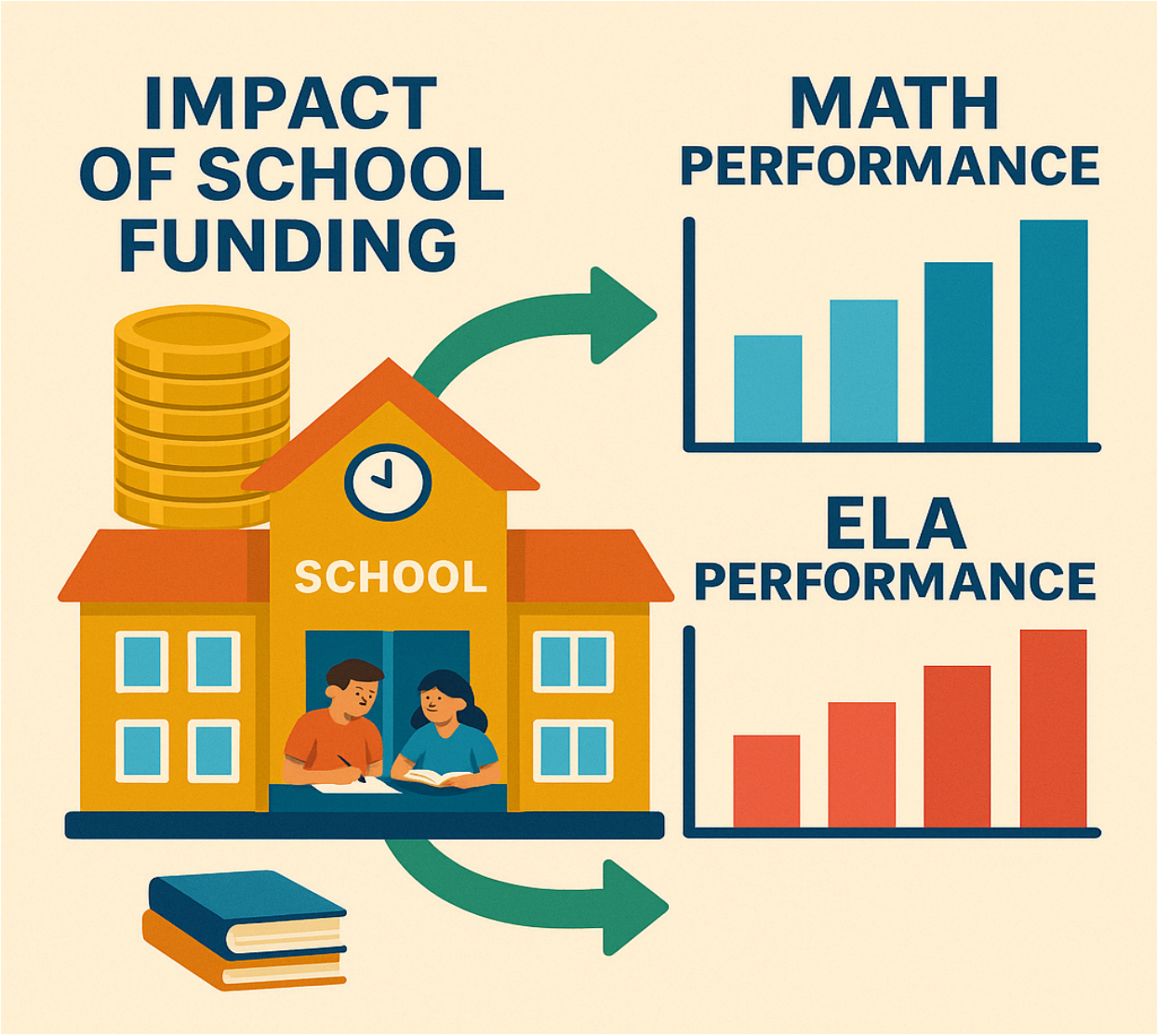

Impact of School Funding on Math/ELA Performance

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Solving Problems with Data (IDS 701)

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REPORT OVERVIEW

Summary

This report investigates the relationship between school funding and academic performance in Florida—one of the lowest-funded states—and Indiana, a moderately funded state (Education Law Center, 2024), using district-level data from 2014 to 2022. We explore whether increased per-pupil funding is associated with improved student outcomes on standardized assessments in Math and English Language Arts (ELA), focusing on both average scale scores and proficiency rates.

