School Choice and Competition: Has There Been Enough Enabling Legislation to Generate Broad-Based Effects?

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Abstract

School choice initiatives and charter schools have grown substantially in the past two and a half decades. Economists argue that this is a move toward more competition and should lead to improved school system performance. However, school choice and charter school enabling laws can be quite restrictive and are limited to relatively few children. Can this limited degree of competition have a noticeable effect on an entire state's overall K-12 performance, i.e., beyond that of for the children in the programs? This paper quantifies the underlying laws that have enabled (or impeded) school choice and charter schools from 1990 to 2019 and conducts an initial empirical analysis to address this question. The basic findings indicate strikingly large test score gains for states that have adopted voucher programs and/or Education Savings Accounts (ESAs). Though per pupil spending on K-12 has a positive effect on test scores, its magnitude is very small and is swamped by the effect of having a voucher or ESA program. Moreover, vouchers and ESAs are associated with less per pupil spending. These effects are robust and are not dependent on outlier states, specific time periods, or pre-existing trends in states.

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I. Introduction

The chronic underperformance of many public schools, despite the long-term growth in resources per pupil devoted to public education, has been a continuing source of concern by the public.[1] This issue has generated an assortment of reforms efforts, many of which have been tried in various states. One substantial reform effort is school choice programs, which allow public funds or tax credit funds to "follow" students to a private school. Another is charter schools. These programs have been examined with respect to how well students who switch from regular public schools to a private school or a charter. Standardized test scores for students who move to a private school via voucher-like programs generally show strong improvement.[2] Likewise for charter school students.[3]

The issue this paper addresses is whether choice and charter programs have affected an entire state's student test scores. Because a minority of students are in choice or charter programs, the public schools must improve to generate a noticeable effect on state's average score. Any such improvement could come from competitive pressure that school choice and charter programs create for public schools to improve. In a related vein, it may be that choice and charter programs compete mostly for students that do "fit" the public schools, enabling each type of school to specialize in students that suit them, generating overall improvements.

A number of studies have examined whether traditional public schools near charter schools or private schools (with vouchers) show improvements in student performance.

[1] See Coulson (2012) for a summary of long-term spending and test scores for K-12.
[2] The improvement is most clear for low-income and minority students, though the effects often are not immediate. See Egalite and Wolf (2016) for a review.
[3] The effects for urban charter schools is particularly large. See Betts and Yang (2019), and Center for Research on Education Outcomes (2015) for overviews, as well as the well-known studies regarding charter schools in New York City (Hoxby, Murarka, and Kang (2009)) and Boston (Abdulkadiroglu, et. al. (2011)).

Generally, they do show test score gains, though this refers only to traditional public schools geographically near charters or private schools.[4]

However, school choice and charter school enabling laws can be quite limiting regarding their funding, the restrictions they place on schools, and are usually restricted to relatively few children. Thus, it remains an open question whether such competitive or sorting effects are broad-based enough to affect an entire state's average test scores. Other studies generally have not examined this.[5]

This paper's basic findings indicate strikingly large 4th grade reading and math test score gains for states that have adopted voucher programs and/or Education Savings Accounts (ESAs). Though per pupil spending on K-12 has a positive effect on these test scores, its magnitude is very small and is swamped by the effect of having a voucher or ESA program. Moreover, vouchers and ESAs are associated with less per pupil spending. These effects are robust and are not dependent on outlier states, specific time periods, or pre-existing trends in states. This indicates a dual dividend for these programs: better student performance at lower cost.

The remainder of the paper is organized as follows. Section II reviews the differences in the private and public sectors regarding incentives and expected performance in the provision of a good or service. The competitive pressure the private sector can place on the public sector, and thereby improve the latter's performance, is discussed. Section III presents an overview of school choice and charter schools programs, as well as the restrictions that state laws place on schools and parents in those programs. These potentially limit the competitive pressure that the programs have. The empirical measures of these programs also are discussed.

[4] For recent work in this respect, see Figlio, Hart, and Karbownik (2021) regarding voucher programs and Gilraine, Petronijevic, and Singleton (2021) on charter schools.
[5] A notable exception is Wolf, et. al. (2021), who address a similar issue though the empirical approach differs.

Section IV presents the basic empirical findings. For both grade 4 reading and math tests, voucher programs and Education Savings Accounts (ESAs) have large, positive, and statistically significant effects. Though per pupil funding K-12 has a positive effect on test scores, its magnitude is very small and is swamped by the effect of having a voucher or ESA program. Charter schools tend to have a positive effect, but only if the state's charter enabling law is not restrictive. These findings are not driven by outlier states and are not dependent on a narrow time period. Also, I test for pre-existing differential trends for states with a voucher or ESA program. None of the effect of a voucher and only part of the effect of an ESA can be attributed a different trend. Also, the basic results hold for average test scores for black students and for free-or-reduced-price-lunch eligible students.

Section V examines more details of school choice programs; in particular the percent of a state's students who are eligible for each program and the funding per pupil in each program. The evidence is suggestive that having a higher degree of funding is important in generating the better state-average test scores associated with certain choice programs. Section VI shows that voucher, ESA, and Scholarship Tax Credit (STC) programs are associated with substantially lower per pupil public school funding. The reductions are approximately 5% for vouchers, 11% for ESAs, and 4% for STCs. Section VII presents plots of raw data for several states of test scores and public school funding. The regression results reveal the typical state's outcome, and do not imply that every state follow that pattern. The data plots visually illustrate this. Lastly, section VIII concludes.

II. Markets, Competition, and Schools

One important underpinning of market-based economic systems is private property rights. Property rights entail: (1) determining how assets are used; (2) claim on the net income

(or enjoyment) generated by the assets; and (3) transferability of the former two.[6] With private property, these are in the hands of individuals or their assignees.

The system of private property creates a strong incentive system. Owners reap the benefits and bear the losses from their decisions on how to deploy their assets. Thus, the decision rights regarding use of assets and the claim on the returns from the outcome of those decisions are inextricably linked with respect to the incentive system. There is no incentive from rewarding people for outcomes beyond their control; nor from awarding rights to control asset use without any gain/loss associated with those decisions.

Competition is a natural outgrowth of private ownership. If one line of commerce generates an abnormally high net income, this attracts other private owners to enter this market and use their assets to produce that good or service. Moreover, this competitive process sharpens the incentives inherent in the system. Competition pushes prices down so that prices reflect marginal value and the marginal cost of production. Thus, rewards to private owners are reflective of value created.

This discussion illustrates a fundamental problem with public ownership of assets. In this setting, a government/political organization has control over use of assets and there is no net income. Thus, there is no way to reward decision makers for value created; the link between the two is broken. The reward system is driven by political incentives to please interest groups and others who influence payments to public sector administrators and workers. Value created may be a factor in this regard, but its influence is diluted from its primacy in the private sector. With diminished incentives to create value, one expects less value created. Moreover, competition is

[6] See Garen (2020) for detailed discussion of this.

often lacking where a good or services is provided by the public sector. This further diminishes incentives to create value.

This is the situation for most public schools. Nearly all are established by a local school district with an elected school board. Funding comes from local, state, and federal government sources, along with rules and regulations from each. Each source is a political entity, subject to the political forces of its jurisdiction. Competition is often quite limited, due to a limited number of schooling alternatives and the difficulty of private schools in competing with the zero tuition of a public school. Thus, public schools are subject to the diminished incentives of public institutions and it should be expected that they produce less value and at higher cost than private schools.

An important question is what happens when public schools face a higher degree of competition. For this to be effective, it needs to generate enough loss of public school students and funding to cause political difficulties for the public system. This could occur with enough budgetary pressure on the public school system. Thus, to ease this pressure, the public system may be induced to upgrade their programs, to increase efficiency, to develop programs that better match their students, or assist poorly-fitting students in exiting to the private sector. In short, such competitive and budgetary pressure creates some measure of a link between rewards and value created and is expected to improve the performance of the public schools.

With the current state of K-12 education, to gain large improvements in student outcomes, it is necessary for public schools to improve. This is because, at present, a very large share of students attend public schools. It is well established that private school alternatives, or other similar school situations, generally show strong improvement for their students. However,

a minority of students have these alternative schooling arrangements. Thus, large changes for average student performance requires a substantial improvement for public school students.

This leads to the empirical issue that this paper addresses. In the past two or three decades, many states have enacted laws to enable alternatives to the regular public schools, including school choice programs that empower parents to send their children to private school and also charter school laws. These programs are not universal and, where they are in place, typically have restrictions on family eligibility, on funding, and on school decision rights. Have they been effective in inducing enough competitive pressure to cause improvement for the whole school system? This is the question that I take up in the ensuing sections.

III. How Much Has School Choice Been Enabled by State Law?

A. Types of Choice

By school choice, I mean a broader set of options for parents beyond the traditional public schools. In this analysis, this is comprised of two categories of programs. One category consists of choice programs, within which there are several types. Choice programs allow public funds or tax credit funds "follow" students to a private school. There are four basic types of these programs, described below.

Scholarship Tax Credits (STCs). Donors to scholarship organizations receive a tax credit. Scholarship organizations award funding to qualified children, e.g., low income, disabled, to attend private school. These funds are usually for tuition but other expenses might be supported.

Individual Tax Credits (ITCs). Individuals receive tax credits for qualified educational expenses, normally expenses associate with a private education.

Vouchers. Qualified recipients receive a publically-funded voucher for private school tuition. Recipients must be in the target group.

Education Savings Accounts (ESAs). Qualified recipients receive a deposit in a "savings account" for private school tuition and other education expenses. Recipients must be in the target group.

A second category of program is charter schools. Though these are public schools, they are intended to differ from traditional public schools in ways that can approximate school choice programs. Charter schools are envisioned to have autonomy from the public school district and be open to all families (within eligibility rules) regardless of household location. As with private schools, funding follows the children and charters must attract enough students to remain financially viable. This is a key aspect of the incentive system faced by charter and private schools.

