
ELA IAR	SY19	739.4	736.7	738.4	744.3
	SY21	728.8	726.9	729.7	734.0
	SY23	735.2	732.3	735	739.6
	% Change from height of pandemic (SY21-SY23)	12.5%	7.8%	6.9%	7.2%
	% Change from pre-pandemic (SY19-SY23)	-3.4%	-5.2%	-4.3%	-4.7%
Math SAT	SY19	485.7	474.9	476.8	494.7
	SY21	473.4	465.1	468.3	481.2
	SY23	463.6	450	458.3	473.9
	% Change from height of pandemic (SY21-SY23)	-3.3%	-4.9%	-4.2%	-2.9%
	% Change from pre-pandemic (SY19-SY23)	-7.2%	-8.1%	-7.1%	-6.9%
ELA SAT	SY19	492.4	486.3	485.4	501.9
	SY21	484.8	478.2	478.6	493.1
	SY23	480.7	471.2	476.5	491.6
	% Change from height of pandemic (SY21-SY23)	-1.1%	-1.7%	-1%	-.4%
	% Change from pre-pandemic (SY19-SY23)	-3.8%	-4.6%	-3.4%	-3.3%

Table C3. *District average scaled score by quartile of ESSER expenditure on academic, pedagogical, and social-emotional learning experiences*

		Per Pupil Expenditure (Quartile)			
		1 (lowest)	2	3	4 (highest)
Math IAR	SY19	735.4	730.8	733.6	735.2
	SY21	727.7	723.2	725.9	726.4
	SY23	730.8	727.7	729.7	729.9
	% Change from height of pandemic (SY21-SY23)	5.4%	6.5%	6.6%	5.8%
	% Change from pre-pandemic (SY19-SY23)	-4.9%	-4.6%	-5.6%	-4.8%
ELA IAR	SY19	742	736.8	739.6	740.3
	SY21	731.8	727.8	729.6	730.3
	SY23	736.5	734	736	735.6
	% Change from height of pandemic (SY21-SY23)	6.8%	8.3%	10.9%	7.9%
	% Change from pre-pandemic (SY19-SY23)	-5.7%	-3.6%	-4.4%	-4.1%
Math SAT	SY19	481.4	479.3	481.9	487.8
	SY21	470.4	467.2	471.2	478.3
	SY23	466.2	456.7	459.2	462
	% Change from height of pandemic (SY21-SY23)	-1.8%	-3.9%	-4.5%	-4.8%
	% Change from pre-pandemic (SY19-SY23)	-5.6%	-7.7%	-7.8%	-7.9%
ELA SAT	SY19	492.2	488.3	491	493.1
	SY21	470.4	467.2	471.2	478.3
	SY23	484	475.7	478.9	480.5
	% Change from height of pandemic (SY21-SY23)	-.1%	-.9%	-1.5%	-1.7%
	% Change from pre-pandemic (SY19-SY23)	-3.1%	-4.2%	-4%	-3.7%

Table C4. *District average scaled score by quartile of ESSER expenditure on wellness and safety*

		Per Pupil Expenditure (Quartile)			
		1 (lowest)	2	3	4 (highest)
Math IAR	SY19	735	732.1	731.3	736.7
	SY21	726.7	724.1	723.2	729.4
	SY23	730.6	728.3	727.2	732.3
	% Change from height of pandemic (SY21-SY23)	5.3%	6.2%	6.3%	6.5%
	% Change from pre-pandemic (SY19-SY23)	-5.7%	-4.6%	-4.9%	-4.3%
ELA IAR	SY19	740.8	738.7	737.1	742.2
	SY21	730.9	728.6	727.1	733.0
	SY23	736.5	734.6	733.0	738.3
	% Change from height of pandemic (SY21-SY23)	7.3%	8.2%	8.4%	10.1%
	% Change from pre-pandemic (SY19-SY23)	-4.6%	-4.7%	-4.4%	-4.1%
Math SAT	SY19	480.8	478.2	475.0	497.1
	SY21	468.8	467.1	465.2	486.1
	SY23	462.8	457.6	451.9	473.6
	% Change from height of pandemic (SY21-SY23)	-2.4%	-3.4%	-4.8%	-4.3%
	% Change from pre-pandemic (SY19-SY23)	-6.1%	-7%	-8.1%	-7.8%
ELA SAT	SY19	490.4	487.4	484.8	502.4
	SY21	480.2	480.1	476.9	496.5
	SY23	479.2	475.8	472.1	492.5
	% Change from height of pandemic (SY21-SY23)	-0.4%	-1.2%	-1.4%	-1.2%
	% Change from pre-pandemic (SY19-SY23)	-3.9%	-3.7%	-4.3%	-3.2%