While we do not find consistent evidence that higher funding universally improves academic outcomes, our matched analysis reveals a statistically and practically significant causal effect of increased funding on proficiency rates within lower-funded districts—specifically among those spending below $12,000 per pupil, the approximate median in our dataset. Comparing schools in the first and second funding quartiles, we observe that districts with moderately higher funding have proficiency rates approximately 2 percentage points higher than their lower-funded peers. These findings suggest that additional funding resources for the lowest funded schools can yield meaningful gains.

Overall, our results confirm a nonlinear relationship between school spending and student performance, and while funding plays an important role, our findings suggest it may not be the only or largest driver of student achievement as measured by test scores and proficiency levels.

Introduction

Education has long been the primary responsibility of state and local communities in the United States, with 44% of total education spending coming from state funds (Nguyen, 2016). In fact, according to a report by the Center on Budget and Policy Priorities, at least 35 states provided less funding per student in the 2013–14 school year compared to pre-recession levels (2007–2009) (Leachman & Mai, 2014). This trend has continued: a 2024 report by the Adequacy and Fairness of State School Finance Systems found that 39 states have devoted a smaller share of their economies to public school funding than they did before the 2008 recession (Baker et al, 2024). As school funding declines, it becomes increasingly important to understand the consequences of reduced investment in public education.

Whether school funding meaningfully impacts academic achievement has been a subject of debate for decades. It is a common belief that increased funding leads to better student performance. But does additional funding actually result in measurable academic gains? This report investigates whether increases in school funding lead to higher student achievement, as measured by standardized test scores and proficiency rates.

By analyzing historical trends in school spending and standardized test scores, we previously identified instances where reductions in funding coincided with stagnation or declines in student performance. We focused on two states—Florida and Indiana—identified by the *Adequacy and Fairness of State School Finance Systems* report as among the least well-funded (Florida) and moderately funded (Indiana). In Indiana, periods of reduced school funding appeared to align with slowed improvements or declines in student achievement. In contrast, Florida exhibited more complex patterns, where funding cuts did not consistently result in immediate score declines, suggesting that other factors—such as policy interventions or demographic changes—may play a role. While these observations offer preliminary insights into how funding levels may influence academic outcomes, they do not establish a causal relationship. In this study, we aim to evaluate whether per-pupil expenditure causally affects academic performance by using matched regression models that control for district-level characteristics and funding levels to identify potential drivers of student proficiency.

This analysis estimates the causal effect of school funding levels on student performance using matched regression techniques applied to observational data. The goal is to assess how differences in per-pupil funding - measured either as expenditure or revenue - impact two key educational outcomes (percent proficient and average performance scores).

Data and Methods

Data used to assess academic outcomes were obtained from the Education Development Center (EDC). Specifically, the State Assessment Data Repository is a comprehensive, publicly available database containing standardized assessment results from all 50 U.S. states for students in grades 3–8. The repository integrates data at the state, district, and school levels, disaggregated by subject, grade level, and student subgroups. From this resource, we used variables such as district location type, grade level, district type, charter status, subject, state, and year as matching variables in our model. We also obtained two academic outcome measures: a continuous score representing standardized test performance in Math and Reading (Average Scale Score), and the proportion of students meeting or exceeding proficiency thresholds (Proficient Percentage).

The National Center for Education Statistics (NCES) served as a resource for total expenditure per student (Per Pupil Expenditure or PPE) and school revenue per student from the previous year (Per Pupil Revenue or PPR), both adjusted for inflation. NCES also provided additional demographic and racial data that was used later during the matching process.

Due to substantial differences in how states report and format their assessment and finance data (variations in subject labeling, grade categorization, subgroup definitions, and data completeness), constructing a standardized, usable dataset across all 50 states posed significant challenges. Many states either lacked key outcome variables, had inconsistent year-to-year reporting, or failed to disaggregate scores at the district level. As a result, we limited our analysis to two states: Florida and Indiana. These states not only provided relatively complete and

consistently structured data across the relevant years but also represent contrasting funding environments—Florida ranking among the lowest-funded states and Indiana closer to the national median (Education Law Center, 2024). This selection enabled a more reliable and interpretable analysis, while still capturing meaningful variation in school funding and performance patterns across different educational and fiscal contexts. Due to lack of data, we only computed Average Scale Score for the state of Florida. The following analyses referencing Average Scale Score should be interpreted with this in mind.