I do not consider other means of choice, including: (i) Tiebout competition, where families move their residence into a desired school catchment zone or school district; (ii) school-district operated magnet schools; (iii) intra- or inter-district transfer policies; and (iv) homeschooling.

Two critical aspects of state policy regarding choice and charter programs are: (1) how prevalent are these programs; and (2) how permissive/restrictive are they in enabling school choice and competition. I turn to this next.

B. Choice Programs

Choice programs mostly rely on private school options being available to students. Naturally, such options do not fall from heaven but are due to various factors that generate a demand for private education. Choice programs may be one of those factors.

Table 1 shows the share of the K-12 student population that attended private school in the 2017-2018 academic year, both for the entire U.S. as well as for selected states. For the U.S., 10.1% of student were in private schools. This varies greatly across states, with several states

having a much higher percentage, and several having a good deal less. The states displayed in Table 1 are intended to provide a sense of this variation.

Table 1
Private School Enrollment in Selected States and U.S., 2017-2018

Some High Enrollment States	Pct. of Total Enrollment	Some Low Enrollment States	Pct. of Total Enrollment
Delaware	17.1	Alaska	3.3
DC	14.1	Kansas	8.1
Florida	14.3	Nevada	5.1
Indiana	12.1	Oklahoma	4.3
Louisiana	17.0	Texas	6.0
New York	14.7	Utah	3.3
Wisconsin	15.0	West Virginia	5.0
Entire U.S.	10.1		

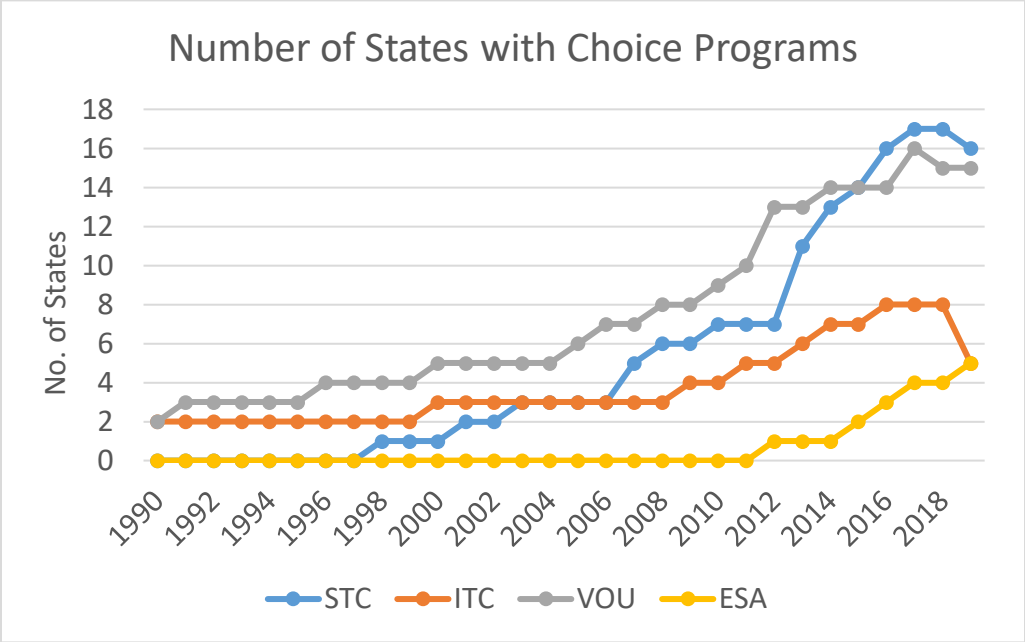
Source: Digest of Education Statistics and author's calculations.

It seems that there is a substantial private sector in K-12 education. Naturally, the choice programs discussed can augment the viability of the private education sector. These choice programs have become increasingly common over the past two to three decades. Figure 1 plots the number of states that have each type of choice program. This figure is based on data from EdChoice.[7] The figure shows that the number of states having voucher and STC programs has risen quite rapidly from the early 2000s all the way to the present. There also is a more recent growth in number of states with ESA programs. The number of states with ITC programs also grew modestly until recently.

Though choice programs have become prevalent – over half of the states have at least one program – the key question is how hospitable they are to significant choice and competition. There are a host of issues that are potentially limiting in this regard, as shown by the various restrictions states have on their programs. They are summarized below.[8]

[7] The underlying data are from https://www.edchoice.org/school-choice-in-america-dashboard-scia/.
[8] The EdChoice website (op. cit., fn. 1) is an excellent source on this information and one that I rely on.

Figure 1



Source: EdChoice and author's calculations.

Student eligibility. This is almost always restricted. It is very common to restrict the program to students who are: (i) disabled, have a learning impairment, an IEP, or who are special needs; (ii) in a family below an income threshold level; and (iii) from low performing schools. Other categories of eligibles that are less common include foster children and veterans' children.

Enrollment Cap. This limits the total number of students that are in the program. Nearly all programs in 2019 did not have caps, though a few did.

Budget Cap. This is particularly relevant for STCs. Many programs in 2019 have caps, though they vary a lot in stringency. This could limit the number of students who can participate.

Account/Voucher/Scholarship Cap. This refers to a cap on dollars the student may receive for tuition and other school expenses. These apply to ESA, voucher, and STC programs. Nearly all programs have a cap, though its stringency varies. Naturally, a lower cap reduces the affordability of private school for parents.

Fund Use Limitations. This refers to whether parents may supplement publically-provided tuition funds with their own dollars and also to limits on use of the funds for other education-related expenses. Without parents being able to supplement public funds with their own dollars, this effectively puts a price control on tuition. Naturally, this discourages the supply of educational services.

Testing Mandates. States often require private schools to administer state and/or national standardized tests if public funds support the school. It is very common to do so (in 2019) with many programs, but it is not universal.

Other School Requirements. These include rules for student enrollment (e.g., use of lotteries), on curriculum (e.g., state approved), and whether religious classes can be required. These limit schools in their flexibility to serve their students.

Clearly, limits on student eligibility, enrollment, and a budget cap restricts the number of families who use the choice programs. Moreover, it reduces the pool of students/families that private schools can meaningfully compete for. These lessen the degree of choice and competition. Low caps on funding that programs pay for private schooling, combined with prohibition on parents supplementing tuition, can severely attenuate that rewards to schools for providing better and better-matched educational programs. Doing the latter can be expensive, and limiting what schools can charge (and what families may pay) reduces the ability and incentive for schools to provide such academic programs. Restrictions on school curriculum, admissions, testing, and related matters reduces the ability of schools to design programs to suit and attract students. Recall that a major source of expected gains in moving toward choice and competition is that schools are more closely rewarded for providing a good experiences for students/families, and they are empowered to find those things that make for that good experience. Each of the above restrictions serves to limit this and lessens the benefit of choice programs.

From the EdChoice database, I have constructed two variables that capture a good deal, though not all, of the restrictions on choice/competition noted above. EdChoice reports estimates of the number of students eligible for each program and year. I divide by the total number of students in the state that year to find the percent of students eligible. Also, EdChoice estimates the average funding awarded per student in the program for each year and program. I

divide this by the public school per pupil funding for that state/year. This yields the program per pupil funding as a percent of the public school per pupil funding.[9]

These two variables should capture the essence of the availability of each choice program to the state's population of students, as well as how well private schools are rewarded for serving students in the program. These are major areas of concern regarding how well a program enables school choice. I do not have variables that capture various other restrictions, such as limits on school curriculum and related decision rights, nor on restriction on parents, such as limits on covered educational services. These may be significant impediments to enabling choice, however.

Table 2 presents a summary of the two variables that I am able to construct. I present the two variables for each program type. For states that have more than one of a program type, I use the earliest program. I pool the data for each program type across years.

It is clear that none of the choice programs, on average, both cover a large share of students and fund students close to public school levels. The programs break into two broad

Table 2

Program Type	Avg. Percent Eligible	Avg. Percent of Public School Funding	No. of Observations (program years)
Scholarship Tax Credit (STC)	39.2%	23.3%	161
Individual Tax Credit (ITC)	46.5%	12.6%	114
Voucher	9.6%	68.0%	227
Education Savings Account (ESA)	13.6%	90.4%	21

Source: EdChoice and author's calculations.

[9] There a quite a number of years of missing values from the EdChoice data funding. However, in nearly all cases, the missing values can be sensibly estimated or interpolated from nearby years. Where needed, I have done so.

categories. On average, STCs and ITC cover a fairly large share of students; 39.2% and 46.5%, respectively. However, as a percent of public school funding, these programs provide a small amount; 23.3% for STCs and 12.6% for ITCs. The converse holds for vouchers and ESAs. They typically cover a small share of the population, but with much more funding per pupil. Vouchers, on average, cover 9.6% of students and ESAs 13.6%. The average funding for vouchers is 68.0% of public school funding and that for ESAs is 90.4%.

Though the various choice programs have become much more common, they typically either have high coverage with low funding on one hand, or low coverage and higher funding on the other. Thus, there can be legitimate questions about how effective these programs might be in inducing competition and improving an entire school system.

C. Charter Schools

Charter schools have become more prominent as well, though they differ a good deal across states. Table 3 shows charter school enrollment as a share of total public school enrollment in 2017-2018 for the U.S. and selected states. For the entire U.S., 6.2% of public schools students were enrolled in charter schools. The variation over states is substantial. Washington, DC is an outlier with 44.8%, but Arizona's is very high at 17.2%. A number of states have no charter schools.

To track the growth and character of charter schools over time, I utilize the data and ratings provided by the Center for Education Reform (CER). Beginning in 1996 and roughly every two years afterwards, the CER provides a rating of each state's charter school law (for those who had one at the time) regarding how well the state's law enable charters to enter and serve students through innovative programs.