Table C5. *District average scaled score by quartile of ESSER expenditure on "Instruction - Purchased services" (1000-300)*

		Per Pupil Expenditure (Quartile)			
		1 (lowest)	2	3	4 (highest)
Math IAR	SY19	736.5	730.9	732.2	735.5
	SY21	729.2	722.7	724.1	727.1
	SY23	732.1	726.8	728.4	730.9
	% Change from height of pandemic (SY21-SY23)	4.8%	6.2%	6.5%	6.8%
	% Change from pre-pandemic (SY19-SY23)	-5%	-4.6%	-5.2%	-4.7%
ELA IAR	SY19	742.8	737.4	737.7	740.8
	SY21	732.8	727.5	728.5	730.8
	SY23	737.9	733.0	734.8	736.5
	% Change from height of pandemic (SY21-SY23)	7.3%	7.5%	8.6%	10.5%
	% Change from pre-pandemic (SY19-SY23)	-5.1%	-4.7%	-3.7%	-4.3%
Math SAT	SY19	489.3	477.0	479.9	485.4
	SY21	477.6	463.1	470.6	476.6
	SY23	471.4	454.0	459.3	461.2
	% Change from height of pandemic (SY21-SY23)	-2.4%	-3.5%	-4.3%	-4.9%
	% Change from pre-pandemic (SY19-SY23)	-6.2%	-8%	-7.3%	-7.6%
ELA SAT	SY19	496.5	487.9	488.4	492.5
	SY21	488.4	477.0	481.5	487.6
	SY23	487.9	473.3	478.2	480.4
	% Change from height of pandemic (SY21-SY23)	-0.1%	-1.3%	-1.1%	-1.7%
	% Change from pre-pandemic (SY19-SY23)	-3%	-5%	-3.5%	-3.5%

Table C6. *District average scaled score by quartile of ESSER expenditure on "Instruction - Supplies & materials" (1000-400)*

		Per Pupil Expenditure (Quartile)			
		1 (lowest)	2	3	4 (highest)
Math IAR	SY19	734.5	729.5	732.9	738.3
	SY21	725.8	721.8	725.7	729.9
	SY23	728.8	725.9	729.2	734.1
	% Change from height of pandemic (SY21-SY23)	7%	6.3%	5.4%	5.6%
	% Change from pre-pandemic (SY19-SY23)	-4.9%	-5.4%	-4.6%	-4.6%
ELA IAR	SY19	739.2	736.2	739.1	744.3
	SY21	728.8	726.8	729.8	733.9
	SY23	734.6	732.7	734.9	739.8
	% Change from height of pandemic (SY21-SY23)	11.8%	8.1%	7%	7.5%
	% Change from pre-pandemic (SY19-SY23)	-3.9%	-4.6%	-4.7%	-4.5%
Math SAT	SY19	484.7	476.1	476.3	495.9
	SY21	473.5	464.4	468.5	482.3
	SY23	463.9	452.8	455.5	474.6
	% Change from height of pandemic (SY21-SY23)	-3.4%	-4%	-4.7%	-3.1%
	% Change from pre-pandemic (SY19-SY23)	-6.9%	-7.9%	-7.4%	-7.1%
ELA SAT	SY19	491.6	487.1	487.0	500.5
	SY21	483.7	477.9	480.5	493.0
	SY23	480.2	474.0	475.5	490.8
	% Change from height of pandemic (SY21-SY23)	-1.1%	-0.9%	-1.6%	-0.7%
	% Change from pre-pandemic (SY19-SY23)	-3.8%	-4.2%	-3.9%	-3.1%

Table C7. *District average scaled score by quartile of ESSER expenditure on "Instruction - Capital outlay" (1000-500)*

		Per Pupil Expenditure (Quartile)			
		1 (lowest)	2	3	4 (highest)
Math IAR	SY19	738.1	731.0	730.9	734.2
	SY21	729.8	722.6	723.1	726.9
	SY23	733.2	727.0	727.0	730.4
	% Change from height of pandemic (SY21-SY23)	4.8%	7.8%	6.3%	5.8%
	% Change from pre-pandemic (SY19-SY23)	-5.6%	-4.9%	-5.0%	-4.0%
ELA IAR	SY19	743.4	736.6	737.2	740.7
	SY21	733.1	726.3	728.2	731.1
	SY23	738.6	733.4	733.4	736.2
	% Change from height of pandemic (SY21-SY23)	7.1%	12.5%	7.5%	7.5%
	% Change from pre-pandemic (SY19-SY23)	-5.0%	-4.1%	-4.3%	-4.3%
Math SAT	SY19	506.6	469.6	473.0	479.5
	SY21	492.4	461.4	462.5	468.3
	SY23	481.4	448.3	453.5	460.1
	% Change from height of pandemic (SY21-SY23)	-3.8%	-5%	-3.3%	-3.3%
	% Change from pre-pandemic (SY19-SY23)	-8.4%	-7.8%	-6.7%	-6.6%
ELA SAT	SY19	507.4	480.8	486.4	488.5
	SY21	502.2	473.1	475.8	481.1
	SY23	496.1	468.7	475.0	477.7
	% Change from height of pandemic (SY21-SY23)	-2%	-1.4%	-0.1%	-1%
	% Change from pre-pandemic (SY19-SY23)	-3.8%	-4.1%	-3.8%	-3.5%

