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Making it Count: The Productivity of Public Charter Schools in Seven U.S. Cities

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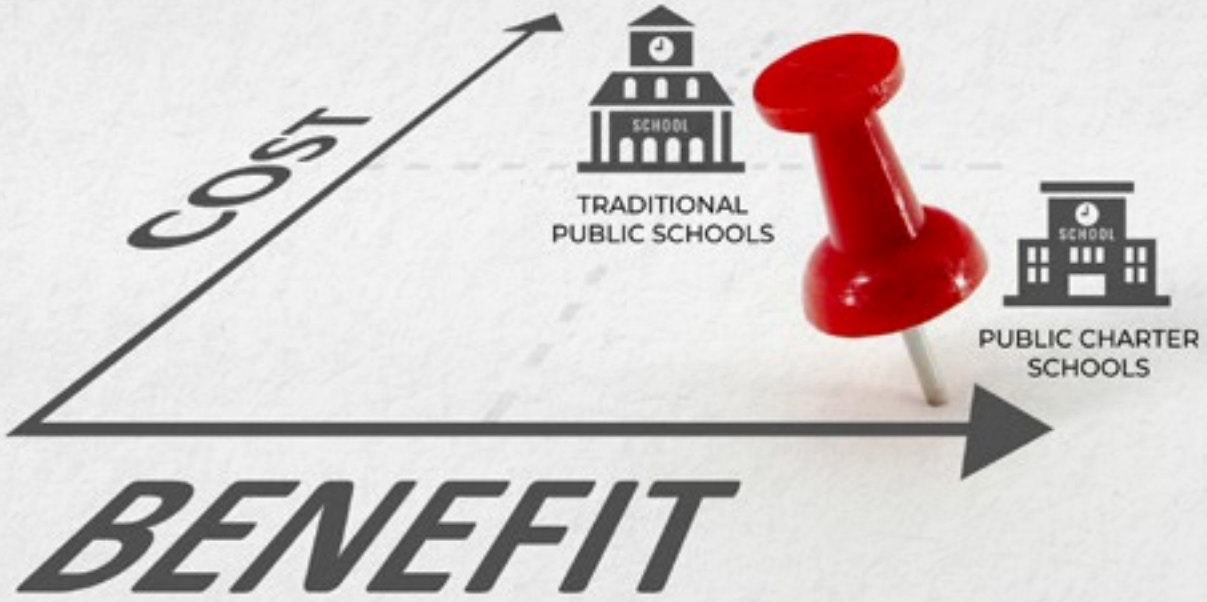

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https://scdp.uark.edu/making-it-count-the-productivity-of-public-charter-schools-in-seven-u-s-cities/

The University of Arkansas was founded in 1871 as the flagship institution of higher education for the state of Arkansas. Established as a land grant university, its mandate was threefold: to teach students, conduct research, and perform service and outreach.

The College of Education and Health Professions established the Department of Education Reform in 2005. The department's mission is to advance education and economic development by focusing on the improvement of academic achievement in elementary and secondary schools. It conducts research and demonstration projects in five primary areas of reform: teacher quality, leadership, policy, accountability, and school choice.

The School Choice Demonstration Project (SCDP), based within the Department of Education Reform, is an education research center devoted to the non-partisan study of the effects of school choice policy and is staffed by leading school choice researchers and scholars. Led by Dr. Patrick J. Wolf, Distinguished Professor of Education Reform and Endowed 21st Century Chair in School Choice, SCDP's national team of researchers, institutional research partners and staff are devoted to the rigorous evaluation of school choice programs and other school improvement efforts across the country. The SCDP is committed to raising and advancing the public's understanding of the strengths and limitations of school choice policies and programs by conducting comprehensive research on what happens to students, families, schools, and communities when more parents are allowed to choose their child's school.

Executive Summary

Historically, public education spending in the United States has risen at a steady rate. In 2017-2018 alone, policymakers spent over $780 billion on the public education system.[1] The intent behind education spending is to create more and better opportunities for students to excel academically, thereby improving their life trajectories. However, looming future challenges such as underfunded teacher pension liabilities suggest that policymakers should "economize" their spending wherever possible.[2] The number of public charter schools, concomitantly, has experienced near exponential growth. From 1991 to 2019, charter school legislation passed in 45 states and the District of Columbia. Student enrollments in public charter schools have increased to over 3.3 million.[3]

Scarcity, inherent among all resources, makes attention to cost-effectiveness and return-on-investment (ROI) considerations critical to long-term policy success. Therefore, we examine which types of public schooling stand to give each student the greatest "bang for their buck." Our analysis compares the productivity of different organizations providing a similar service — in this case, public education. Cost-effectiveness is "the efficacy of a program in achieving given intervention outcomes in relation to the program costs."[4] ROI is

> *A performance measure used to evaluate the efficiency of an investment or to compare the efficiency of a number of different investments. ROI measures the amount of return on an investment relative to the investment's cost. To calculate ROI, the benefit (or return) of an investment is divided by the cost of the investment, and the result is expressed as a percentage or a ratio.*[5]

We examine the differences in cost-effectiveness and ROI for public charter schools and traditional public schools (TPS) in seven major U.S. cities: Camden, Denver, Indianapolis, Shelby County (Memphis), New Orleans, San Antonio, and the District of Columbia. We determine how much money is invested in public charter schools and TPS, what levels of student achievement are attained across the two public school sectors, and how much economic payoff our society can expect to receive as a result of the educational investments in each sector. This report is an update of prior studies examining these differences

We examine which types of public schooling stand to give each student the greatest "bang for their buck."

across the United States at the city and state levels.[6]

We calculate the cost-effectiveness of the charter and TPS sectors in each city by taking the average National Assessment of Educational Progress (NAEP) scores each city achieved and distinguishing the charter school average from the TPS average using recent rigorous evaluations of charter schooling effects by Stanford University's Center for Research on Educational Outcomes (CREDO). We then divide those scores by the city's per-pupil revenue amount received by students in its charter and TPS school sectors. Prior research has established that urban charter schools tend to receive about one-third less in per-pupil funding than their area TPS.[7] Our cost-effectiveness measure is the amount of NAEP math and reading points generated from each $1,000 in per-pupil revenue committed to each sector.

Our determination of the ROI in the public charter and TPS sectors requires additional data. We use information about the expected economic benefits accrued from spending 13 years (K-12) in each of the sectors in order to make that calculation. We also provide a hybrid ROI estimate based on a student spending 6.5 years in the charter sector and 6.5 years in the TPS sector. Since higher student achievement is associated with higher lifetime earnings, we divide the cognitive impact of the K-12 educational experience by the cost-of-investment for each sector in order to calculate city-level ROIs. Finally, we provide cross-city and student-weighted averages for public charter and TPS cost-effectiveness and ROI based on our sample.

Overall, we find that public charter schools outperform TPS on both productivity metrics (Figure ES 1). Specifically:

In all seven cities, public charter schools outperform TPS in both math and reading cost-effectiveness;

- The public charter school sector delivers a cross-city average of an additional 5.92 NAEP points per $1,000 funded in reading, representing a productivity advantage of 43 percent for charters, while the student-weighted public charter school advantage of 5.11 points per $1,000 represents a cost-effectiveness benefit of 35 percent;
- The public charter school sector delivers a cross-city average of an additional 6.26 NAEP points per $1,000 funded in math, representing a productivity advantage of 43 percent for charters, while the student-weighted public charter school advantage of 5.37 points per $1,000 represents a cost-effectiveness benefit of 35 percent;
- The cost-effectiveness advantage for charters compared to TPS regarding NAEP reading scores ranges across the cities from 6 percent (Memphis) to 92 percent (Camden); and,
- The cost-effectiveness for charters compared to TPS in terms of NAEP math scores ranges from 4 percent (Memphis) to 88 percent (Camden).

Overall, we find that public charter schools outperform TPS on both productivity metrics.

In all seven cities, public charter schools outperform TPS in both math and reading cost-effectiveness.

Our ROI analysis finds (Figure ES 2):

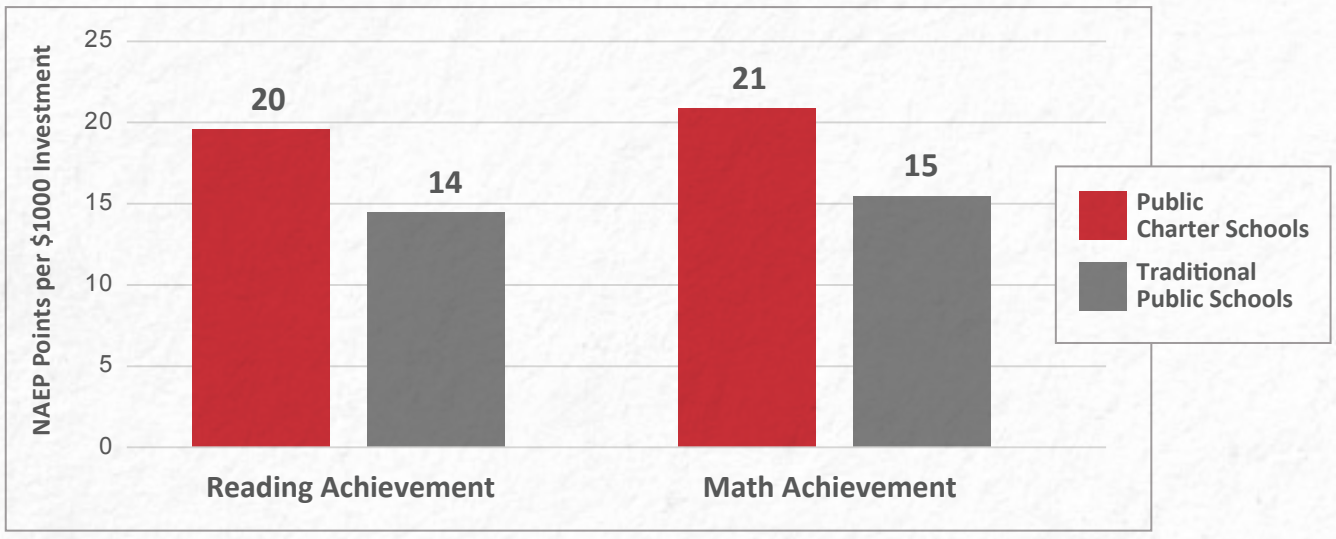
- In all seven cities, public charter schools produce a higher return on investment than TPS;
- On average, each dollar invested in a child's K-12 schooling in TPS yields $5.46 in lifetime earnings compared to $8.00 in lifetime earnings from each dollar invested in a child in public charter schools, demonstrating a 46 percent public charter school ROI advantage;
- The unweighted straight average charter school advantage in ROI is $2.85 or 57 percent;
- On average, public charter schools in our sample would produce $487,177 more in lifetime earnings than the TPS in our sample, if the observed productivity levels remained constant and each sector received the amount of revenues per student currently received by charters;

On average, public charter schools in our sample would produce $487,177 more in lifetime earnings than the TPS in our sample.