Table 3
Charter School Enrollment in Selected States and U.S., 2017-2018

Some High Enrollment States	Pct. of Tot. Public Enrollment	Some Low Enrollment States	Pct. of Tot. Public Enrollment
Arizona	17.2	Connecticut	2.0
California	10.1	Illinois	3.3
Colorado	13.3	Iowa	0.1
Delaware	11.3	New Hampshire	2.0
DC	44.8	Virginia	0.1
Florida	10.4	Washington	0.2
Nevada	9.3	Several other states	0.0
Entire U.S.	6.2		

Source: Digest of Education Statistics, https://nces.ed.gov/programs/digest/d19/tables/dt19_216.90.asp

CER rates charter school laws on the four categories shown below.

Authorizers. Whether the state allows multiple entities outside local school districts to approve charters.

Limits on Number of Schools. The degree of limitation the state puts on the number of charter schools allowed.

Operational Autonomy. The extent of autonomy charter schools are allowed in their operation, e.g., hiring, curriculum.

Funding. Charter school funding compared to traditional public school funding.

It seem clear that these rating categories correspond well to enabling or limiting choice and competition. Restrictions on authorizers and the number of schools limits competition among schools and for students. Allowing more charter school autonomy enables charters to effectively respond to their incentives and use their local knowledge to devise programs suitable to their students. Restrictions on funding limits how competitive charters can be and reduces their ability to receive compensation for value created.

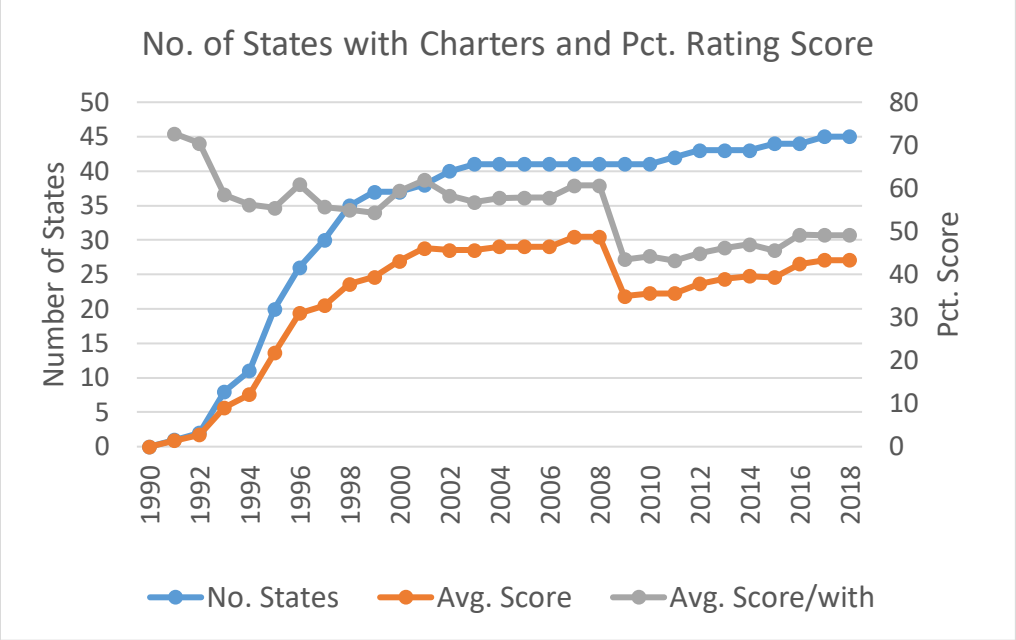
The CER aggregates the scores in the above areas to arrive at an overall score for the state's charter school law. Figure 2 provides summary information in this regard, as well as on the prevalence of charter school laws. The blue line shows the number of states with a charter

school law (left-hand axis) over time. There was a dramatic growth in the number of states with charter schools in the 1990s, with continued but much slower growth after that. As of 2018, 45 states had charter school laws. The gray line shows the average CER overall score for states that had charter laws in that year (right-hand axis). The orange line is the average score inclusive of all states, where states with no law received a zero. Scores between years of the surveys are determined by interpolation.[10] There was a change in the scoring system in 2009, accounting for the sharp fall in the average score then.

The average score among states that have charter laws has been quite stable, aside from the period of the early 1990s when states increasingly passed charter laws. Apparently, new state laws were, on average, worse than those of the earlier states up until the late 1990s. Since then, additional states with charters evidently have rated about the same as prior state laws. There is a good deal of variation in the CER scores across states. Thus, even with a law allowing charter schools, the degree of incentives and discretion for the individual schools may be severely abated. Thus, a weak charter law may not inject much competitive pressure into the school system. Also, it is difficult to know the translation of the CER score to a competitive school system, i.e., does a high score generate a close approximation of a competitive school system? Thus, the score alone does not indicate how much charter laws have fostered competition.

[10] Prior to 1996, I assigned states that had a charter law their score in 1996.

Figure 2



Source: Center for Education Reform, https://edreform.com/.

IV. Estimating the Determinants of NAEP Test Scores: The Basics

A. Basic Findings and Magnitudes

This section begins the presentation of regression estimates of the effect of state school choice and charter laws on state average test scores. For the latter, I use the National Assessment of Educational Progress (NAEP) tests. I focus on grade 4 reading scores and grade 4 math scores. The scores are state-level averages for each year that state-level data are reported. For these tests, this is 1992 to 2019 for years that each test is given.

As a starting point, I characterize each state's school choice and charter school laws in very simple ways. Initially, I utilize dummy variables indicating whether a state has an STC, an ITC, a voucher, or an ESA.[11] I use more detailed data later. The voucher variable refers to only state-wide programs, not those pertaining to a city. Regarding charter school laws, I utilize a

[11] States may have more than one type of program and more than one program of a given type.

dummy variable indicating whether the state has a charter law and a variable for the state's CER charter law score.[12] The other major state policy variable I include is real per pupil public K-12 funding for the state in each year. This is expressed in 2019 dollars and inclusive of state, local, and federal funding.

A host of control variables are used in the regression analysis. One set of variables is regarding the demographics of the state's test takers. These are the percentages of student test takers who are white, black, Hispanic, eligible for free or reduced-price lunch, identified as disabled, identified as an English-language learner, and, of the last two categories, the percent who are tested and tested with accommodation. To control for the business cycle in each state, I use the state's annual unemployment rate and its yearly real GDP growth. Also, I include state dummy variables and time dummy variables. This is the basic difference-in-differences approach. Thus, the regression coefficients are interpreted as the effect of the variable on the state's score improvement relative to nationwide improvement.

Table 4 shows the findings for this basic regression, where I display only the education policy variables. Column (1) shows the results for grade 4 reading and column (3) is for grade 4 math. Columns (2) and (4) express the coefficients as a share of the score standard deviation, which are used to discuss the magnitude of the effects.

Column (1) shows that real per pupil funding has a positive and statically significant association with the grade 4 reading state average NAEP score. Though statistically significant, the magnitude is very small. The coefficient implies that a $1,000 increase in funding raises the grade 4 reading score about 0.25 points. To gain perspective on magnitudes, note that over the

[12] I make an adjustment in these scores for the change in the scaling in 2009.

1990 to 2019 period, mean state funding per pupil is $13,733. For 2019, it is $16, 416. Over this period (for state/years in the sample), the mean grade 4 reading score is 218.15, with a standard

Table 4
Regression Coefficients of the Determinants of NAEP Test Scores &
Computed Effect as a Percent of a Standard Deviation in State Average Score[a]

Dependent Variable: State Average NAEP Score for All Students
(Absolute value of t-statistics in parentheses)

	Grade 4 Reading		Grade 4 Math	
	(1)	(2)[b]	(3)	(4)[b]
Variable	Coeff.	Pct. of σ	Coeff.	Pct. of σ
Real Funds Per Pupil ($1,000s)	0.2514 (2.68)	0.0327	0.1353 (1.48)	0.0135
State Law Allows Charters (yes=1, no=0)	-1.2184 (1.74)	-0.1584	-0.7597 (1.06)	-0.0759
State Charter Law Rating (0 to 1)	3.0522 (2.78)	0.3968	2.7584 (2.47)	0.2757
State Has an STC (yes=1, no=0)	0.3679 (0.79)	0.0478	0.0867 (0.19)	0.0087
State Has an ITC (yes=1, no=0)	0.1812 (0.25)	0.0235	-0.4078 (0.57)	-0.0408
State Has a Voucher[c] (yes=1, no=0)	2.2533 (4.35)	0.2929	1.3687 (2.70)	0.1367
State Has an ESA (yes=1, no=0)	3.4600 (3.76)	0.4498	3.7048 (4.19)	0.3702
R^2 (No. obs.)	0.9181 (N=625)		0.9518 (N=586)	

[a]Control variables are, for test takers, racial composition percentages, percent lunch program eligible, percent disabled, percent English-language learner, percent of the previous two assessed and assessed with accommodation, plus the state's unemployment rate, its real GDP growth, and state effects and year effects.
[b]The coefficients in the previous column as a percent of the standard deviation of state NAEP test scores.
[c]This pertains to statewide voucher programs only.

deviation of 7.7. Thus, $1,000 more funding is associated with scores of about 0.03 of a standard deviation higher.[13]

The negative coefficient on the state having a charter law is negative, but that on the charter law score is positive. The former coefficient is significant only at the 8% level, while the latter is highly significant. This suggests that states with poorly rated charter laws have lower test scores. The effect of a charter law becomes positive with a score of 0.40 (on a scale of 0 to 1). The mean score of state with a charter law is 0.61. At this charter score value, there is a positive effect of 0.64 NAEP score points. This is about 0.08 of a standard deviation; equivalent to over $2,500 of funding per pupil.