Table C8. *District average scaled score by quartile of ESSER expenditure on "Guidance services – Salaries" (2120-100)*

		Per Pupil Expenditure (Quartile)			
		1 (lowest)	2	3	4 (highest)
Math IAR	SY19	734.8	-	-	730.0
	SY21	726.5	-	-	723.5
	SY23	730.2	-	-	727.3
	% Change from height of pandemic (SY21-SY23)	6.1%	-	-	5.8%
	% Change from pre-pandemic (SY19-SY23)	-4.9%	-	-	-4.8%
ELA IAR	SY19	740.7	-	-	736.3
	SY21	730.5	-	-	727.5
	SY23	736.1	-	-	733.6
	% Change from height of pandemic (SY21-SY23)	8.6%	-	-	8.1%
	% Change from pre-pandemic (SY19-SY23)	-4.6%	-	-	-4.0%
Math SAT	SY19	484.1	-	-	479.3
	SY21	472.8	-	-	469.2
	SY23	463.1	-	-	456.5
	% Change from height of pandemic (SY21-SY23)	-3.4%	-	-	-4.8%
	% Change from pre-pandemic (SY19-SY23)	-7.0%	-	-	-8.0%
ELA SAT	SY19	493.0	-	-	487.0
	SY21	484.9	-	-	479.9
	SY23	482.2	-	-	474.0
	% Change from height of pandemic (SY21-SY23)	-0.6%	-	-	-2.1%
	% Change from pre-pandemic (SY19-SY23)	-3.5%	-	-	-4.4%

Note: Districts in quartiles 1-3 allocated 0% of their ESSER funds to this category.

Table C9. *District average scaled score by quartile of ESSER expenditure on "Health services - Supplies & materials" (2130-400)*

		Per Pupil Expenditure (Quartile)			
		1 (lowest)	2	3	4 (highest)
Math IAR	SY19	736.0	732.2	731.0	733.3
	SY21	728.0	722.3	723.2	725.7
	SY23	731.4	727.4	727.4	729.1
	% Change from height of pandemic (SY21-SY23)	6.2%	7.8%	5.9%	5.6%
	% Change from pre-pandemic (SY19-SY23)	-4.8%	-6.1%	-4.7%	-4.9%
ELA IAR	SY19	741.8	738.1	737.1	739.3
	SY21	731.6	727.8	727.9	729.5
	SY23	737.5	733.7	733.3	735.0
	% Change from height of pandemic (SY21-SY23)	9.7%	7.8%	7.2%	7.7%
	% Change from pre-pandemic (SY19-SY23)	-4.3%	-6.1%	-4.7%	-4.9%
Math SAT	SY19	490.0	471.0	478.3	480.9
	SY21	479.2	461.4	467.5	469.5
	SY23	468.3	449.0	457.2	459.3
	% Change from height of pandemic (SY21-SY23)	-3.5%	-4.7%	-3.8%	-4%
	% Change from pre-pandemic (SY19-SY23)	-6.9%	-7.9%	-7.4%	-7.6%
ELA SAT	SY19	496.7	481.6	487.8	490.1
	SY21	489.3	475.3	480.0	481.6
	SY23	484.2	468.9	476.9	479.6
	% Change from height of pandemic (SY21-SY23)	-1.2%	-2.3%	-1%	-0.7%
	% Change from pre-pandemic (SY19-SY23)	-3.9%	-7.9%	-7.4%	-7.6%

Table C10. *District average scaled score by quartile of ESSER expenditure on "Improvement of instruction services - Purchased services" (2210-300)*