- Spending only half of the K-12 educational experience in public charter schools results in $6.48 in benefits for each invested dollar, a 19 percent advantage relative to a full-time (13 year) K-12 experience in TPS or 22 percent if unweighted; and,
- The ROI advantage for an entire K-12 education in public charters compared to TPS ranges from 18 percent (Memphis) to 139 percent (Camden).

We conclude that public charter schools in these seven U.S. cities are more productive relative to their TPS. In most of the cities, public charter

Figure ES 1: **NAEP Points per $1,000 of Funding in Public Charter Schools versus TPS, Seven-City Weighted Average**



Note: Revenue data pertain to the 2018 Fiscal Year, which aligns with the 2017-2018 Academic Year, and are adapted from *Charter school funding: Inequity surges in the cities*, by DeAngelis et al., 2020. NAEP achievement data are from 2019 and are adapted from *The nation's report card*, by NCES, 2020. Overall results are calculated by weighting city-level results by student enrollment in each sector.

We conclude that public charter schools in these seven U.S. cities are more productive relative to their TPS. In most of the cities, public charter schools make it count by accomplishing more with less.

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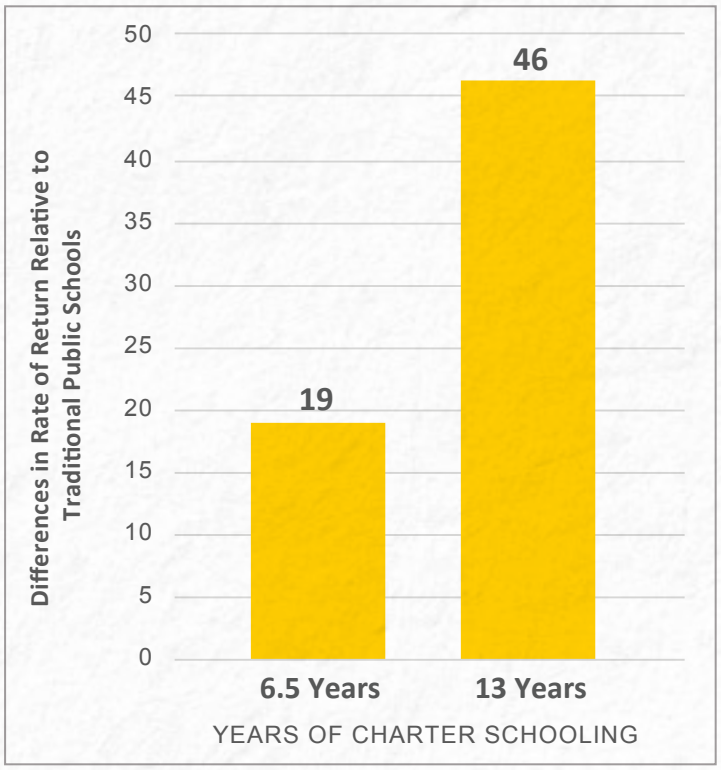
Our study has limitations. It is merely descriptive, presenting the relationships between school revenue and student outcomes as they were observed. However, the cost-effectiveness and ROI analyses are rigorous, as they both use CREDO results based on a rigorous methodology that eliminates many observable differences in student background characteristics across the public charter and TPS sectors. In addition, our productivity results are similar, both indicating large public charter school advantages, whether estimating cost-effectiveness or ROI. As a result, we are confident that these descriptive results represent real differences in productivity across the public charter and TPS sectors of these seven cities.

Figure ES 2: Additional Percentage ROI for Public Charter Schools Relative to TPS, Seven-City Weighted Average



Note: Revenue data pertain to the 2018 Fiscal Year, which aligns with the 2017-2018 Academic Year, and are adapted from *Charter school funding: Inequity surges in the cities*, by DeAngelis et al., 2020. Achievement data are from the 2016-17 school year and are provided by the Center for Research on Education Outcomes (CREDO) *City studies project*, Overall results are calculated by weighting city-level results by student enrollment in each sector.

Acknowledgements

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Introduction

Charter schools are publicly funded schools freed from some of the regulations placed on traditional public schools (TPS). In exchange for that greater level of autonomy, public charter schools are required to meet performance goals contained in their authorizing charter or face the prospect of closure. Most public charter schools may enroll students from a wide geographic area, not just a neighborhood school zone. Such "independent" or "open enrollment" charter schools must admit students by lottery if oversubscribed. Over 7,500 public charter schools enrolled over 3.3 million students during the 2018-19 school year.[8]

Public charter schools remain politically contentious. During his recent successful campaign, President Joe Biden criticized the Trump Administration's charter school policies while promising to expand federal spending exclusively on TPS.[9] In addition to the $13 billion from the CARES Act and $50 billion from the stimulus bill, both of which were enacted in the final year of the Trump Administration, President Biden hopes to inject an additional $130 billion into the public school system to support K-12 reopening efforts.[10] Relief of this magnitude is similar in size to the amount of money the U.S. dedicated to the Marshall Plan to rebuild Europe after World War II.[11]

School choice skeptics frequently claim that public charter schools perform no better than TPS on standardized test scores.[12] Although a few individual studies of public charter schools have supported that assertion,[13] the most comprehensive research reports conclude that, on average, public charter schools have a positive effect on student achievement.[14] Charter school performance appears to be especially strong in major cities.[15]

The most comprehensive research reports conclude that, on average, public charter schools have a positive effect on student achievement.

None of the earlier studies of the relative effectiveness of public charter schools have explicitly considered the funding differences that exist across the two public school sectors. All of our research team's prior reports have found that students in public charter schools receive substantially fewer annual educational resources than their TPS peers.[16] Private philanthropy does not come close to compensating charters for the lack of equity in public funding because TPS receive nonpublic funding, too, and philanthropic dollars compose only 2.5 percent of total charter revenues nationally.[17]

All of our research team's prior reports have found that students in public charter schools receive substantially fewer annual educational resources than their TPS peers.

Our team has produced three of the prior studies of the productivity of public charter schools, accounting for both their effectiveness and funding relative to TPS. In our first public charter school productivity study, across our sample of 21 states plus the District of Columbia, we found that public charter schools generated 17 additional NAEP points in math and 16 additional points in reading per $1,000 of funding compared to TPS.[18] We reported that the return-on-investment (ROI) from a child spending half of his or her K-12 experience (6.5 years) in a public charter school was 19 percent higher than from a child being educated exclusively in TPS.

Our second public charter school productivity study was the first to examine if charters were more productive than TPS in various cities across the U.S.[19] After all, most public charter schools open in cities, specifically to serve highly disadvantaged students. We found that public charter schools outperformed TPS in each of the eight cities on our measures of cost-effectiveness and ROI. On average across the cities, public charter schools were 31 to 32 percent more cost-effective and produced a 38 percent larger ROI than TPS. The public charter school cost-effectiveness advantage ranged from 2 percent in Houston to 68 percent in Washington, D.C., while the public charter school ROI advantage ranged from 4 percent in Houston to 85 percent in the nation's capital.

Our third productivity study assessed the differences in cost-effectiveness and ROI for district schools and charter schools in eight major U.S. cities. We found that public charter schools outperform their TPS counterparts on both productivity metrics for all eight cities. The cost-effectiveness advantage for charters compared to TPS in NAEP reading scores ranged from 5 percent in Houston to 96 percent in Atlanta. Similarly, the cost-effectiveness for charters compared to TPS in NAEP math scores ranged from 5 percent in Houston to 95 percent in Atlanta. Our ROI analysis showed that public charter schools outperform TPS in student achievement despite a significant per-pupil funding gap.[20]

A few other studies discovered cost-effectiveness results in favor of charter schools in Michigan, Texas, and Wisconsin. In Michigan, public charter schools were about 32 percent more cost-effective and produced a 36 percent higher ROI than TPS.[21] A comparison of per-pupil revenue and academic achievement in Texas public school sectors found that public charters were 8 to 42 percent more cost-effective than their traditional counterparts.[22] Similarly, an evaluation of Wisconsin public schools in 2017-2018 showed that independent charter schools and private schools of choice were roughly 30 percent more cost-effective than Wisconsin TPS.[23]

Recently, we conducted a

school revenue study which found that funding inequities that disadvantage students in public charter schools have continued through the 2017-18 school year across 18 metropolitan areas in the U.S.[24] Across the 18 locations, public charter schools received $7,796 less per pupil than TPS, representing a funding inequity of 33 percent, on average. This funding inequity, which favors TPS, has more than doubled in real terms since 2003. Given these disparities and President Biden's promise to increase federal education funding for district schools, this examination of charter school funding inequity and performance is especially timely.

Across the 18 locations, public charter schools received $7,796 less per pupil than TPS, representing a funding inequity of 33 percent, on average.

Because of the COVID-19 pandemic's expected effects on state and local finances, it is vital to determine where scarce educational resources should be allocated to maximize student success. Our current study builds upon our charter funding inequity report, and updates our most recent productivity study, by focusing on how taxpayer investments in the 2017-18 school year translate to student outcomes between the two public school systems. We are able to connect funding to student outcomes for a subset of seven of the 18 locations in our recent revenue study: Camden, Denver, Indianapolis, Memphis, New Orleans, San Antonio, and Washington, D.C.

Because of the COVID-19 pandemic's expected effects on state and local finances, it is vital to determine where scarce educational resources should be allocated to maximize student success.

We use two measures, cost-effectiveness and ROI, to determine which public school sector is more productive in those seven cities using revenue data from the fiscal 2018 school year, which ran from July 1 of 2017 to June 30 of 2018. Cost-effectiveness is measured by how many 2019[25] National Assessment of Educational Progress (NAEP) math and reading test score points each sector produced for each $1,000 spent per student. ROI converts the learning gains experienced by public charter and TPS students to long-run economic benefits, measured by expected impacts on lifetime earnings, and compares those benefits to the total revenues invested in each student's K-12 education.