Regarding the effect of school choice laws, the effect of STCs and ITCs are small when compared to those of vouchers and ESAs. Moreover, the former two effects not statistically significant, while the latter two are highly significant. The effect of the voucher and ESA dummies are very large. Having a statewide voucher program is associated with 2.25 more test score points; nearly 0.30 of a standard deviation. For ESAs, the effect is even larger. An ESA is associated with 3.46 more NAEP score points; almost 0.45 of a standard deviation. In fact, the voucher and ESA effects are stunningly large. They dwarf the effect of $1,000 of funding. The voucher effect is 10 times as large and the ESA effect is almost 14 times as large.

The coefficient estimates for grade 4 math show the same pattern as with grade 4 reading, though magnitudes and statistical significance differ. The coefficient for per pupil funding is positive, though not statistically significant. It indicates that $1,000 more of per pupil funding increases the state average math score by 0.13 point; equivalent to 0.013 of a standard deviation.

[13]The magnitude of the effect is consistent with the survey of Jackson and Mackevicius (2021) who find an average effect of 0.04 of a test score standard deviation for $1,000 of funding in the studies they review. I also examined the data for lagged effects of funding, but the results change little.

(The standard deviation in cross-state, over time grade 4 math scores is 10.01.) As before, the coefficient on having a charter law is negative and that on the charter score is positive, with only the latter attaining statistical significance. The effect become positive at a charter score value of 0.36. At the mean score of 0.61, the effect of charters is 0.92 test score point, equal to 0.092 standard deviations.

The coefficients on having an STC and having an ITC are relatively small and statistically insignificant. As above, the voucher and ESA coefficients are large and highly significant. The former coefficient implies a 1.37 point increase in the test score with a voucher, equal to 0.137 of a standard deviation. An ESA is associated with a 3.7 improvement in the grade 4 math test score, corresponding to a 0.37 standard deviation.

As with the grade 4 reading test, the effects of a voucher and ESA swamp that of $1,000 of funding per pupil. The voucher effect is just over 10 times a large and that for ESAs is 27 time bigger.

B. Robustness

Such large estimates of the effects behooves an investigation regarding the credibility and robustness of the finding. This section subjects the data to a host of checks. At this point, I stick to robustness with respect to the basic regression specification.

(i) Times and Places

Here, I examine whether the findings depend on an outlier state regarding adoption of choice programs and test score performance and/or if they hold only during part of the sample time period.

Regarding the former. I re-estimate each regression by dropping states with an ESA one at a time. These states are Arizona, Florida, Mississippi, North Carolina, and Tennessee.

Because there are so few of these states, one outlier could change the ESA findings a good deal. However, I find little change in the results for either grade 4 reading or grade 4 math.

I repeat a similar procedure but for states with large voucher programs (but no ESA). These states are Georgia, Indiana, Louisiana, Ohio, Wisconsin, plus DC. Again, I find no substantial changes in the results.

I also estimate the equations for two sub-periods: 1992 – 2005 and 2007 – 2019. Regarding the earlier period, there were no ESAs. During this sub-period, the effect of having a voucher program was much larger than for the full sample. The effect of per pupil funding was also larger, though not statistically significant. These differences hold for both the reading and math tests. For the later period, the ESA results remain strong. The voucher effect was smaller in this sub-period for the reading test, though still statistically significant (marginally). For grade 4 math, the voucher effect is very small and statistically insignificant. For both the reading and math tests, the effect of per pupil funding is lower than for the full sample.

(ii) Nonparallel Pre-Existing Trends

One of the assumptions of the difference-in-differences (DD) estimator that I employ is that of parallel trends. This does not hold if, for example, the "treated" observations has a prior trend upward and the "untreated" does not. In this example, the basic DD estimator may falsely attribute the resulting higher values of the treated observations as the effect of "treatment." This subsection considers this issue. I consider this only with regard to the voucher and ESA dummy variables since they have the largest and most compelling effects.

To deal with this issue, the standard procedure is to examine the relationship of the variables in question (i.e., the voucher and ESA dummies) to test scores before the programs were put in place, as well as after. Finding an association before a program is implemented

indicates a different trend for the later-treated observations. I undertake this procedure for both voucher programs and ESAs.

With respect to vouchers, I use four time periods: 1 to 3 years prior to the program implementation, 0 to 2 years after implementation, 3 to 5 year after implementation, and more than 5 years after implementation. I use categorical values rather than individual years since the number of observations is in the data is relatively small and so quite thin for some years. For ESAs, this issue is even more pressing since ESAs are a fairly new type of program. Thus, for ESAs, I use three time periods: 1 to 2 years prior to the program implementation, 0 to 2 years after implementation, and more than 2 years after implementation.

Table 5 presents the findings, with the results for grade 4 reading in column (1) and those for grade 4 math in column (2). I report only the variables regarding vouchers and ESAs. Also, the number of observations is reduced from that shown in Table 4 since use of a 3-year lead eliminates some years of observations.

For both the grade 4 reading and math tests, there is no association of vouchers to test scores prior to their adoption. The association is small and not statistically significant for the first two years after adoption. From 3 to 5 years after adoption, the effects become large and statistically significant and larger yet after 5 years. This holds for both tests.

The findings regarding ESAs are somewhat different. States with ESAs show higher scores in both reading and math 1 to 2 years before implementation. During the first two years after implementation, states show about the same reading and math scores as just before; slightly lower for reading and slightly higher for math. However, after 2 or more years, the effects are much greater. The effect after 2 or more years is calculated as the difference between the

Table 5
Regression Coefficients of the Determinants of NAEP Test Scores,
Leads and Lags for Vouchers and ESAs[a]

Dependent Variable: State Average NAEP Score for Student Subgroup
(Absolute value of t-statistics in parentheses)

	Grade 4 Reading	Grade 4 Math
	(1)	(2)
Variable	Coeff.	Coeff.
State Has a Voucher 1 to 3 years in the future	0.5435 (0.84)	0.27 (0.41)
State Has a Voucher for 0 to 2 years	1.0790 (1.33)	.06857 (0.85)
State Has a Voucher for 3 to 5 years	2.3431 (2.57)	2.9391 (2.44)
State Has a Voucher for more than 5 years	5.5794 (5.63)	3.7581 (3.87)
State Has an ESA 1 to 2 years in the future	2.7886 (2.13)	3.0095 (2.37)
State Has an ESA for 0 to 2 years	2.6535 (1.40)	3.8935 (2.13)
State Has an ESA for more than 2 years	4.4997 (1.70)	5.1891 (2.03)
R^2 (No. obs.)	0.9270 (N=523)	0.9618 (N=484)

[a]Control variables are the same as for Table 4 plus real per pupil funding, state charter dummy, state charter score, STC dummy, and ITC dummy.

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coefficient after and the coefficient before. This value is 1.7111 for grade 4 reading and 2.1796 for grade 4 math. These are smaller than the effects reported in Table 4, but are still very large and still dwarf the per pupil funding effect.

ESAs are relatively new and most of the states that adopted them had previously enacted other choice programs. This perhaps suggests that there was an "atmosphere" in those states

pushing for more accountability in K-12, leading to better performance even before the state enacted its ESA, with the actual enactment and implementation leading to even better outcomes.

C. Results for Subgroups

This subsection presents the findings of the basic regression for two subgroups: black students and students eligible for free or reduced-price lunch. In these specifications, I use either the state's average score for black students or for free and reduced-price lunch students as the dependent variable. There are fewer observations for these estimates because these scores are not reported for each state for all years. Table 6 shows the findings.

Regarding the reading test, the findings bear many similarities to those for all students, but also some differences. The effect of per pupil funding is much smaller for black students, but larger for lunch-eligible students. The presence of charter schools and the charter school score have similar effects for black students as for all students, i.e., charter school states with low scores have a negative effect, but those with high scores have a positive effect. However, for lunch-eligible students, charters have a negative effects, although statistical significance is weak.

An STC has essentially no effect on black student scores, but a positive effect for lunch-eligible students. An ITC has little effect on either subgroup. Both the presence of a voucher program and an ESA program have positive, significant, and large effects for both subgroups. The voucher effects for each subgroup are somewhat smaller than for all students, and those for ESAs are larger. As with the findings for all students, these effects swamp that of per pupil funding.

With respect to the math test, the effect of per pupil funding for lunch-eligible students is similar to that for all students, but the effect for black student scores is essentially zero. The pattern of effects of charters schools is similar as well; negative for low scoring charter states and

positive for high scoring. An STC or and ITC have little effect. In contrast to other results, the effect of vouchers is small and not statistically significant for both black and lunch-eligible students. The effect of an ESA is like that found previously; positive, significant, and large in magnitude.

Table 6
Regression Coefficients of the Determinants of NAEP Test Scores, Black Students and Free or Reduced-Price Lunch Eligible Students[a]

Dependent Variable: State Average NAEP Score for Student Subgroup
(Absolute value of t-statistics in parentheses)

	Grade 4 Reading		Grade 4 Math	
	(1)	(2)	(3)	(4)
	Black Students	Lunch Eligibles[b]	Black Students	Lunch Eligibles[b]
Variable	Coeff.	Coeff.	Coeff.	Coeff.
Real Funds Per Pupil ($1,000s)	0.0266 (0.16)	0.3646 (3.20)	-0.0261 (0.18)	0.1295 (1.28)
State Law Allows Charters (yes=1, no=0)	-3.1380 (2.77)	-1.7031 (1.71)	-3.0914 (2.91)	-0.9906 (1.20)
State Charter Law Rating (0 to 1)	4.5220 (2.59)	1.2619 (0.18)	4.5420 (2.75)	2.6429 (1.99)
State Has an STC (yes=1, no=0)	-0.0370 (0.05)	1.0784 (1.85)	-0.5466 (0.81)	0.1329 (0.26)
State Has an ITC (yes=1, no=0)	0.6576 (0.58)	0.7887 (0.91)	0.1178 (0.12)	0.0340 (0.04)
State Has a Voucher (yes=1, no=0)	1.6795 (2.01)	1.8229 (2.90)	0.6333 (0.86)	0.5880 (1.05)
State Has an ESA (yes=1, no=0)	4.5002 (3.08)	4.5698 (4.34)	4.1404 (3.28)	4.2473 (4.51)
R^2 (No. obs.)	0.8181 (N=529)	.8548 (N=543)	0.9284 (N=497)	0.9360 (N=544)

[a]Control variables are the same as for Table 4.
[b]Denotes students who are eligible for free or reduced-price lunch.