		Per Pupil Expenditure (Quartile)			
		1 (lowest)	2	3	4 (highest)
Math IAR	SY19	735.4	731.5	731.4	733.4
	SY21	728.4	721.2	722.9	724.4
	SY23	731.7	723.8	727.1	728.5
	% Change from height of pandemic (SY21-SY23)	5.5%	6.1%	6.6%	6.7%
	% Change from pre-pandemic (SY19-SY23)	-4.4%	-8.1%	-4.5%	-5.9%
ELA IAR	SY19	741.8	736.9	737.0	738.8
	SY21	731.6	727.8	727.9	729.5
	SY23	737.8	730.7	733.0	734.4
	% Change from height of pandemic (SY21-SY23)	9.7%	7.8%	7.2%	7.7%
	% Change from pre-pandemic (SY19-SY23)	-4.2%	-5.6%	-4.3%	-4.9%
Math SAT	SY19	487.0	483.9	472.8	485.5
	SY21	479.2	461.4	467.5	469.5
	SY23	466.6	463.3	452.2	459.6
	% Change from height of pandemic (SY21-SY23)	-3.5%	-4.7%	-3.8%	-4.0%
	% Change from pre-pandemic (SY19-SY23)	-6.6%	-7.3%	-7.0%	-9.5%
ELA SAT	SY19	494.7	494.1	483.5	492.7
	SY21	486.3	482.1	478.2	483.6
	SY23	484.1	476.1	472.3	479.3
	% Change from height of pandemic (SY21-SY23)	-0.3%	-2.1%	-1.8%	-1.7%
	% Change from pre-pandemic (SY19-SY23)	-3.3%	-6.3%	-3.5%	-4.8%

Table C11. *District average scaled score by quartile of ESSER expenditure on "Educational media services - Purchased services" (2220-300)*

		Per Pupil Expenditure (Quartile)			
		1 (lowest)	2	3	4 (highest)
Math IAR	SY19	735.4	-	729.4	731.6
	SY21	727.5	-	720.1	723.9
	SY23	731.0	-	724.5	727.9
	% Change from height of pandemic (SY21-SY23)	6%	-	7.2%	5.8%
	% Change from pre-pandemic (SY19-SY23)	-4.6%	-	-5.9%	-5.1%
ELA IAR	SY19	741.2	-	735.4	737.6
	SY21	731.5	-	724.3	728.0
	SY23	737.0	-	730.6	734.0
	% Change from height of pandemic (SY21-SY23)	8.5%	-	9%	8%
	% Change from pre-pandemic (SY19-SY23)	-4.2%	-	-5.4%	-4.6%
Math SAT	SY19	486.9	-	472.7	476.6
	SY21	475.4	-	460.6	467.5
	SY23	465.9	-	451.9	453.3
	% Change from height of pandemic (SY21-SY23)	-3.3%	-	-3%	-5.3%
	% Change from pre-pandemic (SY19-SY23)	-7.0%	-	-7.4%	-8.0%
ELA SAT	SY19	494.3	-	481.5	487.5
	SY21	487.1	-	473.7	478.5
	SY23	484.0	-	470.9	472.8
	% Change from height of pandemic (SY21-SY23)	-0.8%	-	-0.7%	-1.8%
	% Change from pre-pandemic (SY19-SY23)	-3.4%	-	-7.4%	-8.0%

Note: Districts in quartiles 1 & 2 allocated 0% of their ESSER funds to this category.

Table C12. *District average scaled score by quartile of ESSER expenditure on "Operation and maintenance – Salaries" (2540-100)*

		Per Pupil Expenditure (Quartile)			
		1 (lowest)	2	3	4 (highest)
Math IAR	SY19	735.4	-	730.1	731.5
	SY21	727.1	-	721.3	724.7
	SY23	730.8	-	725.6	728.5
	% Change from height of pandemic (SY21-SY23)	6.3%	-	6.3%	5.4%
	% Change from pre-pandemic (SY19-SY23)	-4.9%	-	-5.7%	-4.4%
ELA IAR	SY19	741.4	-	735.6	737.5
	SY21	730.9	-	726.5	729.0
	SY23	736.9	-	731.0	734.3
	% Change from height of pandemic (SY21-SY23)	9.4%	-	6.3%	7.1%
	% Change from pre-pandemic (SY19-SY23)	-4.5%	-	-5.4%	-3.9%
Math SAT	SY19	489	-	475.4	470.8
	SY21	477.2	-	465.1	461.8
	SY23	467.9	-	451.4	449.2
	% Change from height of pandemic (SY21-SY23)	-3.1%	-	-5.3	-4.8
	% Change from pre-pandemic (SY19-SY23)	-6.9%	-	-8.4%	-7.8%
ELA SAT	SY19	489.0	-	475.4	470.8
	SY21	488.8	-	476.7	473.5
	SY23	467.9	-	451.4	449.2
	% Change from height of pandemic (SY21-SY23)	-0.9%	-	-2.3%	-1%
	% Change from pre-pandemic (SY19-SY23)	-6.9%	-	-8.4%	-7.8%

Note: Districts in quartiles 1 & 2 allocated 0% of their ESSER funds to this category.