We find that public charter schools outperform TPS in each of the seven cities on both productivity measures. On average, for the students in our cities, public charter schools are 35 percent more cost-effective and produce a 46 percent larger ROI than TPS. The charter cost-effectiveness

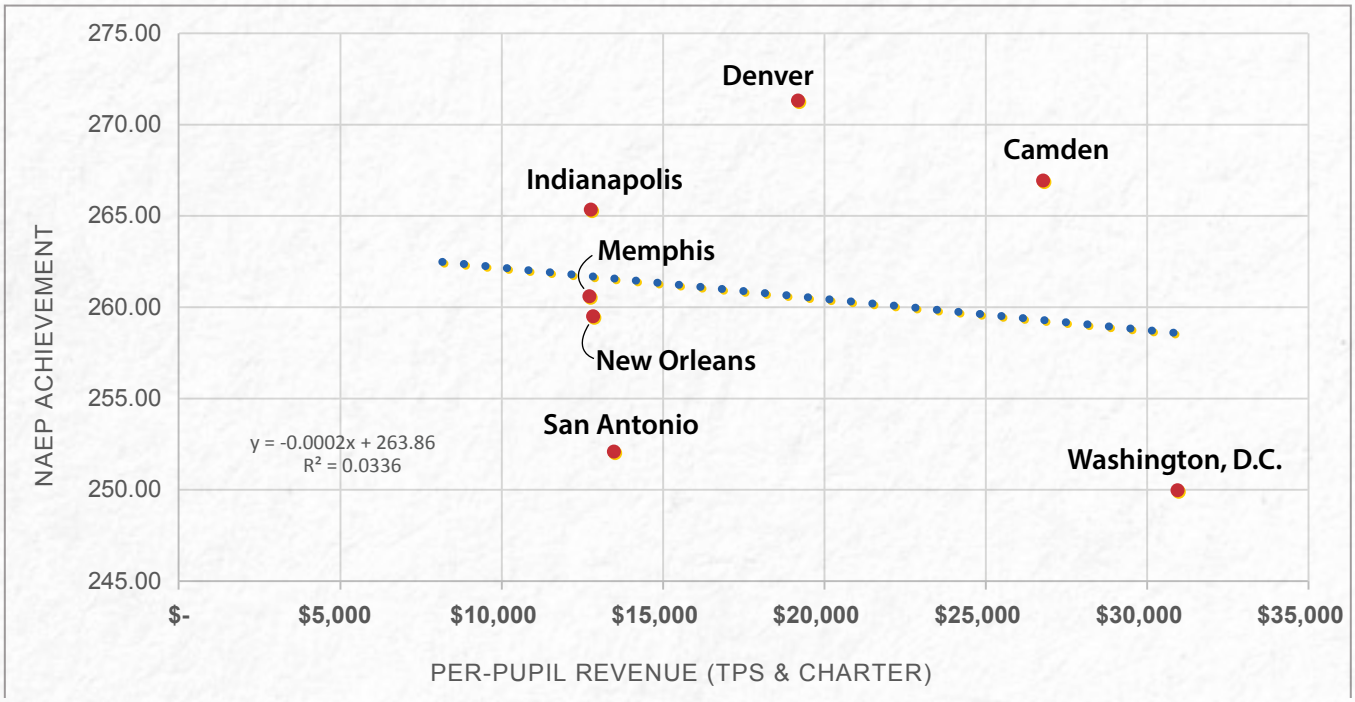
advantage ranges from 4 percent in Memphis to 88 percent in Camden, while the charter ROI advantage ranges from 18 percent in Memphis to 139 percent in Camden.

Public charter schools are 35 percent more cost-effective and produce a 46 percent larger ROI than TPS.

Background: Spending and Achievement in the Seven Cities

Scholars continue to debate the extent to which school resources affect student achievement.[26] The seven cities in our sample vary substantially in both their average per-pupil funding for public school students in both sectors combined and student performance on the NAEP in reading (Figure 1). Washington, D.C. funds the most per public school pupil, an average of about $31,000; however, it is the lowest performing city in the analysis.[27] Denver, in contrast, funds its public school students around $19,000 per pupil, and its students score about 20.8 points higher on the NAEP than Washington, D.C. students do. Similarly, Indianapolis spends about $18,000 less per pupil than D.C., and its students score 13.2 points higher on average. While none of these comparisons prove that more money does not improve student achievement, examples like these show that per-pupil funding does not consistently correlate with academic achievement. Some cities manage to achieve better results with fewer funds.

Figure 1: NAEP Achievement by Per Pupil Funding Level for All Public School Students in the Seven Cities



Although the relationship between per-pupil funding and student performance is statistically zero for these cities, as indicated by the regression running from below Indianapolis across the grid, large metropolitan areas such as Washington, D.C. may commit so much revenue to public education precisely because they have a student body that faces greater education challenges, leading to low student outcomes even with a high commitment of resources.

Obviously, comparing differences in revenue and outcomes across cities is not a strong method for determining how educational resources affect student achievement. We present these simple correlations merely to illustrate the spending and achievement backgrounds of our cities. D.C. and Camden are the biggest spending cities in our sample, while Denver, Camden, and Indianapolis are the top performers.

Analytic Methods

As an improvement upon the descriptive data illustrated above, we compare NAEP scores to per-pupil funding across public school sectors within the same city. This way, we control for cross-city differences in student backgrounds in our analyses.

We present two averages of the results across the cities in our sample. The first is the average of the cities, treating each city as a single, equally-weighted observation. The second, our preferred method, is a student-weighted average across the sample which gives greater weight to cities that have more students contributing to the calculation and less weight to cities that have fewer students contributing. The student-weighted calculations of cost-effectiveness and ROI are completed in two steps. First, we determine the student-weighted averages separately by public school sector, with cities that have relatively larger TPS sectors weighted more heavily in the TPS calculation, and cities that have relatively larger public charter sectors weighted more heavily in the charter calculation. After the student-weighted average results are determined for each sector, the lower number (always the TPS number in our case) is subtracted from the higher number (always the public charter number in our case) to determine the weighted average of the charter productivity advantage (see Appendix A for details). This two-step process generates true student-weighted average productivity levels across our sample at both the sector and overall levels. If, instead, one weights each city's results by the combined K-12 student population for both TPS and charter, the productivity results change only slightly.

Some cities manage to achieve better results with fewer funds.

D.C. and Camden are the biggest spending cities in our sample, while Denver, Camden, and Indianapolis are the top performers.

Our analysis addresses the

question of levels of student disadvantage in the charter and TPS sectors in two ways. First, the evidence on student achievement differences between the two sectors in a given city used in the ROI analysis come from two sources — the 2019 Center for Research on Education Outcomes (CREDO) study and 2019 NAEP math and reading test scores. The CREDO study estimates achievement gaps between a typical student in each city and a typical student in the corresponding states while controlling for a series of individual characteristics like poverty status, English Language Learner designation, special education status, and prior academic achievement.[28] These estimates are then used to project NAEP reading and math scores for each sector in each city. Second, the evidence on revenue differences between charter and TPS in our cities comes from our previous revenue study in which we found that four of our cities — Camden, Denver, Memphis, and Washington, D.C. — enrolled higher or similar rates of low-income students in their charter sectors compared to their TPS sectors in 2018.[29] The other three cities — Indianapolis, San Antonio, and New Orleans — enrolled a higher rate of low-income students in their TPS than their charter sectors. The TPS sectors more consistently enrolled higher percentages of students labeled as English Language Learners or in special education, but those enrollment gaps failed to explain the revenue differences between the different types of public schools. Different levels of student disadvantage across the public school sectors in these cities explain some, but not all, of the productivity advantage for public charter schools.

Cost-Effectiveness Using NAEP Achievement Scores

Cost-effectiveness is "the efficacy of a program in achieving given intervention outcomes in relation to the program costs."[30] Our study measures the effectiveness of the school system to produce outcomes relative to the costs associated with improving children's academic achievement throughout their 13-year K-12 educational experience. We use the nation's report card — NAEP math and reading scores in 2019 — as the intervention outcome and the total per-pupil revenue allocated in fiscal year (FY) 2018 to students in the public charter and TPS sectors as the program cost.

Students in the 4th, 8th, and 12th grades take the NAEP exam. The 4th grade NAEP results likely understate all the learning

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Our study measures the effectiveness of the school system to produce outcomes relative to the costs associated with improving children's academic achievement throughout their 13-year K-12 educational experience.

acquired throughout the K-12 educational experience, as students still have over 60 percent of their schooling remaining. The 12th grade NAEP results likely overstate overall learning levels because they do not include struggling students who dropped out prior to 12th grade. As a result, we use 8th grade NAEP math and reading test scores for our outcome in this analysis. The results are similar if 4th grade NAEP scores are used in place of 8th grade scores, and 12th grade NAEP scores are not available at the individual city level. Although it would be interesting to compare the cost-effectiveness of the public charter and TPS sectors specifically for low-income students, such subgroup NAEP data are not available at the city level.

Math and reading scores are not the only outcomes that educational institutions produce. However, public schools explicitly focus on standardized tests, especially since math and reading test scores were public school accountability measures that the federal government mandated during the period of this study. Furthermore, math and reading test scores, at the very least, serve as proxy measures for the overall quality of an educational experience.

Overall Cost-Effectiveness Results

Now we consider the results across all seven of our cities. The average public charter school sector in our sample produced 19.59 NAEP reading points per $1,000 funded compared to 13.68 points in the average TPS sector (Table 1). This 5.92 NAEP reading score difference represents a 43 percent public charter school sector advantage over TPS in cost-effectiveness. Accounting for the different sizes of the K-12 populations in the public charter and TPS sectors of the seven cities, the student-weighted average production of the public charter sector was 19.58 NAEP reading points per $1,000 compared to 14.47 for TPS. The student-weighted public charter school advantage of 5.11 reading points per $1,000 represents a cost-effectiveness benefit of 35 percent.

The average public charter school sector in our sample produced 19.59 NAEP reading points per $1,000 funded compared to 13.68 points in the average TPS sector.