Generally speaking, the results for these two subgroups are akin to the overall effects. Per pupil funding generally has a small or nearly zero effect. A charter school presence has a negative effect for low scoring charter systems and positive for high scoring ones. STCs and ITCs seem to have little effect. States that have vouchers and ESAs generally have much higher scores overall and for the two subgroups examined.

V. More Details on the Programs and Their Effects

This section begins a look at some specifics of the choice programs that may generate the above findings. In particular, I examine the two measures of the restrictiveness of each program noted previously: (i) the percent of a state's students eligible for the program, and; (ii) program per pupil funding as a percent of public school per pupil funding. Recall from Table 2 that program types generally fall into two categories: (1) low percent eligible with relatively high funding, and (2) relatively high percent eligible with low funding. Voucher programs and ESAs usually fall into the first category and STCs and ITCs into the second, though there are exceptions to this.

The previous results indicated strong effects on test scores of vouchers and ESAs but minimal effects of STCs and ITCs. This suggests that a key is having high levels of per pupil funding, even if a relatively low number of students are eligible. The reasons for this are not immediately obvious, but I suggest the following possibility.

To cause substantial improvements in the state's average NAEP test score, a large number of students – not just the small minority in choice programs – must improve, implying that a considerable number of public schools, and their students, need to improve. This can occur if the public schools feel sizable enough competitive pressures to upgrade their programs, to develop programs that better match students, or assist parents in moving their children to a

better-suited private school. For this competitive pressure to exist, it must be feasible and credible for parents to move their children out of the public school system.

If a lot parents are eligible for a school choice program, but there is very little financial assistance, it seems plausible that few parents will be induced to move their children to a private school. One reason for this is that, in many respects, the quantity of schooling services is lumpy, i.e., it tends to be all or nothing. So funding that covers, say, 20% of the cost of private tuition is unlikely to be enough to induce many switches to a private school, i.e., moving to no public schooling and all private schooling. Moreover, there are fixed costs of transitioning to a new school that are not worth undertaking for a small amount of funding. If this line of reasoning is correct, then low-funded choice programs do not provide a credible and feasible threat of parents moving their children to private schools, even if many parents are eligible.

In contrast, programs that have a substantial degree of funding make it feasible and credible for eligible parents to choose a private school, thus can create some competitive pressure on public schools. The above evidence suggests that this is occurring, even though a minority of families are eligible.

To investigate this in more empirical detail, I examine each program type regarding the variation in percent of students covered and percent of funding.[14] For ESAs, all programs are low percent eligible and high percent funding. ITCs are almost invariably the converse; high percent eligible and low percent funding. There is more variation regarding STCs and vouchers, however.

Table 7 below illustrates this. I list the STC programs with greater than 40% funding in panel (a) and the voucher programs with less than 40% funding in panel (b). I choose the 40%

[14] For states with multiple programs of one type, I examine the earliest program. Also, for voucher programs, I consider only statewide programs.

threshold somewhat arbitrarily. From panel (a) one can see there are quite a number of state/years that have atypical STCs in that their funding is well about the STC average of 23%. Also, the percent eligible for these programs are all considerably lower than the STC average of 39%. Indeed, on these two measures, these STCs look much more like voucher programs.

Table 7
States and Years with STCs with High Funding and Vouchers with Low Funding

Panel (a): State/Years with High Funding STCs			
State	Years	Avg. Pct. Eligible[a]	Avg. Pct. Funding[b]
Alabama	2016-2019	22.1%	51.4%
Florida	2003-2009, 2013-2019	26.0%	55.5%
Illinois	2019	27.0%	42.2%
Nevada	2016-2019	30.2%	45.9%
South Carolina	2014-2015	12.2%	66.3%
Panel (b): State/Years with Low Funding Vouchers			
State	Years	Avg. Pct. Eligible	Avg. Pct. Funding
DC	2009-2091	18.0%	31.4%
Indiana	2012-2019	54.4%	32.4%
Louisiana	2011-2013	18.7%	37.4%
Maryland	2017-2019	12.1%	10.8%
North Carolina	2014	11.5%	29.8%

[a]Average for the state/years of percent of students eligible for the program.
[b]Average for the state/years of percent of funds per student utilizing the program relative to the state's per pupil funding for public schools.

Panel (b) shows that there are quite a number of atypical voucher programs as well with respect to percent funding. Those shown all have funding well below the voucher program average of 68%. The value for DC is somewhat deceiving though. This low value is mostly due to the very high value of per pupil funding for DC public schools. The latter was over $31,000 for 2019; nearly double the national average and 1.5 as much as neighboring Maryland. Regarding the other states/years, Indiana looks more like an STC program with its high percent

eligible and low funding. Louisiana, Maryland, and North Carolina are restrictive programs (for these years) based on both percent eligible and percent funding.

I estimated a series of regressions similar to those above regarding the determinants of the statewide average NAEP test scores for grade 4 reading and math, but with use of the percent eligible and percent funding variables. I experimented with a host of specifications that included a dummy variable for having each type of program, plus percent eligible and percent funding for each program type. Generally, the percent eligible variable had little explanatory power, but percent funding did in some cases. Table 8 presents the estimation results of what I think are the most representative and revealing. The specification includes dummy variables for each program type plus percent funding for STC programs and voucher programs. Column (1) is for the grade 4 reading test scores and column (2) pertains to grade 4 math.

Regarding column (1), the dummy for an STC program is negative and marginally significant, while that on STC percent funding is positive and significant. The net effect of an STC is positive for percent funding above 18%. This finding implies that well-funded STCs have a large, positive effect, e.g., a percent funding of 40% raises the NAEP score by 1.6 points. For ITCs, the dummy variable is small and statistically significant as before. The dummy variable for having voucher is large, positive, and significant as in Table 4. However, the voucher percent funding variable is essentially zero. This is in contrast to the STC finding and contrary to the hypothesis that well-funded vouchers would be more effective. The reasons for this contradiction are not clear. Regarding ESAs, the dummy variable is large and statistically significant as in previous results.

The findings for the math test in column (2) show a similar sign pattern but statistical significance is generally much weaker. As with column (1), the STC dummy is negative and the

Table 8
Regression Coefficients of the Determinants of NAEP Test Scores[a]

Dependent Variable: State Average NAEP Score for All Students
(Absolute value of t-statistics in parentheses)

	Grade 4 Reading	Grade 4 Math
	(1)	(2)
Variable	Coeff.	Coeff.
State Has an STC (yes=1, no=0)	-1.3160 (1.82)	-0.7348 (1.01)
Pct. Funding[b], STC	0.0733 (3.03)	0.0361 (1.47)
State Has an ITC (yes=1, no=0)	0.0103 (0.01)	-0.4125 (0.57)
State Has a Voucher (yes=1, no=0)	2.7263 (2.76)	0.9477 (1.00)
Pct. Funding[b], Voucher	-0.0084 (0.60)	.0070 (0.51)
State Has an ESA (yes=1, no=0)	3.4148 (3.73)	3.7280 (4.22)
R^2 (No. obs.)	0.9101 (N=625)	0.9521 (N=586)

[a]Control and other variables are as in Table 4.
[b]Pct. Funding is the program's average funds per student utilizing the program relative to the state's per pupil funding for public schools.

STC percent funding variable is positive. The calculated point that the STC effect becomes positive is at a percent funding of 20%. At percent funding of 40%, the STC has a positive effect of 0.71 NAEP score points. However, both of these coefficients have weak statistical significance. The ITC coefficient in column is small and statistically insignificant. With respect to the voucher variables, neither the dummy variable nor the percent funding variable show statistical significance, though we know from before that having a voucher

program has a positive, large, and statistically significant effect on the math test score. Evidently, the effect of having a program is not discernable from having a better funded program. Lastly, the ESA coefficient is large and highly significant as above.

Overall, there is some evidence that well-funded STC programs improve performance relative to poorly funded ones. Unexpectedly, there is no strong distinction in the effect of poorly- and well-funded voucher programs.

VI. The Effects on Public K-12 Funding

This section examines the effect of school choice and charter laws on real per pupil funding. Here, the dependent variable in the regressions is the state's real pupil funding (or the log of funding) in each year. Table 9 shows the findings. I concentrate on a basic specification where each state charter law is characterized by whether it has a charter law and the law's score, and the state's school choice laws are characterized by the four dummy variables indicating whether the state has an STC, ITC, voucher, and ESA. Column (1) of Table 8 presents the estimates where test-taker demographics are included and column (3) drops these variables. The latter allows use of more years and states, i.e., the years/states where no NAEP test was given can use used since the other variables are available for every state and every year from 1990 to 2019.[15] Columns (2) and (4) use the logarithm of real funding as the dependent variable so coefficients can be interpreted as percentage effects on funding.

A perusal of Table 9 shows some quite large and statistically significant effects. In particular, states that have an STC, a voucher program, or an ESA have substantially lower per pupil funding. For example, from the results in column (1), states with an STC show $685 less of per pupil funding, those with vouchers have $919 less, and those with ESAs have $2,237

[15] The demographics (and other variables) used are from the states/years of the grade 4 reading test.

less.[16] Recalling that real per pupil funding over all sample years is $13,733 and for 2019 it is $16, 416, it is clear that these are substantial amounts. The estimates of column (2), using the logarithm of funding, provide an easy way to see the percentage effects. They are 3.8%, 5.2%, and 11.3% reductions for STCs, vouchers, and ESAs, respectively.