Table C13. *District average scaled score by quartile of ESSER expenditure on "Operation and maintenance - Supplies and Materials" (2540-400)*

		Per Pupil Expenditure (Quartile)			
		1 (lowest)	2	3	4 (highest)
Math IAR	SY19	735.0	731.5	732.7	736.0
	SY21	727.1	723.0	725.3	727.9
	SY23	731.1	726.6	729.4	731.1
	% Change from height of pandemic (SY21-SY23)	5.2%	5.6%	6%	7.6%
	% Change from pre-pandemic (SY19-SY23)	-4.9%	-6.0%	-4.1%	-4.5%
ELA IAR	SY19	741.0	737.8	738.6	741.4
	SY21	731.1	727.5	729.6	731.4
	SY23	737.2	733.1	735.2	736.7
	% Change from height of pandemic (SY21-SY23)	7.4%	8%	7.7%	10.8%
	% Change from pre-pandemic (SY19-SY23)	-4.1%	-6.0%	-4.1%	-4.5%
Math SAT	SY19	483.7	478.1	479.4	489.7
	SY21	471.5	466.7	468.7	480.6
	SY23	463.2	456.7	457.8	466.8
	% Change from height of pandemic (SY21-SY23)	-3.4%	-3.6%	-4%	-4.3%
	% Change from pre-pandemic (SY19-SY23)	-7.2%	-7.4%	-7.5%	-7.2%
ELA SAT	SY19	492.9	487.0	488.3	496.6
	SY21	485.2	476.5	480.3	492.2
	SY23	483.0	474.4	474.9	486.5
	% Change from height of pandemic (SY21-SY23)	-1%	-0.5%	-1.6%	-1.3%
	% Change from pre-pandemic (SY19-SY23)	-3.7%	-4.3%	-4.4%	-2.7%

Table C14. *District average scaled score by quartile of ESSER expenditure on "Food services - Supplies & materials" (2560-400)*

		Per Pupil Expenditure (Quartile)			
		1 (lowest)	2	3	4 (highest)
Math IAR	SY19	734.7	-	-	730.7
	SY21	726.8	-	-	722.6
	SY23	730.2	-	-	727.2
	% Change from height of pandemic (SY21-SY23)	5.8%	-	-	6.8%
	% Change from pre-pandemic (SY19-SY23)	-5.0%	-	-	-4.6%
ELA IAR	SY19	740.7	-	-	736.4
	SY21	730.8	-	-	726.9
	SY23	736.2			733.4
	% Change from height of pandemic (SY21-SY23)	8.2%	-	-	9.2%
	% Change from pre-pandemic (SY19-SY23)	-4.7%	-	-	-3.6%
Math SAT	SY19	486.2	-	-	473.1
	SY21	475.3	-	-	462.3
	SY23	464.1	-	-	452.7
	% Change from height of pandemic (SY21-SY23)	-3.9%	-	-	-3.7%
	% Change from pre-pandemic (SY19-SY23)	-7.4%	-	-	-7.2%
ELA SAT	SY19	493.8	-	-	484.0
	SY21	486.1	-	-	476.0
	SY23	481.9	-	-	473.3
	% Change from height of pandemic (SY21-SY23)	-1.2%	-	-	-0.9%
	% Change from pre-pandemic (SY19-SY23)	-3.9%	-	-	-3.6%

Note: Districts in quartiles 1-3 allocated 0% of their ESSER funds to this category.

Table C15. *District average scaled score by quartile of ESSER expenditure on "Operation and maintenance - Capital outlay" (2540-500)*

		Per Pupil Expenditure (Quartile)			
		1 (lowest)	2	3	4 (highest)
Math IAR	SY19	738.8	730.8	732.8	731.7
	SY21	730.8	722.6	725.2	723.5
	SY23	734.3	726.1	728.5	728.4
	% Change from height of pandemic (SY21-SY23)	5.1%	5.7%	5.5%	8.0%
	% Change from pre-pandemic (SY19-SY23)	-5.0%	-5.9%	-4.4%	-4.4%
ELA IAR	SY19	744.3	735.8	738.8	738.9
	SY21	734.3	726.5	729.2	728.4
	SY23	740.0	731.9	734.5	735.1
	% Change from height of pandemic (SY21-SY23)	7.3%	7.9%	7.5%	11.2%
	% Change from pre-pandemic (SY19-SY23)	-4.4%	-4.3%	-4.7%	-4.4%
Math SAT	SY19	501.9	476.9	478.1	477.4
	SY21	486.6	467.3	467.5	468.5
	SY23	480.9	452.2	456.6	458.5
	% Change from height of pandemic (SY21-SY23)	-2.4%	-5.3%	-4.0%	-3.4%
	% Change from pre-pandemic (SY19-SY23)	-7.3%	-8.2%	-7.5%	-6.4%
ELA SAT	SY19	506.1	485.5	488.5	487.3
	SY21	497.9	476.9	480.5	481.0
	SY23	495.0	471.9	478.1	476.5
	% Change from height of pandemic (SY21-SY23)	-1.2%	-1.4%	-0.6%	-1.2%
	% Change from pre-pandemic (SY19-SY23)	-4.0%	-4.2%	-3.5%	-3.5%