Example Computation: Indianapolis

Our cost-effectiveness metric is a benefit-cost ratio of NAEP math and reading achievement to average per-pupil revenues allocated for each sector. This calculation can be expressed as:

Cost-Effectiveness = Achievement Scores / Per-Pupil Revenue

We need:

- NAEP Averages broken out by sector and city.

We have:

- NAEP state-wide performance averages
- CREDO: average differences in test-score performance of the TPS and charter students, separately, in a city compared to the state average

CREDO-Adjusted NAEP Estimate for **TPS Reading** in Indianapolis = Reading NAEP State Average + (CREDO estimated difference for **TPS Reading** Relative to State Average * 1 Standard Deviation on NAEP Reading Exam)

262.91 = 265.95 + (-0.08 * 38)

CREDO-Adjusted NAEP Estimate for **Charter Reading** in Indianapolis = Reading NAEP State Average + (CREDO estimated difference for **Charter Reading** Relative to State Average * 1 Standard Deviation on NAEP Reading Exam)

267.85 = 265.95 + (0.05 * 38)

Indianapolis Reading Cost-Effectiveness = Achievement Scores / Per-Pupil Revenue (PPR)

Use: CREDO-Adjusted NAEP Estimates / PPR

TPS Indianapolis ▪ 262.91 / $16,230 = **16.20** / $1,000

Charter Indianapolis ▪ 267.85 / $9,299 = **28.80** / $1,000

The result is a **12.61-point public charter school advantage** in reading achievement per $1,000 spent.

After considering the per-pupil funding differences between the two sectors, Indianapolis public charter schools produced an average of 12.61 more points on the NAEP reading assessment and 13.53 more points on the NAEP math exam for each $1,000 in funding than TPS in Indianapolis. This difference amounts to a 78 and 79 percent public charter school advantage over TPS in cost-effectiveness in producing reading and math scores, respectively. See Table C1 in Appendix C for the CREDO achievement conversions for all seven cities.

Table 1: NAEP Reading Achievement Levels per Thousand Dollars Funded

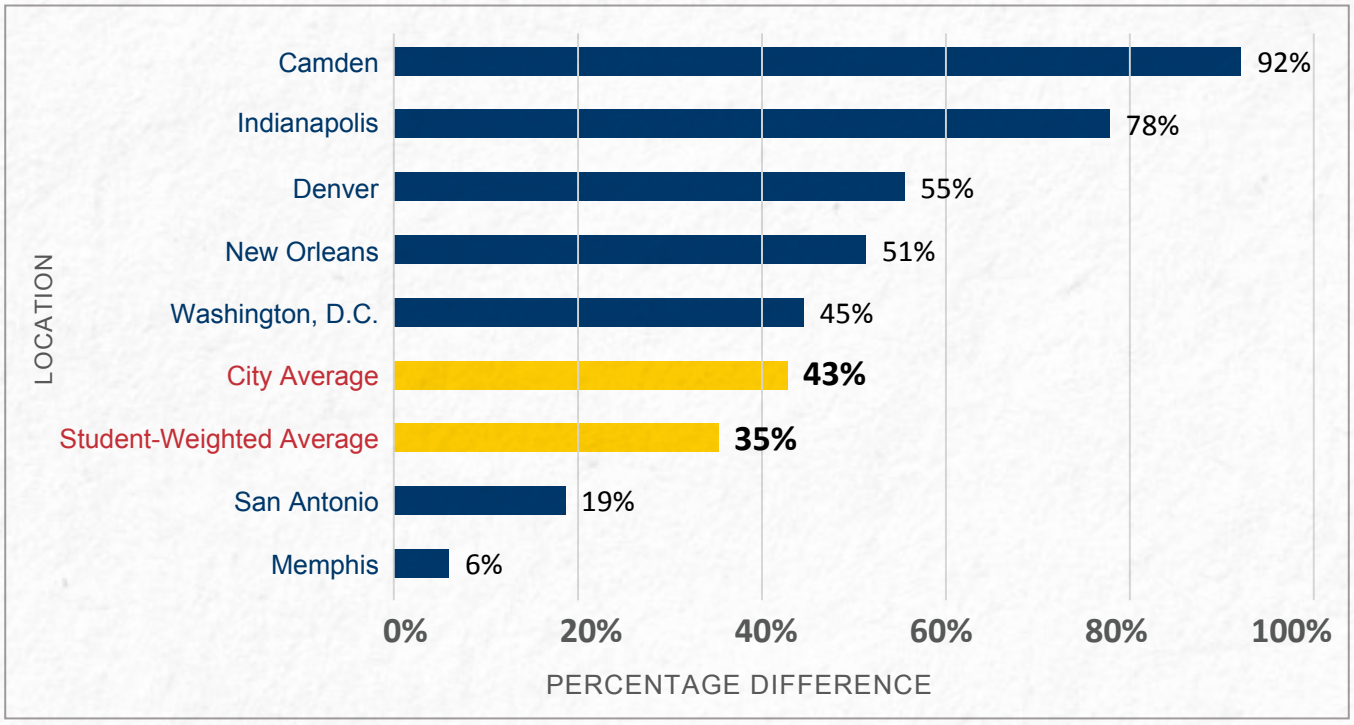
	Traditional Public Schools			Public Charter Schools			Difference
Location	NAEP Score	Per-Pupil Revenue	NAEP Points per $1,000 Funded	NAEP Score	Per-Pupil Revenue	NAEP Points per $1,000 Funded	NAEP Points per $1,000 Funded
Indianapolis	262.91	$16,230	16.20	267.85	$9,299	28.80	12.61
Denver	271.11	$20,827	13.02	271.87	$13,433	20.24	7.22
New Orleans	256.28	$18,694	13.71	259.70	$12,520	20.74	7.03
Camden	262.76	$35,216	7.46	270.74	$18,899	14.33	6.86
San Antonio	251.56	$13,830	18.19	254.98	$11,818	21.58	3.39
Washington, D.C.	250.95	$36,266	6.92	249.05	$24,896	10.00	3.08
Memphis	259.80	$12,842	20.23	263.60	$12,292	21.44	1.21
CITY AVERAGE	**259.34**	**$21,986**	**13.68**	**262.54**	**$14,737**	**19.59**	**5.92**
STUDENT-WEIGHTED AVERAGE	**259.35**	**$20,721**	**14.47**	**261.67**	**$14,754**	**19.58**	**5.11**

Note: Revenue data pertain to the 2018 Fiscal Year, which aligns with the 2017-2018 Academic Year, and are adapted from *Charter school funding: Inequity surges in the cities*, by DeAngelis et al., 2020. NAEP reading achievement data are from 2019 and are adapted from *The nation's report card*, by NCES, 2020. The results in the last row are weighted by each city's total enrollment.

These cost-effectiveness results differ across the seven cities. The charter school cost-effectiveness advantage ranges from 6 percent in Memphis to 92 percent in Camden (Figure 2). Six of the seven cities have public charter school cost-effectiveness advantages exceeding 15 percent and five of them are above 40 percent. Four locations — New Orleans, Denver, Indianapolis, and Camden — have public charter school cost-effectiveness advantages above 50 percent.

Four locations — New Orleans, Denver, Indianapolis, and Camden — have public charter school cost-effectiveness advantages above 50 percent.

Figure 2: Reading Cost-Effectiveness Advantage for Public Charter Schools in Percentage Terms, by City



The charter school advantage is nearly identical for NAEP math scores. On average, per $1,000 funded, the public charter school sectors in our study produce 20.91 NAEP math points compared to 14.65 points for the TPS sectors (Table 2). This 6.26-point math difference is equivalent to a 43 percent cost-effectiveness advantage for public charter schools. The student-weighted average production of the public charter sector was 20.86 NAEP math points per $1,000 compared to 15.48 for TPS. The student-weighted public charter school advantage of 5.37 math points per $1,000 represents a cost-effectiveness benefit of 35 percent.

The public charter school advantage in math cost-effectiveness is 40 percent or larger in all but two locations: Memphis and San Antonio (Figure 3). Again, the gaps are the largest in New Orleans, Denver, Indianapolis, and Camden, where the charter school cost-effectiveness advantage exceeded 50 percent in each location.

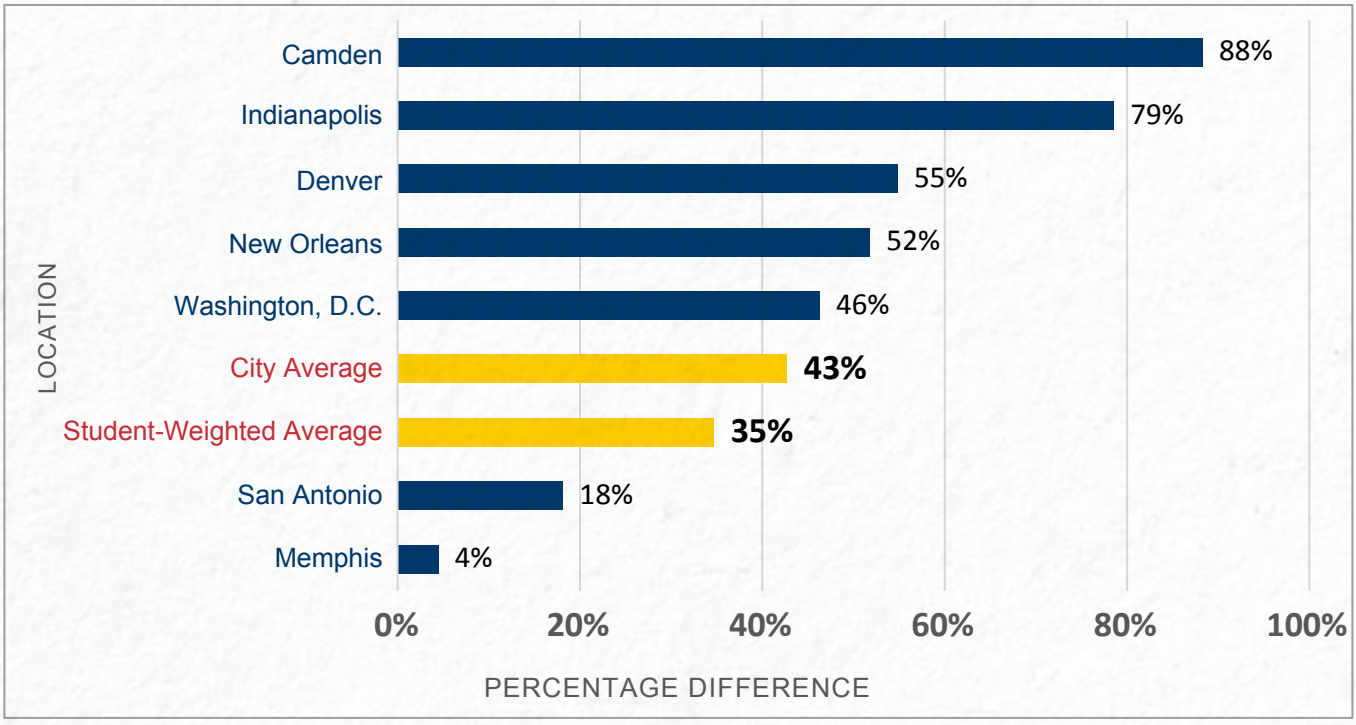
On average, per $1,000 funded, the public charter school sectors in our study produce 20.91 NAEP math points compared to 14.65 points for the TPS sectors.