Table 9
Regression Coefficients of the Determinants of State Real Per Pupil Funding[a]

Dependent Variable: State Real Per Pupil Public K-12 Funding (2019$) or Logarithm of Real Per Pupil Funding
(Absolute value of t-statistics in parentheses)

	Funding (W/ Demog.[a])	Log(Funding) (W/ Demog.[a])	Funding (W/O Demog.[b])	Log(Funding) (W/O Demog.[b])
	(1)	(2)	(3)	(4)
Variable	Coeff.	Coeff.	Coeff.	Coeff.
State Allows Charters (yes=1, no=0)	-0.1081 (0.34)	0.0079 (0.45)	0.0285 (0.14)	0.0044 (0.39)
State Charter Law Rating (0 to 1)	-0.0029 (0.01)	-0.0349 (1.26)	-0.3282 (1.03)	-0.0409 (2.34)
State Has an STC (yes=1, no=0)	-0.6846 (3.23)	-0.0383 (3.28)	-0.8027 (5.27)	-0.0428 (5.11)
State Has an ITC (yes=1, no=0)	-0.4465 (1.33)	0.0001 (0.00)	-0.2004 (0.86)	0.0149 (1.16)
State Has a Voucher (yes=1, no=0)	-0.9193 (3.93)	-0.0525 (4.08)	-0.5117 (3.05)	-0.0392 (4.26)
State Has an ESA (yes=1, no=0)	-2.23688 (5.79)	-0.1131 (5.02)	-2.2376 (7.13)	-0.1220 (7.01)
R^2 (No. obs.)	0.9362 (N=625)	0.9539 (N=625)	0.9100 (N=1530)	0.9404 (N=1530)

[a]Control variables are the same as for Table 4 (expect for real per pupil funding).
[b]Control variables for test-taker demographics are dropped.

[16] Note that funding is expressed in $1,000s, so the values in the text are the coefficients times 1000. Also, recall that these are difference-in-differences estimates, so reflect a state's change relative to the nationwide change.

The estimates of columns (3) and (4), using the larger sample but no demographic controls, show quite similar results. In this specification, the effect of an STC is slightly larger, that of a voucher program is somewhat lower, and that of an ESA is nearly the same.

Recall from the results regarding test scores that the effect of an STC program was generally positive, small, but statistically significant. Those for vouchers and ESAs were positive, large, and statistically significant. That each is associated with lower K-12 public funding speaks of a double dividend of choice program: they raise test scores (or, at minimum, do not lower them) and they save money.

VII. Some Specific States

The relationships found in the data among school choice programs, test scores, and state K-12 funding does not imply that they occur for every state and each time period. Rather, the regression estimates reveal the typical relationships among the variables examined, i.e., what usually happens when a state adopts choice and charter programs, controlling for other influences. There is no guarantee of a particular outcome regardless of what the regression estimates show. Indeed, states have had varying experiences before and after adoption of choice programs. This section presents several exhibits to illustrate this.

This first state I illustrate is Florida. This is in Exhibit 1. Panel (a) of this exhibit shows the plot of Florida's grade 4 NAEP reading score (in blue) and the U.S. average score (in red), both over time. The vertical lines represent the years that choice programs were passed into law. In Florida, these were a voucher program in 2000, an STC in 2003, and an ESA in 2015.[17] As can be seen, Florida has shown remarkable improvement, starting below the national average in the 1990s and rising above it by the mid-2000s. This occurred in the same time frame of the

[17] Florida enacted other choice programs of the same types. The vertical lines show the first program of its type.

passage of choice programs. Panel (b) of Exhibit 1 illustrates this in a somewhat different way. Here, the vertical axis is the difference-in-differences value for each year, i.e., the gap between Florida's NAEP score for that year and the Florida average score for all years minus the gap between the U.S. average that year and the U.S. average over time. It measures Florida's improvement relative to that of the U.S. The plot in panel (b) illustrates the remarkable improvements in Florida.

Panel (c) shows the plot over time of real per pupil funding for Florida (in blue) and the U.S. (in red). Early in this time frame, Florida's per pupil spending was about the same as the U.S. average. However, it dropped below the U.S average in 2000, then the gap narrowed, then widened. Note that this was the time period of large gains in Florida's test scores.

Perhaps Florida is the most dramatic illustration of the nature of the regression results, that is, the large improvements in test scores and reduction in public funding associated with choice programs, especially vouchers and ESAs. The plots for a number of other states are similar in nature, though not as dramatic. An example is Indiana, illustrated in Exhibit 2.

Panel (a) of Exhibit 2, shows the Indiana's grade 4 NAEP score was initially above the national average but falling. Around the period of the adoption of its choice programs (2010, 2011, and 2012), its score moved above the national average. Panel (b), showing the difference-in-differences, illustrates this as well. Panel (c) shows that per pupil funding in Indiana followed the U.S. average until 2010, where it dropped substantially below. This is another illustration of how adoption of choice programs is associated with better statewide test scores and less spending.

Such effects are not shown in similar exhibits for all states that adopt choice programs, though. Wisconsin is an example of this, shown in Exhibit 3. In panel (a), it is seen that

Wisconsin's test scores were initially above the national average, then dropped to the national average in 2009. They have stayed there since. Wisconsin is known for one of the first voucher programs started in 1991, but it was just for the city of Milwaukee. Another city voucher program (for Racine) started in 2011, with statewide programs in 2014 and 2017. An ITC program was enacted in 2014. The data plots show no particular change around the time of these statewide program introductions. Panel (b) is similar in this respect. Panel (c), regarding per pupil funding, shows a slower growth in Wisconsin's funding than for the U.S. Its per pupil funding dropped below that of the U.S. around the time of the adoption of statewide choice programs, consistent with the regression finding of lower funding associated with choice programs.

Exhibit 4 presents the data plots for a state that does not have any choice programs; Connecticut. Panel (a) show that Connecticut's test scores are consistently above the national average, though they have changed little for a many years such that the gap from the national average has shrunk. Panel (b) of the difference-in-differences illustrates this as well. Panel (c) shows that Connecticut's per pupil funding has always been above the national average, with the gap growing in recent years.

Connecticut shows a pattern similar to many states, especially those in the northeast U.S. Historically having high spending and high test scores, these states have faltered regarding the latter, but have retained their high spending ways. These states mostly do not have significant choice programs (though most have charter schools). This pattern among this subset of states helps explain the regression results.

A last state I illustrate is Minnesota, in Exhibit 5. As seen in panels (a) and (b), Minnesota is another state that has test scores above the national average, but the gap has

narrowed. Minnesota also has two ITC program, though as seen in the findings above, they typically provide little funding to students and do not normally effect statewide test scores. Regarding funding, panel (c) shows that Minnesota typically matches, or is somewhat above, the national average.

VIII. Conclusion

The degree to which a state's school choice and charter school programs influence the entire state's educational progress is an important question. Since so many students currently remain in traditional public schools, any statewide effect must come through competitive pressure on the public system from choice and charter programs. Can these programs have a noticeable competitive effect, especially since they are typically limited to a small subset of students and have a host of other restrictions placed on them?

This paper finds a remarkably large and robust effects, especially from voucher and ESA programs. They are associated with large improvements in grade 4 reading and math NAEP test scores and are much bigger than the effect of school funding. Moreover, they are associated with lower schooling costs, implying a double dividend of better outcomes at lower cost.

There is some evidence that choice programs that are well-funded have larger effects on test scores, even if they cover a small percentage of students. However, this finding is not universal in my analysis. Also, the finding that part of the positive effect of ESAs occurs before their enactment suggests that there may be an atmosphere of education accountability and innovation in those states leading to improved test scores. This "atmosphere" may come with programs such as inter- and intra-district public school choice, more magnet schools, and greater ease of home schooling. I have not accounted for these effects, however, though they may be part of the story.

An examination of particular states reveals that the effects I estimate are not universal. This is not a surprise since regression estimates reveal the typical effect. However, it is clear that many states are doing something right through their adoption of choice programs. Perhaps the lessons learned from the more successful states can be applied elsewhere. Note, though, that the expected gains from choice and competition comes from enabling schools to find what works for their specific situation and allowing parents to reward those schools by enrolling their children. "What works" in one place may not work in another. The real key is establishing the incentive system that allows and rewards finding what works.

References

Abdulkadiroglu, Atila; Angrist, Joshua; Dynarski, Susan; Kane, Thomas; and Pathak, Parag. "Accountability and Flexibility in Public Schools: Evidence from Boston's Charters and Pilots," *Quarterly Journal of Economics*, 126(2), May 2011, pp. 699-748.

Betts, Julian R. and Tang, Y. Emily, "The Effect of Charter Schools on Student Achievement," in Berends, Mark; Waddington, Joseph; and Schoenig (eds.), *School Choice at the Crossroads: Research Perspectives*, New York: Routledge, Taylor & Francis Group, 2019, pp. 69-91.

Center for Education Reform, https://edreform.com/.

Center for Research on Education Outcomes, "Urban Charter School Study Report on 41 Regions," CREDO, 2015, https://urbancharters.stanford.edu/download/Urban%20Charter%20School%20Study%20Report%20on%2041%20Regions.pdf.

Coulson, Andrew, "Public School Spending. There's a Chart for That!," Cato Institute, September 6, 2012, https://www.cato.org/blog/public-school-spending-theres-chart.

Digest of Education Statistics, https://nces.ed.gov/programs/digest/.

EdChoice, School Choice in America, 2021, https://www.edchoice.org/school-choice-in-america-dashboard-scia/.

Egalite, Anna J. and Wolf, Patrick J. "A Review of the Empirical Research on Private School Choice," Peabody Journal of Education, 91:14, June 2016, pp. 441-454, https://twin.sci-hub.se/5891/0bdba10332d50619a87aa37808152664/egalite2016.pdf.

Figlio, David; Hart, Cassandra; and Karbownik, Krysztof, "Effects of Scaling Up Private School Choice Programs on Public School Students," CESifo Working Paper No. 9056, May 2021, https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3842320.