We chose to focus on the years 2014–2019 and 2021–2022, as this is the most current and accessible data. We excluded the 2019–2020 school year because no testing data exists for that year due to COVID-19. Our regression model focuses on Florida and Indiana school districts and includes predictors such as student grade level, year, state, school district urbanicity (e.g., rural, suburban, urban), whether the district is a charter, district governance type, and subject area (Math or English Language Arts). We also include indicators for the racial composition of the district, including the percentage of students who identify as Black, White, Hispanic, Asian, Native American, Pacific Islander, and multiracial.

To facilitate causal inference, we implemented a matched regression framework. Each treatment variable—per-pupil expenditure or lagged per-pupil revenue—was binarized into high versus low funding groups based on median splits. We applied covariate balancing using DAME (Dynamic Almost Matching Exactly) to retain only units with high-quality matches across demographic and structural characteristics, including grade level, year, state, urbanicity, subject, district type, and binned racial composition. Following matching, we estimated treatment effects using weighted least squares (WLS) regression.

To further investigate whether funding effects vary across the distribution, we conducted a secondary analysis limited to schools below the median funding level (approximately $12,000 per pupil). Within this subsample, we compared schools in the first and second funding quartiles, allowing us to test for nonlinear effects and assess whether increases in funding yield stronger impacts in under-resourced settings.

Results

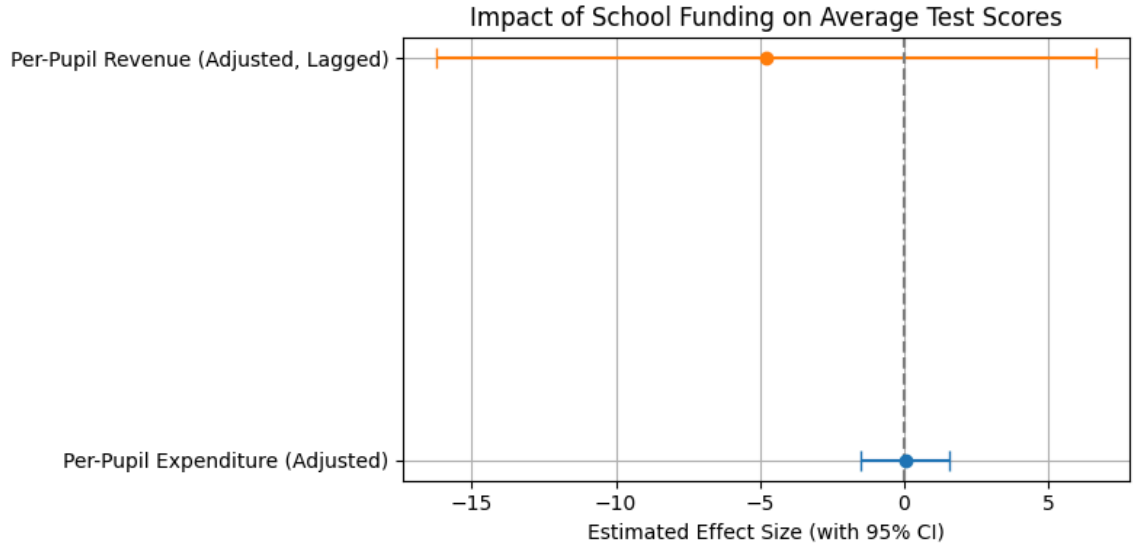
This section presents the findings from our matched regression analysis examining the causal relationship between district funding and student academic outcomes. To estimate the average treatment effect of increased funding, we first matched school districts on a set of covariates including grade level, year, state, subject area, district urbanicity, district type, charter status, and binned racial composition. This allowed us to compare districts that were structurally and demographically similar but differed in per-pupil funding.

In the initial analysis, we used median splits to compare districts with higher versus lower per-pupil funding while controlling for key covariates. Across our four outcome-treatment combinations, most matched regressions showed no statistically significant effect, except for a

small but significant negative association between higher per-pupil expenditure and proficiency rates. However, this counterintuitive result—alongside observed patterns in exploratory plots—motivated a follow-up investigation focused on whether funding effects vary within lower-funded districts.

To visualize the results of our initial matched regression models, we plot the estimated average treatment effects (ATEs) of both per-pupil expenditure and lagged per-pupil revenue on student outcomes, including 95% confidence intervals.

Figure 1. Impact of School Funding on Average Test Scores (Scale Score)



**Note: Average scale score was only computed for the state of Florida.*

For average scale scores, neither PPE nor lagged PPR produced statistically significant effects, and both models showed wide confidence intervals, reflecting substantial uncertainty (Figure 1). This lack of precision is partly due to smaller sample sizes and greater variability in the continuous outcome. These results provide limited support for a causal relationship between funding and average student performance across all districts.