Table 2: NAEP Math Achievement Levels per Thousand Dollars Funded

	Traditional Public Schools			Public Charter Schools			Difference
Location	NAEP Score	Per-Pupil Revenue	NAEP Points per $1,000 Funded	NAEP Score	Per-Pupil Revenue	NAEP Points per $1,000 Funded	NAEP Points per $1,000 Funded
Indianapolis	279.57	$16,230	17.23	286.03	$9,299	30.76	13.53
Denver	287.71	$20,827	13.81	287.33	$13,433	21.39	7.58
New Orleans	270.12	$18,694	14.45	274.68	$12,520	21.94	7.49
Camden	288.40	$35,216	8.19	291.44	$18,899	15.42	7.23
San Antonio	274.33	$13,830	19.84	276.99	$11,818	23.44	3.60
Washington, D.C.	268.42	$36,266	7.40	269.56	$24,896	10.83	3.43
Memphis	277.80	$12,842	21.63	277.80	$12,292	22.60	0.97
CITY AVERAGE	**278.05**	**$21,986**	**14.65**	**280.55**	**$14,737**	**20.91**	**6.26**
STUDENT-WEIGHTED AVERAGE	**277.26**	**$20,721**	**15.48**	**279.06**	**$14,754**	**20.86**	**5.37**

Note: Revenue data pertain to the 2018 Fiscal Year, which aligns with the 2017-2018 Academic Year, and are adapted from *Charter school funding: Inequity surges in the cities*, by DeAngelis et al., 2020. NAEP math achievement data are from 2019 and are adapted from *The nation's report card*, by NCES, 2020. The results in the last row are weighted by each city's total enrollment.

Figure 3: Math Cost-Effectiveness Advantage for Public Charter Schools, by City



The ROI is the average impact each sector has on student learning gains, and the cost of the investment is the total per-pupil revenue allocated over 13 years of schooling for each sector.

Calculating ROI in Terms of Economic Returns to Education

Return-on-investment (ROI) is:

> *A performance measure used to evaluate the efficiency of an investment or to compare the efficiency of a number of different investments. ROI measures the amount of return on an investment relative to the investment's cost. To calculate ROI, the benefit (or return) of an investment is divided by the cost of the investment, and the result is expressed as a percentage or a ratio.*[31]

In our case, the ROI is the average impact each sector has on student learning gains, and the cost of the investment is the total per-pupil revenue allocated over 13 years of schooling for each sector. To monetize this measure, we convert the average learning gains produced by each public school sector to the economic return of lifetime earnings. This ROI is essentially a benefit-cost ratio, calculated as:

ROI = Income Returns to Investment / Cost of Investment

The cost of investment is a straightforward calculation that captures the per-pupil revenue invested in a child's K-12 educational experience over 13 years. It can easily be calculated by multiplying the average FY 2018 per-pupil revenue for each sector by 13.

The income return to investment is the net present value of additional lifetime earnings accrued through higher cognitive ability as measured by test scores. Average learning gains for the charter and TPS sectors in each of the seven cities come from the 2019 CREDO *City Studies Project* and 2019 NAEP scores. First, we compile CREDO estimates of the achievement gap between a typical student in each city and a typical student in the corresponding states while controlling for a series of individual characteristics. These estimates are then used to estimate average learning gains for the charter and TPS sectors in each of the seven cities using NAEP reading and math scores.[32] Stanford University economist, Eric Hanushek, has estimated that a one standard deviation increase in cognitive ability leads to a 13 percent increase in lifetime earnings.[33] Only 70 percent of gains in learning persist each year. If we multiply these two estimates together, we find the learning gains relative to the average worker in the state. By comparing the learning gains relative to the average worker in the state, we estimate the returns to the schooling investment in terms of yearly income while accounting for contextual features of the local markets.[34] We use 2019 data from the United States Bureau of Labor Statistics

The income return to investment is the net present value of additional lifetime earnings accrued through higher cognitive ability as measured by test scores.

to find state-level average annual earnings and assume that current students will work for 46 years between the ages of 25 and 70.[35] When calculating the net present value of lifetime earnings, we assume a one percent yearly growth in average salaries and a three percent annual discount rate.[36]

The calculation can be expressed by the following formula (see box below for specifics):

$$\text{Lifetime Earnings in Sector} = \text{Lifetime Earnings in State} * \left[1 + (\text{Sector SD}) * (0.13/\text{SD}) * (0.70)\right]^{13}$$

Overall ROI Results

Our ROI calculations for each city are depicted in graphs with four quadrants, depending on whether or not student achievement is higher for public charter schools or TPS and whether or not student funding is higher for charters or TPS (Figures 4 and 5). In practice, the two left quadrants of the graph are the only ones that are relevant, since all seven cities contain public charter school sectors with lower funding than their TPS counterparts.

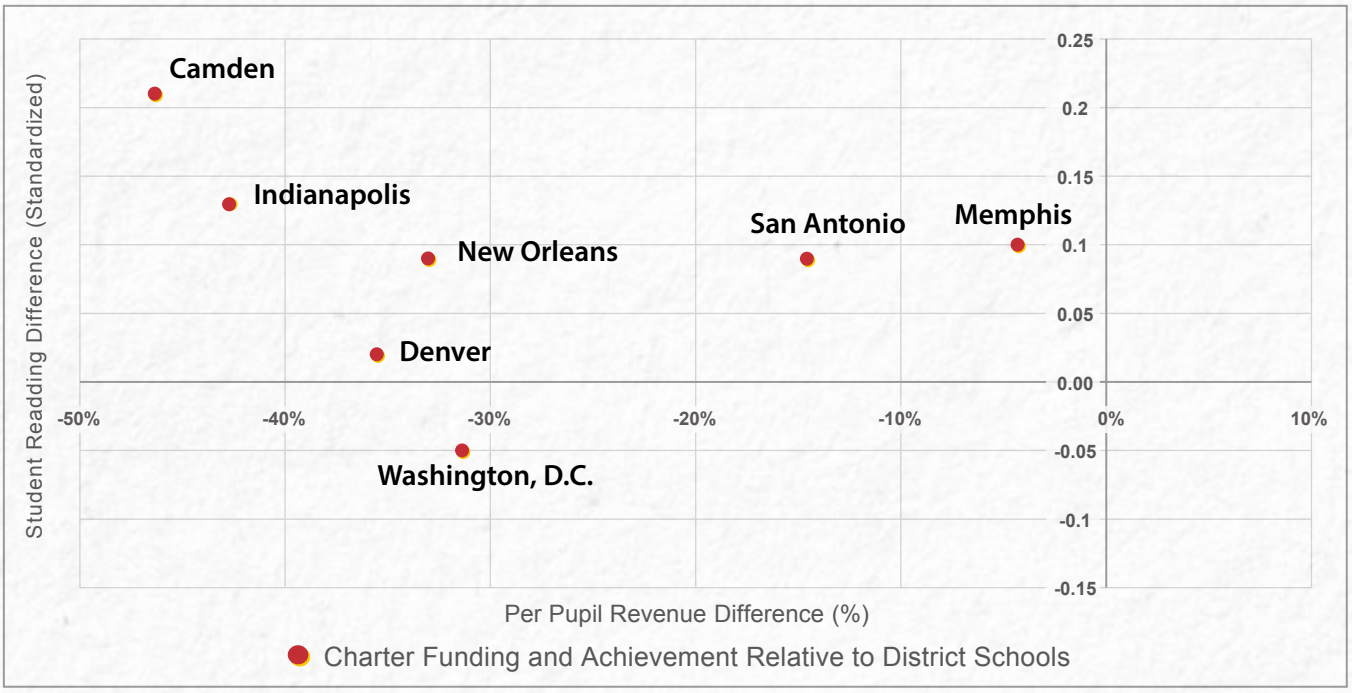
The top left quadrant in Figure 4 contains six of our seven cities. In these places, public charter schools are outperforming their local TPS on reading achievement despite receiving less funding per student. Camden charter schools demonstrate the highest advantage among the cities in student reading achievement gains compared to their TPS counterparts (as measured on the vertical axis). At the same time, Camden charter schools have the largest funding gap among the seven cities (as measured on the horizontal axis), as their public charter schools are funded around 45 percent below the funding rate for their local TPS. Indianapolis, Denver, New Orleans, San Antonio, and Memphis also are doing more in terms of increasing student achievement with less funding than their TPS.

Washington, D.C. is the only city in our analysis where the average reading performance of TPS students is higher than that of charter school students, controlling for student and family backgrounds. That is why D.C. appears in the lower left quadrant, slightly below the horizontal "0 Achievement Difference" line. The difference in average charter school student reading achievement compared to TPS students of -0.05 standard deviations is small compared to the massive gap in per-pupil funding for charters relative to TPS of -32 percent. Public charter schools in the nation's capital are producing student reading gains only slightly below those of TPS, with one-third less funding.

Camden charter schools demonstrate the highest advantage among the cities in student reading achievement gains compared to their TPS counterparts.

Results based on math scores tell a similar story. The top left quadrant in Figure 5 contains five of our seven cities, indicating that public charter schools perform better than TPS in math in the same city despite receiving less funding

Figure 4: Charter School Funding and Reading Performance



Note: Revenue data pertain to the 2018 Fiscal Year, which aligns with the 2017-2018 Academic Year, and are adapted from *Charter school funding: Inequity surges in the cities*, by DeAngelis et al., 2020. Achievement data are from the 2016-17 school year and are provided by the Center for Research on Education Outcomes (CREDO) *City studies project*.