Table C16. *District average scaled score by quartile of ESSER expenditure on "Operation and maintenance - Purchased services" (2540-300)*

		Per Pupil Expenditure (Quartile)			
		1 (lowest)	2	3	4 (highest)
Math IAR	SY19	735.5	731.0	732.4	733.1
	SY21	728.1	722.2	722.9	725.7
	SY23	732.3	725.7	726.5	733.1
	% Change from height of pandemic (SY21-SY23)	5.8%	5.1%	7.1%	5.7%
	% Change from pre-pandemic (SY19-SY23)	-4.2%	-6.1%	-6.3%	-4.3%
ELA IAR	SY19	741.7	736.9	737.0	739.7
	SY21	732.3	727.0	726.4	730.1
	SY23	738.1	731.7	732.4	735.5
	% Change from height of pandemic (SY21-SY23)	7.4%	6.6%	11.3%	8%
	% Change from pre-pandemic (SY19-SY23)	-4.3%	-5.5%	-5.1%	-3.8%
Math SAT	SY19	488.6	478.8	480.2	474.2
	SY21	478.4	466.4	471.4	460.3
	SY23	467.8	453.5	459.5	451.4
	% Change from height of pandemic (SY21-SY23)	-4%	-3.7%	-4%	-3.3%
	% Change from pre-pandemic (SY19-SY23)	-7.2%	-7.3%	-6.9%	-8.1%
ELA SAT	SY19	495.8	487.8	487.7	486.3
	SY21	488.6	479.3	483.1	474.2
	SY23	485.8	473.2	476.6	472.1
	% Change from height of pandemic (SY21-SY23)	-1%	-0.8%	-1.8%	-0.7%
	% Change from pre-pandemic (SY19-SY23)	-3.5%	-3.8%	-3.5%	-4.7%

Table C17. *District average scaled score by quartile of ESSER expenditure on "Instruction - Salaries & benefits" (1000-100 & 1000-200)*

		Per Pupil Expenditure (Quartile)			
		1 (lowest)	2	3	4 (highest)
Math IAR	SY19	731.9	730.8	734.4	737.7
	SY21	724.3	723.1	726.6	729.2
	SY23	727.6	726.9	730.3	733.1
	% Change from height of pandemic (SY21-SY23)	5.7%	6.4%	5.4%	6.8%
	% Change from pre-pandemic (SY19-SY23)	-5.1%	-5.2%	-4.8%	-4.5%
ELA IAR	SY19	738.3	736.9	740.8	742.7
	SY21	728.7	727.4	730.7	732.6
	SY23	733.9	733.1	736.4	738.5
	% Change from height of pandemic (SY21-SY23)	7.9%	8.2%	7.4%	10.3%
	% Change from pre-pandemic (SY19-SY23)	-4.3%	-4.3%	-4.9%	-4.2%
Math SAT	SY19	481.9	473.4	481.5	495.7
	SY21	470.7	464.5	471.7	481.5
	SY23	459.2	455.7	458.4	472.0
	% Change from height of pandemic (SY21-SY23)	-4%	-3%	-5.3%	-3%
	% Change from pre-pandemic (SY19-SY23)	-7.6%	-5.9%	-8.3%	-7.7%
ELA SAT	SY19	491.1	485.2	489.4	500.1
	SY21	482.4	477.1	483.1	492.2
	SY23	477.1	475.8	477.9	488.3
	% Change from height of pandemic (SY21-SY23)	-1.4%	-0.1%	-2.1%	-0.9%
	% Change from pre-pandemic (SY19-SY23)	-4.4%	-3.1%	-4.0%	-3.8%

Table C18. *District average scaled score by quartile of ESSER expenditure on "Attendance and social work services - Salaries & benefits" (2110-100 & 2110-200)*