Figure 2. Impact of School Funding on Student Proficiency Rates

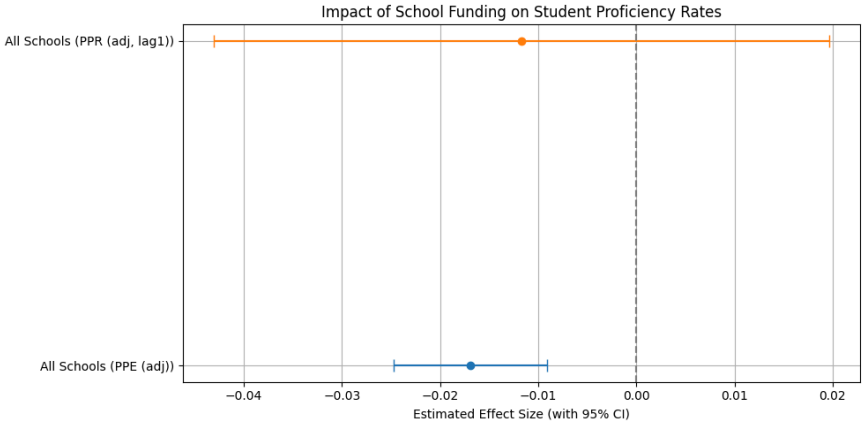
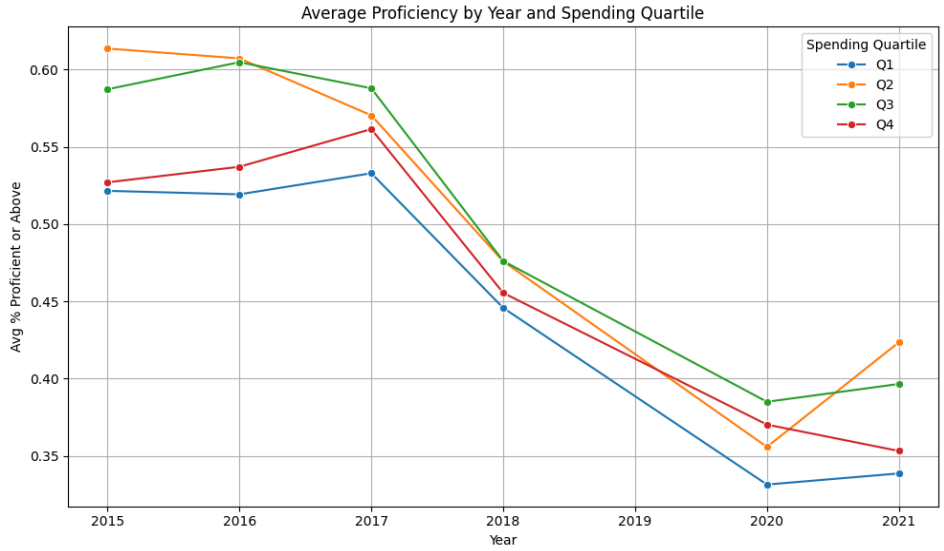


Figure 2 above shows the estimated effects of higher funding on the proportion of students meeting proficiency thresholds. Although both treatment types (PPE and PPR) are associated with negative coefficients, only the per-pupil expenditure effect is statistically significant. This counterintuitive result—indicating a slight decrease in proficiency with higher spending—motivated further investigation into whether effects differ at specific spending levels.

Given the unexpected initial regression results, we further explored how proficiency outcomes vary across different levels of per-pupil spending. To do this, we binned districts into quartiles based on adjusted per-pupil expenditure. Seen in Figure 3.

Figure 3. Trends in Average Proficiency Rates by Per-Pupil Spending Quartile (2015–2021)



Surprisingly, we found that both the lowest-spending (Q1) and highest-spending (Q4) districts consistently exhibited the lowest average proficiency rates across most years (Figure 3). In contrast, districts in the second and third quartile maintained the highest average proficiency rates for most of the time period. This pattern suggests that the relationship between spending and performance is not linear—higher spending does not always equate to better outcomes. Instead, it points toward a more complex, context-dependent relationship in which mid-range funding levels may yield the most consistent academic benefits. These findings justify additional subgroup analysis to assess the causal effect of moderate funding increases within low-funded districts.