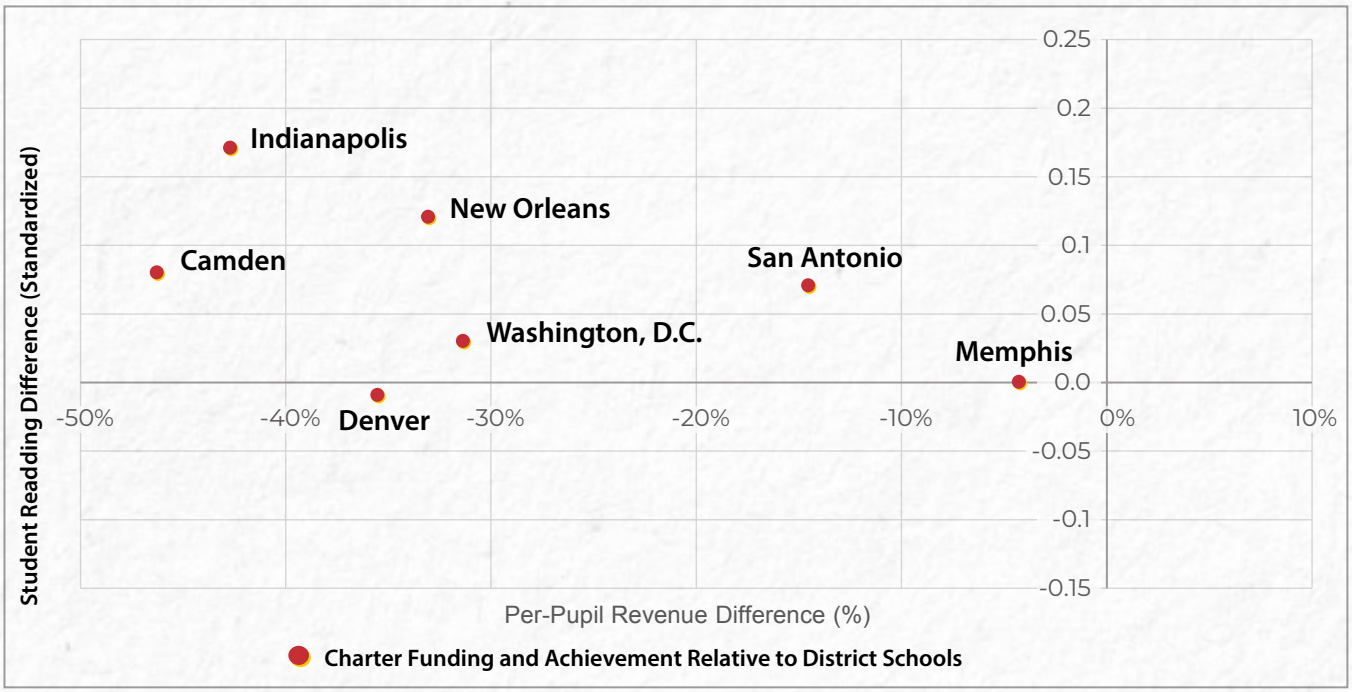
per student. Washington, D.C., while below the "0 Achievement Difference" line in Figure 4, rises above that line in Figure 5, signaling that its charter schools outperformed its TPS in math.

All seven cities fall to the left of the vertical axis indicating that public charter schools receive less funding per student than TPS in the same city. Indianapolis charter schools demonstrate the largest math achievement gains relative to TPS in the same city despite receiving 43 percent less funding per student. Denver charter schools performed a trivial amount below Denver TPS in math achievement, while receiving 36 percent less in per-pupil funding. Memphis public charter school students kept pace with their TPS peers in math achievement while their charter schools received 4 percent less revenue than Memphis TPS.

Public charter schools in the nation's capital are producing student reading gains only slightly below those of TPS, with one-third less funding.

Overall, the public charter school ROI benefit is even larger than the cost-effectiveness advantage of charters. On average, each dollar invested in a child's K-12 schooling results in $8.00 in lifetime earnings in public charter schools compared to $5.46 in lifetime earnings in TPS, a higher return of $2.54 per dollar in the charter versus TPS sectors that represents a 46 percent ROI advantage.

Figure 5: Charter School Funding and Math Performance



Note: Revenue data pertain to the 2018 Fiscal Year, which aligns with the 2017-2018 Academic Year, and are adapted from *Charter school funding: Inequity surges in the cities*, by DeAngelis et al., 2020. Achievement data are from the 2016-17 school year and are provided by the Center for Research on Education Outcomes (CREDO) *City studies project*.

As shown in Table 3 and Figure 6, averaged across the seven cities, a 13-year investment in public charters yields ROIs which are 57 percent higher than a TPS investment. The charter school ROI advantage exceeds 25 percent in six locations, ranging from 18 percent in Memphis to 139 percent in Camden. Notably, public charter school ROI advantages exceed 50 percent in Camden, Denver, Indianapolis, and New Orleans.

When we project this charter school advantage in ROI over the typical number of years that a U.S. worker is employed, on average, the public charter schools in our sample would produce $487,177 more in lifetime earnings per student than the TPS in our sample. This forecast is based on the student-weighted average ROI and assumes that the observed productivity levels of the two types of public schools remained constant and each sector received the amount of revenues per student currently received by charters.

We arrive at this forecast by

Overall, the public charter school ROI benefit is even larger than the cost-effectiveness advantage of charters.

The public charter schools in our sample would produce $487,177 more in lifetime earnings per student than the TPS in our sample.

multiplying the student-weighted annual cost of the investment in public charter schools for the seven cities of $14,754 by 13 years, which equals $191,802. We then multiply this total investment in the average charter school student by the additional ROI in the charter sector of $2.54 per dollar invested, yielding $487,177 in forecasted additional lifetime earnings.

Box 1: Calculating Relative ROI Using the Economic Returns to Education

Again, the ROI for each city and sector can be calculated as:

ROI = Income Returns to Investment / Cost of Investment

Calculating Cost of Investment:

(**TPS**) Per-Pupil Revenue	*	**13** yrs. of **TPS**	=	**TPS Cost of Investment**		
(**Charter**) Per-Pupil Revenue	*	**13** yrs. of **Charter**	=	**Charter Cost of Investment**		
Charter Per-Pupil Revenue * **6.5** years	+	**TPS** Per-Pupil Revenue * **6.5** years	=	**Half Charter Schooling Cost of Investment**		

Calculating ROI:

Average lifetime earnings for workers in a given state	+	Changes in lifetime earnings accrued from learning gains in **TPS**	=	**Income Return to Investment for TPS Students**
Average lifetime earnings for workers in a given state	+	Changes in lifetime earnings accrued from learning gains in **Charters**	=	**Income Return to Investment for Charter Students**

Example Computation: Indianapolis

We again turn to Indianapolis for an example of how we computed the charter school ROI compared to the TPS ROI. The per-pupil revenue is $16,230 in TPS and $9,299 for public charter schools, so a 13-year investment would equal $210,990 in TPS and $120,887 in charters. The average lifetime earnings for a worker in the state of Indiana is $1,163,790. Since the expected Indianapolis TPS achievement effects are 8 percent of a standard deviation less than the Indiana state average, and 70 percent of learning impacts persist from one year to the next, the expected lifetime earnings for a student spending 13 years in a TPS in Indianapolis is $1,058,334. Dividing this benefit by the cost of investment yields an ROI of $5.02 for each dollar

invested in TPS in Indianapolis. Since the expected Indianapolis public charter school achievement effects are 5 percent of a standard deviation higher than the Indiana state average, the expected lifetime earnings for a student attending a public charter school for 13 years in Indianapolis is $1,234,540. Dividing this benefit by the cost of investment yields an ROI of $10.21 for each dollar invested in public charters in Indianapolis. The charter school ROI of $10.21 compared to the TPS ROI of $5.02 yields a 104 percent ROI advantage favoring public charter schools in Indianapolis.

Further, if a student in Indianapolis experiences half of their K-12 education (6.5 years) in TPS and the other half in public charters, the taxpayer ROI is $6.89, still around 37 percent higher than the ROI for a full 13-year K-12 educational investment in TPS.

ROI = Income Returns to Investment / Cost of Investment

In TPS Full Time

Cost of Investment:	**$210,990**	= **$16,230** * 13 years
Income Returns:	**$1,058,334**	= **$1,163,790** * [1 – (0.080 SD) * (0.13/SD) * (0.70)]^{13}
ROI :	**$5.02**	= $1,058,334 / $210,990

In Charter Full Time

Cost of Investment:	**$120,887**	= **$9,299** * 13 years
Income Returns:	**$1,234,540**	= **$1,163,790** * [1 + (0.050 SD) * (0.13/SD) * (0.70)]^{13}
ROI :	**$10.21**	= $1,234,540 / $120,887

In Charter Half Time

Cost of Investment:	**$165,939**	= (**$16,230** * 6.5 years) + (**$9,299** * 6.5 years)
Income Returns:	**$1,143,047**	= (**$1,163,790** * [1 – (0.080 SD) * (0.13/SD) * (0.70)]$^{6.5}$ + **$1,163,790** * [1 + (0.050 SD) * (0.13/SD) * (0.70)]$^{6.5}$)
ROI :	**$6.89**	= $1,143,047 / $165,939

Moreover, an investment in students spending half of their time in each sector yields an overall ROI benefit of $6.14 for each invested dollar, a 22 percent advantage relative to a full-time (13 year) K-12 experience in TPS or 19 percent if student-weighted.[37] As shown in the last column of Table 3, and Figure 7, these benefits in higher ROI from charter schooling range from 8 percent in Memphis to 48 percent in Camden.