		Per Pupil Expenditure (Quartile)			
		1 (lowest)	2	3	4 (highest)
Math IAR	SY19	737.7		730.9	731.0
	SY21	726.9		720.1	722.3
	SY23	730.6		724.4	726.2
	% Change from height of pandemic (SY21-SY23)	6%		7.2%	6.2%
	% Change from pre-pandemic (SY19-SY23)	-4.6%		-7.1%	-5.7%
ELA IAR	SY19	740.7		737.7	736.5
	SY21	730.9		725.9	726.6
	SY23	736.7		731.2	731.9
	% Change from height of pandemic (SY21-SY23)	8.7%		9%	7.5%
	% Change from pre-pandemic (SY19-SY23)	-4.1%		-6.2%	-5.6%
Math SAT	SY19	482.3		483.3	483.1
	SY21	471.4		465.0	472.3
	SY23	461.8		459.6	459.1
	% Change from height of pandemic (SY21-SY23)	-3.5%		-2%	-4.6%
	% Change from pre-pandemic (SY19-SY23)	-6.9%		-8.5%	-8.3%
ELA SAT	SY19	491.9		484.4	489.4
	SY21	483.2		480.2	483.5
	SY23	480.6		478.1	477.1
	% Change from height of pandemic (SY21-SY23)	-0.7%		-0.8%	-1.9%
	% Change from pre-pandemic (SY19-SY23)	-3.7%		-2.4%	-4.1%

Note: Districts in quartiles 1 & 2 allocated 0% of their ESSER funds to this category.

Table C19. *District average scaled score by quartile of ESSER expenditure on "Health services - Salaries & benefits" (2130-100 & 2130-200)*

		Per Pupil Expenditure (Quartile)			
		1 (lowest)	2	3	4 (highest)
Math IAR	SY19	734.5	-	730.4	733.9
	SY21	726.2	-	723.0	726.3
	SY23	730.1	-	727.6	729.3
	% Change from height of pandemic (SY21-SY23)	6.4%	-	6.6%	5.1%
	% Change from pre-pandemic (SY19-SY23)	-4.9%	-	-5.1%	-4.8%
ELA IAR	SY19	740.5	-	736.4	739.5
	SY21	730.3	-	727.1	730.4
	SY23	736.0	-	733.6	735.4
	% Change from height of pandemic (SY21-SY23)	9%	-	8.7%	7%
	% Change from pre-pandemic (SY19-SY23)	-4.5%	-	-4.0%	-4.5%
Math SAT	SY19	482.9	-	477.4	485.0
	SY21	472.2	-	466.0	474.1
	SY23	461.8	-	455.6	462.5
	% Change from height of pandemic (SY21-SY23)	-3.8%	-	-3.5%	-4.1%
	% Change from pre-pandemic (SY19-SY23)	-7.1%	-	-7.3%	-7.7%
ELA SAT	SY19	491.4	-	486.7	493.0
	SY21	464.2	-	477.8	484.9
	SY23	479.8	-	474.5	481.9
	% Change from height of pandemic (SY21-SY23)	-1.3%	-	-0.8%	-0.9%
	% Change from pre-pandemic (SY19-SY23)	-3.8%	-	-3.9%	-3.7%

Note: Districts in quartiles 1 & 2 allocated 0% of their ESSER funds to this category.

Table C20. *District average scaled score by quartile of ESSER expenditure on "Improvement of instruction services - Salaries & benefits" (2210-100 & 2210-200)*

		Per Pupil Expenditure (Quartile)			
		1 (lowest)	2	3	4 (highest)
Math IAR	SY19	735.4	-	729.1	732.7
	SY21	728.3	-	719.7	723.3
	SY23	731.9	-	724.2	727.0
	% Change from height of pandemic (SY21-SY23)	5.9%	-	6.7%	6.1%
	% Change from pre-pandemic (SY19-SY23)	-3.9%	-	-6.5%	-6.1%
ELA IAR	SY19	741.7	-	735.0	737.7
	SY21	732.6	-	723.9	726.9
	SY23	738.1	-	730.2	732.6
	% Change from height of pandemic (SY21-SY23)	8.4%	-	8.9%	8.4%
	% Change from pre-pandemic (SY19-SY23)	-3.7%	-	-5.8%	-5.4%
Math SAT	SY19	484.1	-	468.0	487.8
	SY21	473.4	-	457.4	476.3
	SY23	464.0	-	447.6	462.4
	% Change from height of pandemic (SY21-SY23)	-3.5%	-	-3.2%	-4.9%
	% Change from pre-pandemic (SY19-SY23)	-6.9%	-	-6.9%	-8.5%
ELA SAT	SY19	493.1	-	479.3	493.7
	SY21	484.6	-	470.0	488.3
	SY23	482.8	-	465.4	480.9
	% Change from height of pandemic (SY21-SY23)	-0.5%	-	-1.1%	-2.3%
	% Change from pre-pandemic (SY19-SY23)	-3.4%	-	-4.5%	-4.1%

Note: Districts in quartiles 1 & 2 allocated 0% of their ESSER funds to this category.