Garen, John, "The Allocation and Exchange of Property Rights as a Way to Understand Comparative Economics Systems and Managerial Economics," *Journal of Private Enterprise*, 35(4), Winter 2020, pp. 43-59.

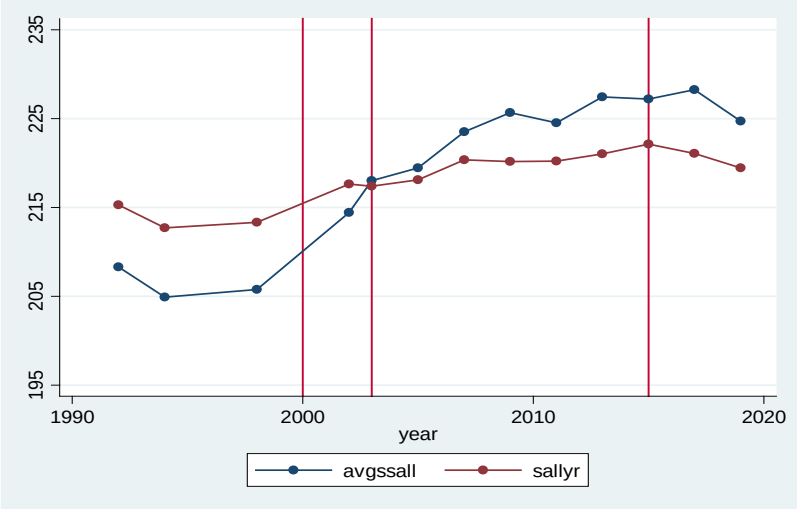
Gilraine, Michael; Petronijevic, Uros; and Singleton, John D., "Horizontal Differentiation and the Policy Effect of Charter Schools," *American Economic Journal: Economic Policy*, 13:30, August 2021, pp. 239-276.

Hoxby, Caroline; Murараka, Sonali; and Kang, Jenny, "How New York City's Charter Schools Affect Achievement," New York City Charter Schools Evaluation Project, September 2009, http://users.nber.org/~schools/charterschoolseval/how_NYC_charter_schools_affect_achievement_sept2009.pdf.

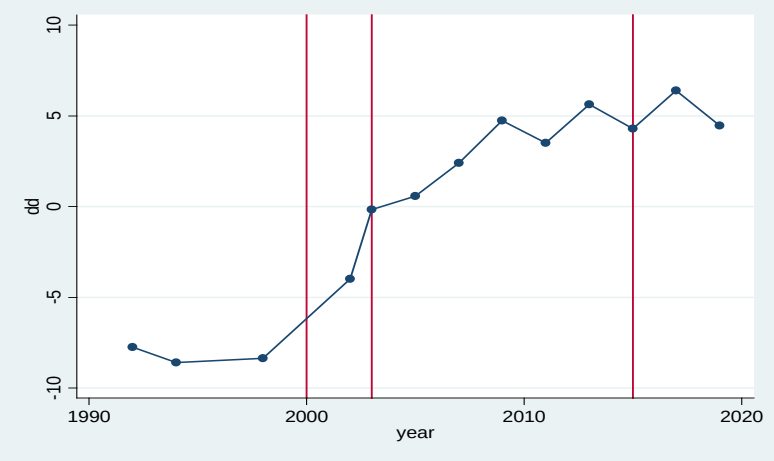
Jackson, C. Kirabo and Mackevicius, Claire, "The Distribution of School Spending Impacts," NBER Working Paper 28517, March 2021.

Wolf, Patrick; Greene, Jay; Ladner, Matthew; and Paul, James, "Education Freedom and Student Achievement: Is More School Choice Associated with Higher State-Level Performance on the NAEP?," School Choice Demonstration Project, University of Arkansas, March 2021, education-freedom-and-naep-scores.pdf (cpb-us-e1.wpmucdn.com).

Exhibit 1: Florida (blue) and U.S. (red)
Vertical Lines: 1st: 2000 voucher; 2nd: 2003 STC; 3rd: 2015 ESA
Panel (a): NAEP Grade 4 Reading Score by Year



Panel (b) NAEP Diff.-in-Diff. by Year



Panel (c): Real Per Pupil Funding ($1000) by Year

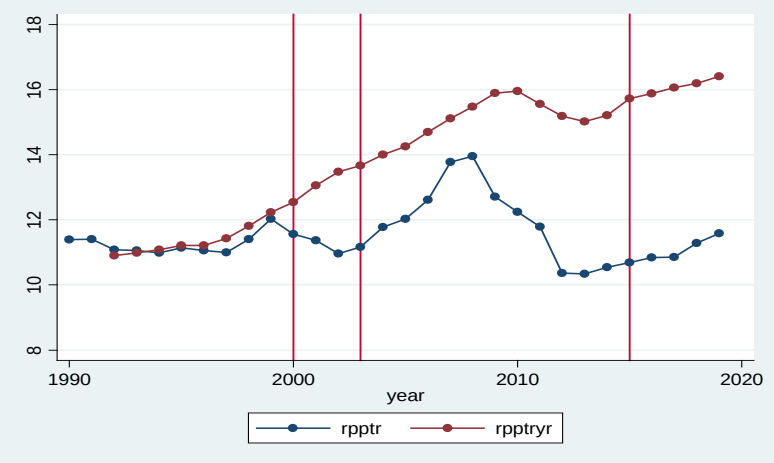
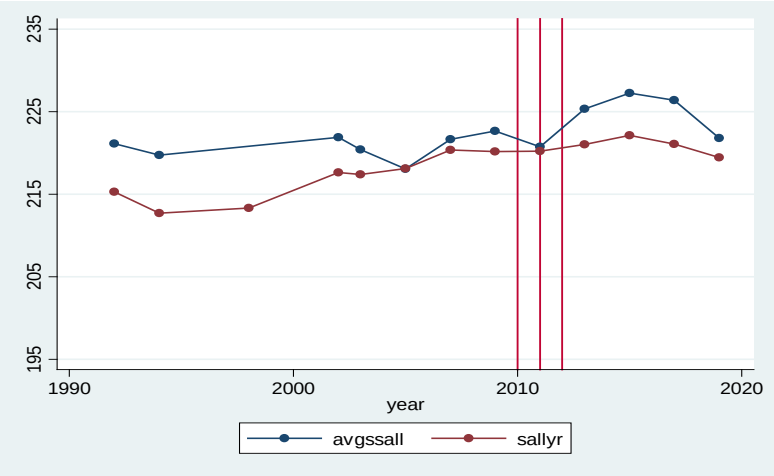
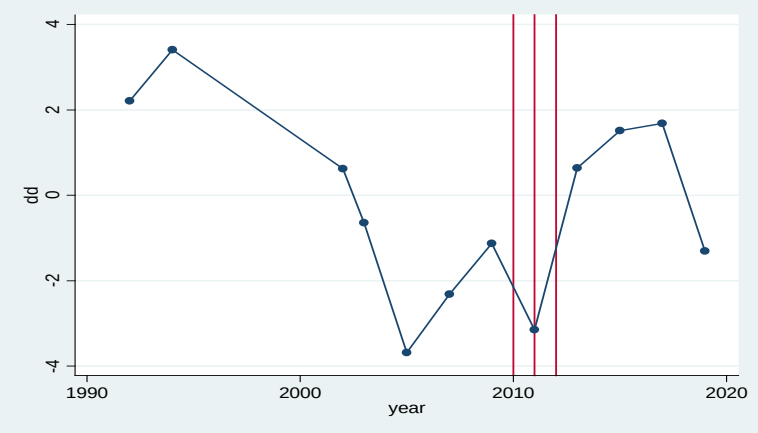


Exhibit 2: Indiana (blue) and U.S. (red)
Vertical Lines: 1st: 2010 STC; 2nd: 2011 ITC; 3rd: 2012 voucher
Panel (a): NAEP Grade 4 Reading Score by Year



Panel (b) NAEP Diff.-in-Diff. by Year



Panel (c): Real Per Pupil Funding ($1000) by Year

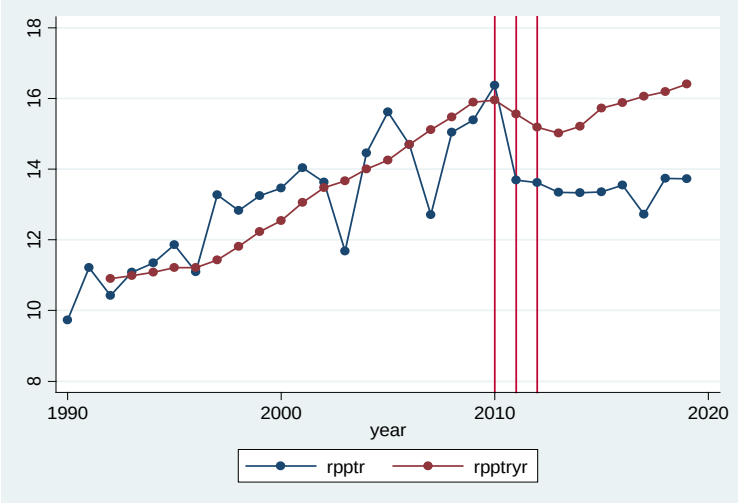
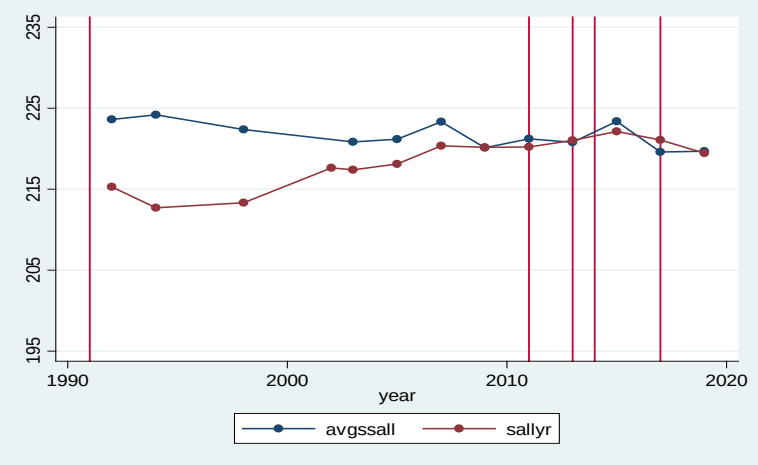
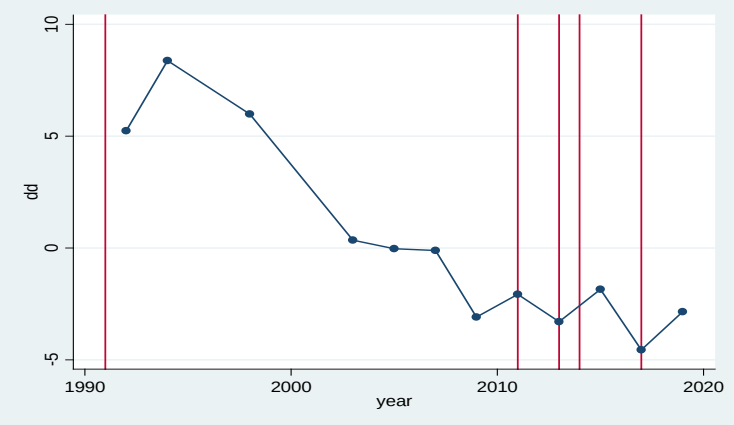