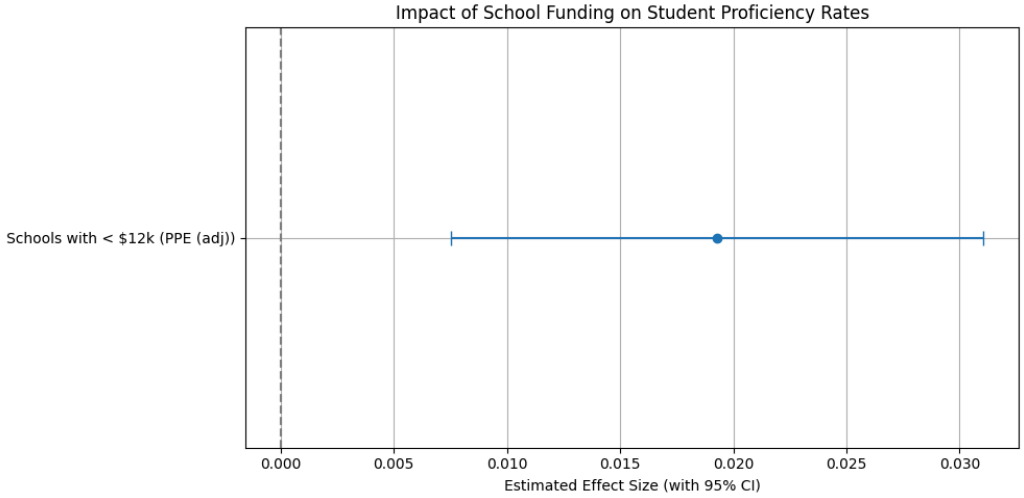
Targeted Analysis Among Low-Funded Districts

To further explore whether school funding has a greater impact in under-resourced settings, we conducted a secondary analysis restricted to the lowest-funded districts. Specifically, we limited the sample to schools spending below the median per-pupil expenditure threshold of approximately $12,000. Within this subset, we compared districts in the first and second funding

quartiles to assess whether modest increases in funding were associated with improved academic outcomes.

This second-stage analysis aimed to provide more targeted causal insight into whether marginal dollars yield greater impact when baseline resources are limited. Due to sample size constraints, we focused on the funding-treatment pairing with the largest number of observations in this low-spending subset—per-pupil expenditure (PPE) as the treatment and proficiency rate as the outcome—in order to retain sufficient statistical power.

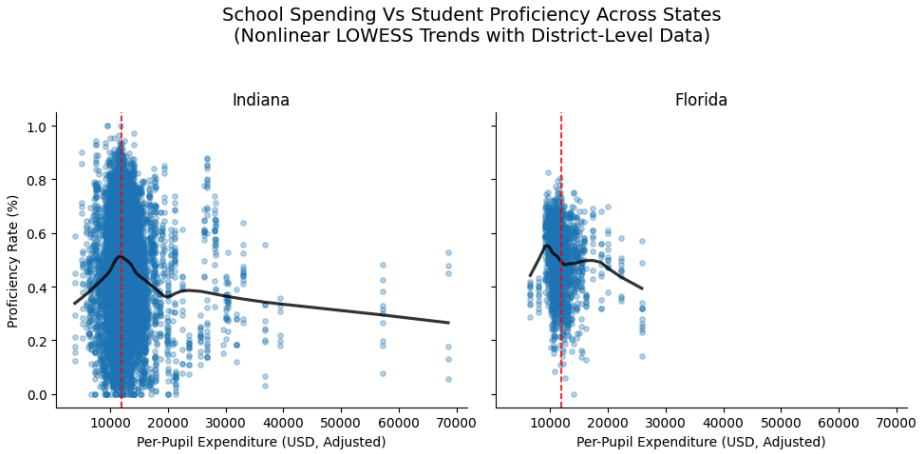
Figure 4. Effect of Increased Funding on Proficiency Rates Among Underfunded Districts



As shown in Figure 4, after matching we find a statistically significant causal effect, with districts in the second funding quartile exhibiting proficiency rates approximately 2 percentage points higher than those in the lowest quartile—suggesting meaningful gains from increases in funding among under-resourced schools to moderately funded schools.

This can also be seen visually here in Figure 5, where the red line shows the cut off point of $12,000.

Figure 5. Nonlinear LOWESS Trends of School Spending versus Student Proficiency Rates in Indiana and Florida



Within our dataset, we observe a positive trend between per-pupil expenditure (PPE) and proficiency rates at funding levels below $12,000 per pupil, with the relationship flattening as spending increases (Figure 5). This visual pattern—based on raw data without controlling for covariates—helps to further motivate our secondary analysis comparing academic outcomes across spending quartiles.