Appendix D

Table D1. *Hierarchical linear model estimates of district average change in student achievement from SY19 to SY23 by top 20 ESSER budget codes, including outliers*

Budget code(s) (function-object)	Budget code name	IAR ELA	IAR Math	SAT Reading	SAT Math
1000-300	Instruction - Purchased services	0.48	0.04	1.26	0.70
1000-400	Instruction - Supplies & materials	-0.04	0.16	0.32	0.42
1000-500	Instruction - Capital outlay	0.13	0.42	0.55	1.09
2120-100	Guidance services - Salaries	0.37	-0.14	1.15	0.90
2130-400	Health services - Supplies & materials	0.56	0.41	-1.58	-4.71
2210-300	Improvement of instruction services - Purchased services	0.33	-0.10	-0.64	-3.68
2220-300	Educational media services - Purchased services	0.11	0.26	-3.31	-3.64
2540-100	Operation and maintenance - Salaries	0.36	0.29	2.98	1.49
2540-400	Operation and maintenance - Supplies and Materials	1.35	0.74	0.51	0.97
2560-400	Food services - Supplies & materials	1.88	0.24	9.87	4.78
2540-500	Operation and maintenance - Capital outlay	0.13	0.18	0.07	0.30
2540-300	Operation and maintenance - Purchased services	0.17	0.26	0.15	0.28
1000-100 & 1000-200	Instruction - Salaries & benefits	0.12	0.01	0.31	0.36

Table D1 (cont.).

2110-100 & 2110-200	Attendance and social work services - Salaries & benefits	-0.50	-0.36	-2.39	-1.26
2130-100 & 2130-200	Health services - Salaries & benefits	-0.91	-1.00	-0.83	-1.88
2210-100 & 2210-200	Improvement of instruction services - Salaries & benefits	-0.47	-0.51	0.92	2.05
SY23 difference from SY19 (intercept)		-3.55**	-4.98**	-7.80**	-21.69**
Constant		732.68**	727.95**	479.22**	475.91**
N students		2,925,423	2,925,423	507,709	507,709
N schools		2,878	2,878	692	692
N districts		685	685	455	455

**p<.002, **p<.001*

Note: P-value threshold of 0.002 reflects overall α=0.05, corrected for multiple hypothesis tests (n=21) using Bonferroni correction. Controls included student race, gender, grade level, FRPL status, EL status, IEP status, proportion of SY21 spent remotely (grades 3-8 only), proportion of SY21 spent absent (grades 3-8 only); school SY19 characteristics including enrollment, attendance, mobility, per-pupil expenditure, and *5Essentials* measures of Effective Leaders, Involved Families, Ambitious Instruction; district SY19 characteristics including student mobility and funding capacity; and district total per pupil ESSER expenditure.

Table D2. *Hierarchical linear model estimates of district average change in student achievement from SY19 to SY23 by top 5 ESSER spending categories, including outliers*

Category	*IAR ELA*	*IAR Math*	*SAT Reading*	*SAT Math*
Physical buildings	0.13	0.20	0.33	0.27
Infrastructure for teaching & learning	0.04	0.30	0.55	0.52
Enhancement of academic, pedagogical, and social-emotional learning	0.34	-0.01	1.18	0.49
Stipends for school personnel	0.16	0.08	0.59	0.41
Wellness & safety	0.17	-0.03	-0.12	-0.39
SY23 difference from SY19 (intercept)	-3.58**	-4.39**	-7.96	-21.77**
Constant	732.68**	727.95**	479.24	475.89
N students	2,925,423	2,925,423	507,709	507,709
N schools	2,878	2,878	692	692
N districts	685	685	455	455

**p<.002, **p<.001*

Note: P-value threshold of 0.002 reflects overall α=0.05, corrected for multiple hypothesis tests (n=25) using Bonferroni correction. Controls included student race, gender, grade level, FRPL status, EL status, IEP status, proportion of SY21 spent remotely (grades 3-8 only), proportion of SY21 spent absent (grades 3-8 only); school SY19 characteristics including enrollment, attendance, mobility, per-pupil expenditure, and *5Essentials* measures of Effective Leaders, Involved Families, Ambitious Instruction; district SY19 characteristics including student mobility and funding capacity; and district total per pupil ESSER expenditure.

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