Exhibit 3: Wisconsin (blue) and U.S. (red)
Vertical Lines: 1st: 1991 Milw. voucher; 2nd; 2011 Racine voucher;
3rd: 2013 statewide voucher; 4th: ITC; 5th: statewide voucher
Panel (a): NAEP Grade 4 Reading Score by Year



Panel (b) NAEP Diff.-in-Diff. by Year



Panel (c): Real Per Pupil Funding ($1000) by Year

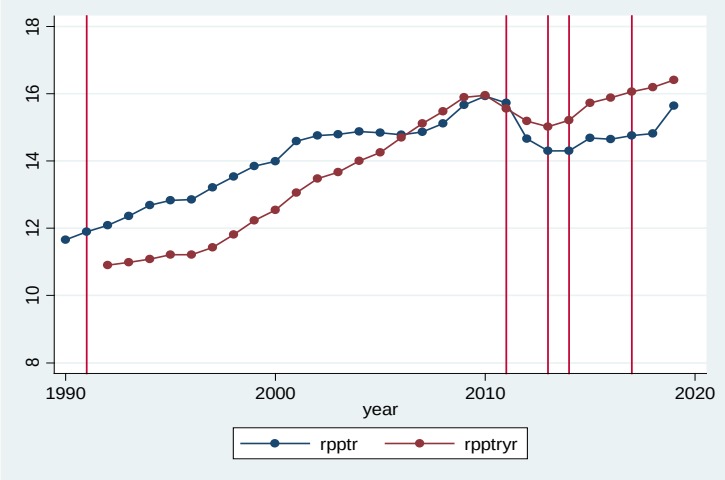
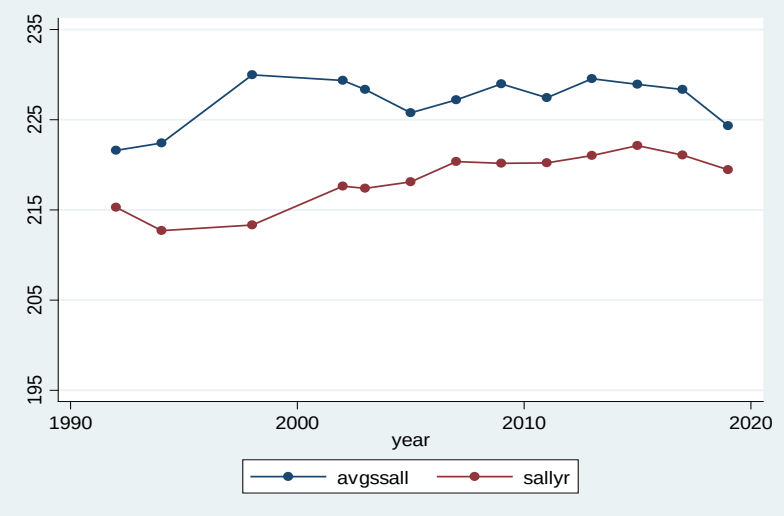
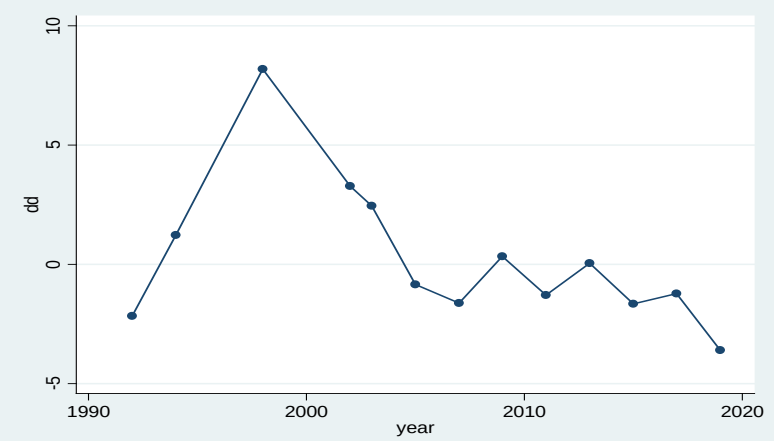


Exhibit 4: Connecticut (blue) and U.S. (red)
Panel (a): NAEP Grade 4 Reading Score by Year



Panel (b) NAEP Diff.-in-Diff. by Year



Panel (c): Real Per Pupil Funding ($1000) by Year

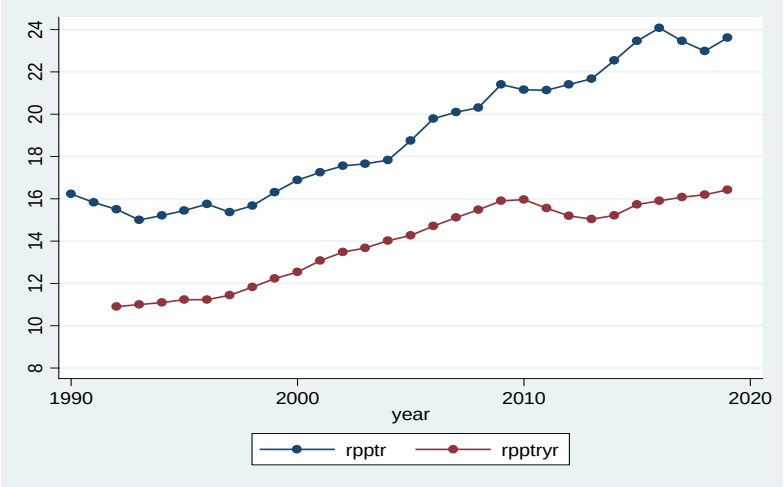
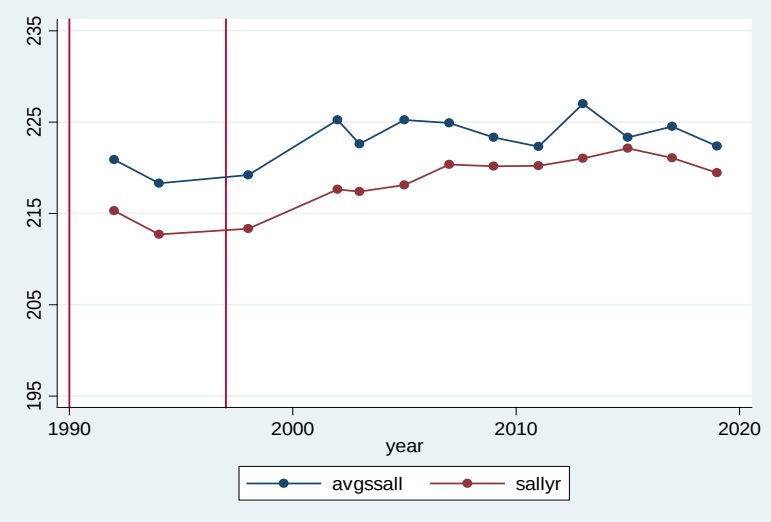
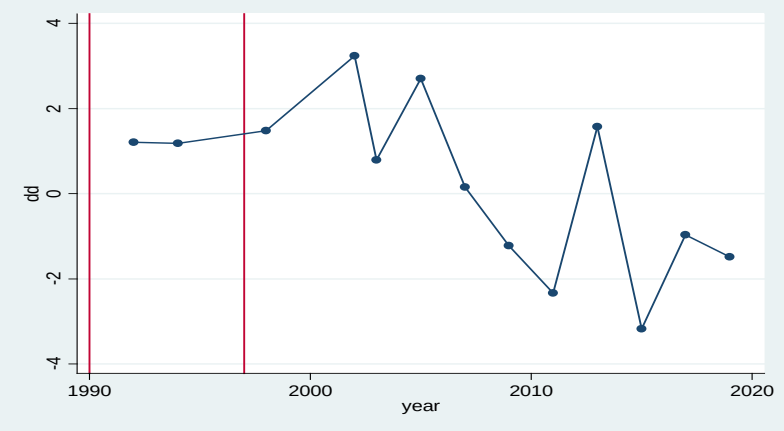


Exhibit 5: Minnesota (blue) and U.S. (red)
Vertical Lines: 1st: 1990 ITC; 2nd: 1997 ITC
Panel (a): NAEP Grade 4 Reading Score by Year



Panel (b) NAEP Diff.-in-Diff. by Year



Panel (c): Real Per Pupil Funding ($1000) by Year