Table 3: ROI Comparisons between Charter and Traditional Public Schools in the Cities

Location	Charter 13 Years		Charter 6.5 Years	
	ROI Difference (Charter – TPS)	ROI Difference (Percent)	ROI Difference (Charter – TPS)	ROI Difference (Percent)
Camden	$3.58	139%	$1.22	48%
Indianapolis	$5.20	104%	$1.87	37%
New Orleans	$2.88	66%	$1.15	26%
Denver	$3.50	59%	$1.37	23%
Washington, D.C.	$1.83	37%	$0.74	15%
San Antonio	$1.85	30%	$0.84	14%
Memphis	$1.10	18%	$0.53	8%
CITY AVERAGE	**$2.85**	**57%**	**$1.10**	**22%**
STUDENT-WEIGHTED AVERAGE	**$2.54**	**46%**	**$1.01**	**19%**

Figure 6: ROI for Charter Schools Relative to TPS (13 Years in Charter)

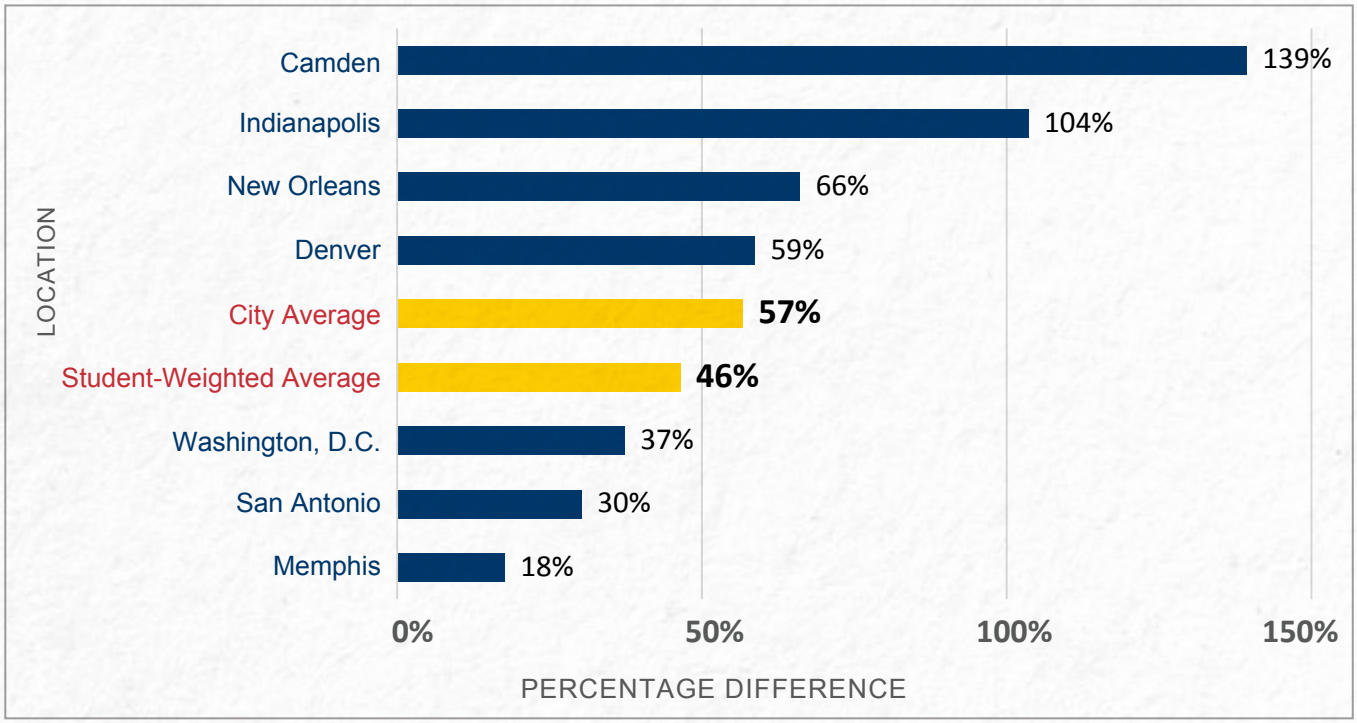
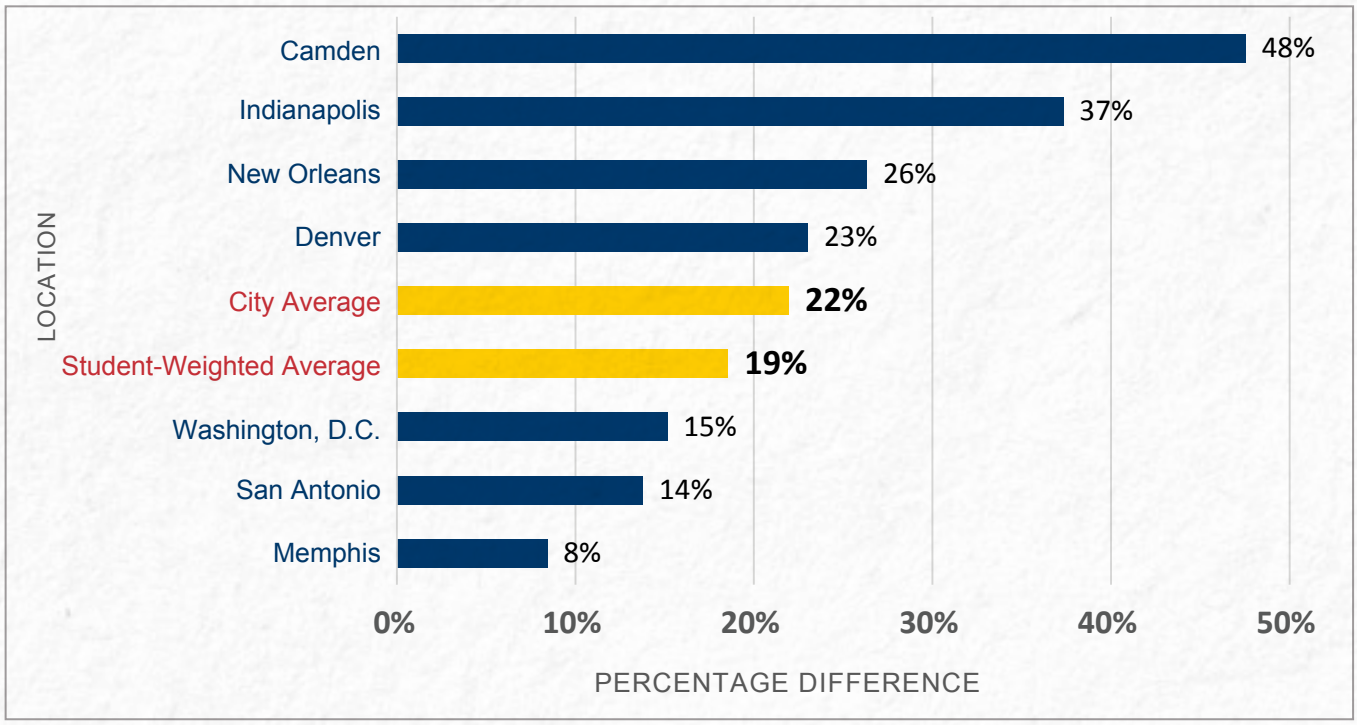


Figure 7: ROI for Charter Schools Relative to TPS (6.5 Years in Charter)



Conclusion and Policy Implications

This report contributes to the growing body of evidence that public charter schools tend to do more with less. Our evidence indicates that charter schools, on average, yield a more efficient allocation of educational resources than does the traditional way of delivering public education through geographically assigned district schools. Since educational resources are limited, charter schools serve as an attractive vehicle for delivering education to students more productively.

Our study has limitations. It is merely descriptive, presenting the relationships between school revenue and student outcomes as they were observed. However, the cost-effectiveness and ROI analyses are rigorous, as they both use CREDO results based on a rigorous methodology that eliminates many observable differences in student background characteristics across the public charter and TPS sectors. In addition, our productivity results are similar, both indicating large public charter

Our evidence indicates that charter schools, on average, yield a more efficient allocation of educational resources than does the traditional way of delivering public education through geographically assigned district schools.

school advantages, whether estimating cost-effectiveness or ROI.

The results of this study reiterate the twofold reality of public charter schools. On one hand, state funding laws shortchange charter schools in all seven cities; on the other hand, the relevant charter schools outperform their TPS counterparts in delivering learning gains in all our cities in reading, math, or both subjects. This observation should call greater attention to the funding inequities between the public school sectors. Charter school students have received less funding than TPS since these studies began in 2003 and the funding gap has doubled in real terms since that time.[38]

If the Biden Administration reinforces district schools at the expense of public charter schools, the funding disparities between the public school sectors will only increase beyond the current level of charters receiving an average of one-third less in revenue than TPS. Furthermore, this funding discrepancy undermines the general belief that all students should be given the opportunity to succeed through well-funded education institutions. Rather, funding inequalities such as this one suggest that public charter students are not worth funding at the same rate as their traditional public school peers. Even so, the data show that pouring money into traditional public schools does not yield a comparable degree of academic success. Perhaps traditional public schools might take note of their counterparts' success and consider the ways in which they make good on each dollar they receive. For example, researchers have determined that extra instructional time, consistent behavioral policies, and a strong emphasis on achievement — often called "academic press" — are approaches common to successful charters.[39]

Across the seven cities in our study, the student-weighted public charter school advantage represents a reading cost-effectiveness benefit of 35 percent. The charter school cost-effectiveness advantage ranges from 6 percent in Memphis to 92 percent in Camden. Six of the seven cities have advantages exceeding 15 percent and five places exceed 40 percent. Similarly, in NAEP math achievement levels, the public charter school advantage in math cost-effectiveness is 40 percent or larger in all but two locations. While these cities have different populations, funding laws, and charter school landscapes, the fact remains that public charter schools are overperforming relative to their funding levels.

Our findings only pertain to the seven cities included in our analyses. Those cities, however, represent the diversity of American urban areas with

Perhaps traditional public schools might take note of their counterparts' success and consider the ways in which they make good on each dollar they receive.

public charter school sectors. Our sample includes cities with well-established charter school sectors, like New Orleans, and cities with burgeoning charter school landscapes, like San Antonio. It includes cities in the midwest (Indianapolis), south (Memphis, New Orleans, and San Antonio), east (Camden and Washington, D.C.), and west (Denver). The public charter school sectors in all seven of these U.S. cities are more cost-effective and deliver a higher ROI than their respective traditional public school sectors. In these important urban environments, there is a clear productivity advantage for public charter schools.

In these important urban environments, there is a clear productivity advantage for public charter schools.