Discussion

While our findings align with earlier studies, such as those by Coleman et al. (1966) and Jencks (1972), which concluded that the relationship between school funding and student achievement is weak, our results differ from several more recent studies that have reported significant positive effects of increased educational spending.

Jackson et al. (2016), for example, examined cohorts of children born between 1955 and 1985, tracking outcomes through 2011. Utilizing variation in school funding resulting from court-mandated finance reforms, they found that a 10% increase in per-pupil spending throughout K–12 schooling was associated with an additional 0.27 years of completed education, a 7.25% increase in adult wages, and a 3.67% reduction in poverty in adulthood. These effects were especially significant among children from low-income families.

Similarly, Abott et al. (2020) analyzed the effects of school finance reforms in seven states where local districts passed levies directing additional resources toward support services and teacher salaries. Their results indicated that a $1,000 per-pupil increase in spending led to a 0.15 standard deviation improvement in standardized test scores and a 9% rise in high school graduation rates.

Moreover, a meta-analysis investigating 31 causal studies on the relationship between school spending and student outcomes reported consistent, statistically significant effects.[10] Using a precision-weighted method-of-moments approach, their analysis found that a $1,000 increase in per-pupil spending raised test scores by 0.0352 standard deviations, increased high school graduation rates by 1.92%, and increased college enrollment by 2.65%.

California's Local Control Funding Formula (LCFF), a school-funding reform aimed at redistributing funds to districts serving high-need students, also led to major educational gains.[9] LCFF-induced increases in school spending significantly improved test scores across all tested academic subjects and grade levels. This spending also decreased grade repetitions, suspensions, and expulsions. The increase in school spending also led to a significant increase in the likelihood of graduating high school and college readiness scores. These effects were stronger the longer students were exposed to increased funding. Relatedly, our study did observe a modest but statistically significant effect within the lower end of the funding distribution. Among schools in the bottom two quartiles of per-pupil funding (less than $12,000), those in the higher quartile demonstrated higher academic proficiency than their lower-funded counterparts. This

finding aligns with the outcomes observed under LCFF; additional resources may be especially impactful for schools with limited baseline funding.

In contrast, our study did not detect statistically significant effects of school funding on student achievement broadly. Although these studies measured very different outcome variables than the present study, they highlight several limitations that likely contributed to our null finding. First, our dataset only had two states with sufficient data for analysis. Second, we employed a coarse classification of funding levels, using a binary approach of putting schools into "low-funded" and "high-funded" categories. This binary approach may have shadowed effects that could have been detectable with a continuous funding spectrum. Despite these limitations, our results should not be interpreted as evidence that school funding has no effect on student outcomes, as recent studies suggest that school funding can have meaningful and measurable effects.

Conclusion

Our analysis reveals a nuanced relationship between school funding and academic performance. While we find no consistent evidence that higher funding universally improves student outcomes, our matched regressions identify a small but statistically significant gain in proficiency rates among the lowest-funded districts when comparing the first and second funding quartiles in Figure 3. This suggests that modest increases in funding can have meaningful impact in under-resourced contexts. Overall, the results support a nonlinear funding-outcome relationship, highlighting that the effects of school spending vary by baseline funding levels and local conditions.

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Appendix

Table 1. Matched WLS Estimates of Per-Pupil Funding Effects on Math & ELA Outcomes

Outcome	Treatment	Coefficient	Std. Error	P-Value	95% CI	R^2	Sample Size (Total/Treated /Control)
Proficient %	PPE (adjusted)	-0.0169	0.004	0.00003	[-0.0250, -0.0088]	0.002	8,124 / 4,058 / 4,066
Avg Scale Score	PPE (adjusted)	0.0418	0.776	0.957	[-1.481, 1.565]	0.000	948 / 468 / 480
Proficient %	PPR (adj, lag1)	-0.0117	0.016	0.471	[-0.0432, 0.0198]	0.001	509 / 253 / 256
Avg Scale Score	PPR (adj, lag1)	-4.7724	5.847	0.416	[-16.234, 6.689]	0.006	118 / 58 / 60

*Table 1 reports matched regression estimates for all four treatment-outcome combinations. While most effects are statistically insignificant, one combination—per-pupil expenditure and proficiency rate—shows a statistically significant negative association. However, as discussed later, this average masks more nuanced patterns we observe when focusing on lower-funded districts, where funding increases appear to yield positive effects. *Note. Average scale score was only computed for the state of Florida, due to lack of data for Indiana.*