Appendix A

Methodology for Revenue Data that Informed the Study

Location Selection

The team selected 18 metropolitan areas for the revenue analysis that contributed to this return on investment (ROI) study,[40] based on one of two criteria: the concentration of charter schools within an area or the potential for charter school growth there. Locations represent selected cities or counties used as an analysis domain for aggregating district data and geographically and demographically similar charter school data for comparative purposes. The objective of our location selection is to match district students with charter students by educational setting and student need. Locations are used as a proxy for urban/metropolitan settings. They can include a single district or multiple districts and include geographically related multiple charter schools. The revenue study provided district and charter revenue totals and funding disparity amounts for each location. As shown in the table below, our productivity analysis was limited to seven locations because CREDO findings were not available for 11 locations.

Table A1: Cities Included in and Excluded from the Productivity Analyses

City	Included in NAEP ROI Analysis	Reason for Exclusion from Analysis
Memphis	Yes	
San Antonio	Yes	
Washington, D.C.	Yes	
New Orleans	Yes	
Denver	Yes	
Indianapolis	Yes	
Camden	Yes	
Boston	No	CREDO Achievement Data Not Available
Houston	No	CREDO Achievement Data Not Available
New York City	No	CREDO Achievement Data Not Available
Phoenix	No	CREDO Achievement Data Not Available
Detroit	No	CREDO Achievement Data Not Available
Oakland	No	CREDO Achievement Data Not Available
Los Angeles	No	CREDO Achievement Data Not Available
Tulsa	No	CREDO Achievement Data Not Available
Chicago	No	CREDO Achievement Data Not Available
Atlanta	No	CREDO Achievement Data Not Available
Little Rock	No	CREDO Achievement Data Not Available

Fiscal Year

We gathered publicly available revenue data for the 2017-18 *fiscal year* (FY 2018). Because states differ in the fiscal year used for their public schools, we attempted to select the fiscal year that most closely matched the 2017-18 school year. We refer to that year throughout this report as "FY 2018."

Data Gathering

Source records were acquired directly from official state department of education records, and from independently audited financial statements when a state does not collect financial data. We used the most reliable, most detailed, official records available in all cases. The same data and analysis standards for the four previous revenue studies were applied for each location in the study.[41]

Revenues and expenditures were collected from many sources, from state and federal agencies where these data are kept, as well as from audits. After the FY 2018 school year concluded, the team waited 18 months to begin researching this project in order to allow state departments of education and charter schools time to produce and submit all of their official financial records, Annual Financial Reports, independent audits, enrollment statistics, and other data. The methodology matches a state's Department of Education's (DOE) records of school district revenues to the same fiscal year of data drawn from independent audits for the charter schools. Because all data analyzed for districts and charter schools are as of the same date, FY 2018, all data are properly matched based on the reporting time period.

The analytic team did not rely upon finance data or demographic data collected by federal agencies, except in very rare cases where the data are not available from state and local sources. Data sourced from federal agencies have gone through extensive aggregation and reporting processes that tend to be aggregated to the point where there is insufficient specificity to be useful for our analysis, and where we have seen reporting errors when checked against original state sources.

New Orleans is included in the totals in our recent set of reports, including this productivity analysis, for the first time. State funding and accounting for charter schools after Hurricane Katrina was unusual in the Crescent City for many years, which required that we exclude New Orleans from our totals so as not to skew the results. Now that we have reliable data on funding, we can fully include it in our studies.

Data from Various Unique State Sources, Analyzed into Comparative Datasets

In each state that was home to one of the metropolitan areas in our analysis, we encountered a maze of web sites, reports, audits, and other information that, while extremely challenging to piece together, ultimately provided the best sources of primary data for understanding and analysis of funding levels and comparisons. By using each state's individual accounting system, we were able to isolate revenue streams for inclusion or exclusion to accommodate our consistent methodology and to make valid comparisons across school sectors and locations.

We began our research on state web sites, searching for financial data reported by local, state, federal, and other revenue categories. Though many states provided some form of revenue data, often the data existed only for school districts (not charters), or the data did not conform to the classifications used in other states. In those cases, we used additional data sources to develop conforming revenue figures. In instances where the state did not collect charter school revenue data, we used independent audits of financial data and sometimes federal Form 990.

We gathered enrollment data from state education department web sites. We also obtained funding formula guidelines for both districts and charters for FY 2018.

Analysis of Revenues, Inclusions and Exclusions, Demographic Context

Productivity calculations, such as these, are informed by the revenues received by organizations, not by their expenditures. Our mission was to examine how charter schools were treated in state public finance systems, so we focused on how much money schools received as a social investment. We looked for the following data and supporting detail:

Revenues: We included all revenues that districts and public charter schools received. Our goal was to determine the total amount of revenue received to run all facets of a school system, regardless of source. This analysis includes revenues and enrollments related to Adult Education and Pre-K. Also included are charter school contributions for the purpose of building schools (or other capital items), and similarly charter (if any) and district bond and loan proceeds for the purpose of building schools, excluding proceeds resulting from restructuring of debt. For charter schools, we included one-time revenues associated with starting the school, such as the federal Public Charter School Program and, in some cases, state and private grants. Fund transfers were not considered revenue items and were not included in the analysis.

Arguably, one-time revenues could have been excluded since they are not part of a charter school's recurring revenues. However, they are a notable part of the funding story for the charter sector; when considering how much money is provided to run charter schools, these revenues cannot be and were not ignored. Furthermore, we also included onetime grants of various kinds to districts.

Funds that traditional public schools initially received and were passed along to charters usually were flagged as "pass-through funds" in the documentation we used to determine charter school revenue. In some cases, we were able to identify additional cases of TPS providing services to charter students, usually involving special education, by examining expenditure data. In all cases where we were able to determine that traditional public school (TPS) funds either passed through to charters or were spent on charter school students, we counted that as charter school revenue and not TPS revenue. Additionally, we adjusted revenues downward for districts and upward for charters in cases where the district provides classroom space to charter schools.

Enrollment: Where multiple forms of enrollment data were available, we used the figures related to the official fall count day. Depending on a state's particular method of reporting enrollment, the official count could be either Average Daily Attendance (ADA) or Average Daily Membership (ADM).

Exclusion of Revenue: The only revenue item we excluded from our analysis was "funds resulting from the restructuring of debt," because those are not "new revenues," but merely a repackaging of existing assets and obligations.

Selection of Schools: All charter schools in each locality were included in this study with the exception of schools for which we could not obtain valid revenue and enrollment data. If we could not obtain revenue data, the enrollments for those schools were excluded from the analysis. If we could not obtain enrollment data, the revenues for that school were excluded from the analysis.

Rounding

Dollar values were rounded to the nearest dollar for each item. Percentages were rounded to the nearest whole number, which may cause apparent differences by a percentage.

Tables and Charts

If no citation accompanies a table or chart, the information therein was compiled by the research team according to the process outlined above. When we relied on the data or publications of other organizations, we provided the relevant citation.

Weighted Average Calculations

The totals presented in each table are weighted averages based on enrollments in the public school sectors of each city. We generated them by taking the total student enrollment in a specific city for the 2018 Fiscal Year (2017-18 Academic Year) in their TPS sector and dividing it by the total student enrollment in all seven cities in their TPS that year. We did the same for their public charter school sectors. To generate the student-weighted average differences we multiply each city's TPS cost-effectiveness or ROI by its percent of the total enrollment for TPS in our collection of cities (Table A2), take the average of those seven numbers, do the same for the charter sector, and subtract the TPS student-weighted average from the charter student-weighted average. This straightforward method automatically generates a student-weighted average that is a "true" mean for the aggregated set of cities, given their different enrollments across the cities and between the public school sectors.

Table A2: Percent of Students from Study Locations, FY 2018

Location	State	Students (TPS)	Percent of Total (TPS)	Students (Charters)	Percent of Total (Charter)	City Percent of Total
Memphis	TN	90,570	30.23%	23,337	12.99%	23.77%
Denver	CO	71,880	23.99%	20,583	11.46%	19.29%
Washington	DC	48,229	16.10%	42,820	23.84%	19.00%
San Antonio	TX	50,683	16.91%	10,149	5.65%	12.69%
Indianapolis	IN	27,630	9.22%	27,256	15.17%	11.45%
New Orleans	LA	2,714	0.91%	46,932	26.13%	10.36%
Camden	NJ	7,941	2.65%	8,535	4.75%	3.44%
TOTALS		299,647	100.00%	179,612	100.00%	100.00%

Appendix B

Revenue Information Sources

Colorado (Denver)

- Colorado Department of Education, the School Finance Unit

District of Columbia

- District of Columbia Public Charter School Board
- District of Columbia Department of Revenue

Indiana (Indianapolis)

- Indiana Department of Education, School Finance

Louisiana (New Orleans)

- Louisiana Department of Education, School Finance

New Jersey (Camden)

- New Jersey Department of Education, School Finance

Tennessee (Shelby County, Memphis)

- Tennessee Charter School Center
- Tennessee Comptroller of the Treasury
- Tennessee Department of Education

Texas (San Antonio)

- Texas Education Agency, Public Education Information System (PEIMS) Access database

Appendix C

Adjusted NAEP Performance Averages Using CREDO

The generation of the CREDO adjusted NAEP achievement averages for the TPS and charter sectors for all seven cities is presented in Table C1, using the approach described in the text of the report.

Table C1: Reading Estimates Across NAEP and CREDO Data Sets

	NAEP State Average	CREDO Estimated Differences Relative to State Average in Standard Deviation Units		CREDO Estimates Relative to State Average in NAEP Points		CREDO-Adjusted NAEP Estimates for Each City	
Location	Reading	TPS Reading	Public Charter Reading	TPS Reading	Public Charter Reading	TPS Reading	Public Charter Reading
Memphis	262.46	-0.07	0.03	-2.66	1.14	259.80	263.60
San Antonio	255.74	-0.11	-0.02	-4.18	-0.76	251.56	254.98
Washington, D.C.	249.81	0.03	-0.02	1.14	-0.76	250.95	249.05
New Orleans	257.42	-0.03	0.06	-1.14	2.28	256.28	259.70
Denver	267.31	0.10	0.12	3.80	4.56	271.11	271.87
Indianapolis	265.95	-0.08	0.05	-3.04	1.90	262.91	267.85
Camden	270.36	-0.20	0.01	-7.60	0.38	262.76	270.74

Note: CREDO estimates are reported as a percent of a standard deviation. NAEP reported that 1 standard deviation on the NAEP exam is 38 points. Charter school achievement effects are from the the Center for Research on Education Outcomes (CREDO) *City studies project*.

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