The Efficacy of Private Sector Providers in Improving Public Educational Outcomes.*

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Abstract

Under No Child Left Behind (NCLB), school districts are required to provide supplemental educational services (SES) to students in schools that are not making adequate yearly progress. A key feature of the SES mandate is its intention to use the private sector to offer eligible students greater choice in a competitive market that ostensibly encourages innovative service approaches and squeezes out ineffective providers. In this paper, we estimate provider effects in a large, urban school district that accounts for a significant share of students receiving SES, using four different estimation techniques. Identifying provider effects on student achievement is complicated by the fact that participation is voluntary among eligible students. We find that the district provider is more effective, on average, than non-district providers and also other on-site providers. On average, students attending SES with on-line and for-profit providers gain less than those attending with other providers. We identify specific non-district SES providers that are effective in increasing students' math and reading achievement, and observe some consistency across years in the providers that are producing learning gains for students. We expect this research to not only inform education policy as NCLB comes up for reauthorization, but to also address more broadly the viability of policy interventions that employ a private market model to improve public sector outcomes.

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1 Introduction

The U.S. No Child Left Behind (NCLB) Act was designed to increase the achievement of economically disadvantaged students by introducing greater choice, flexibility and accountability in public education. Key legislative provisions include offering educational choice to those in persistently low-performing schools; empowering parents with more information about the quality of their children's schools; holding states, districts and schools accountable for student achievement by identifying and imposing requirements on schools in need of improvement, and targeting federal funds on effective practices for improving teacher and school quality.[1] As in the decentralization or divestment of government functions in other social policy areas (public assistance, publicly-funded training, child welfare, etc.), the expectation is that involving the private sector in public services delivery is likely to bring about a more efficient, innovative, competitive, results-oriented and responsive public sector that better accommodates diverse public preferences, values and needs (Frederickson and Smith 2003; Rivlin 1992).

We study the NCLB provision that requires schools that have not made adequate yearly progress in increasing student academic achievement (for at least two years) to offer parents of children in low-income families the opportunity to receive extra academic assistance, or supplemental educational services (SES). The primary responsibility for implementing SES lies with school districts, which largely rely on the private sector to offer eligible students a range of choices for SES. NCLB obligates school districts to set aside 20 percent of their Title I funding for SES and lays out criteria and guidelines for state and local educational agencies in approving SES providers and arranging for their services.[2] Importantly, it requires state and local educational agencies to measure provider effectiveness in increasing student achievement, and to use this information to withdraw approval of ineffective providers.

A large number of diverse organizations with widely varying hourly rates, service costs, tutor qualifications, tutoring session length, instructional strategies, and curricula have entered the market to compete for the opportunity to provide SES. These include national and local organizations, for-profit and non-profit providers, on-line and off-line providers, those offering services on-site at the schools (and off-site), and in some cases, schools districts engaging directly in SES provision. Burch, Steinberg and Dono-

[1] See Title I, Section 1116(e) of the Elementary and Secondary Education Act (ESEA), reauthorized by the No Child Left Behind Act of 2001.

[2] Title I federal funding, which began in the 1965 Elementary and Secondary Act, was created to allow all students an equal opportunity to receive the highest quality education possible. Through Title I, school districts can hire teachers to lower student-teacher ratios, provide tutoring for struggling students, create school computer labs, fund parent involvement activities, purchase instructional and professional development materials for teachers, hire teacher assistants, and more. The 20% Title I set-aside for SES and school transfers cannot be spent on administrative costs for these activities, although the district may reallocate any unused set-aside funds to other Title I activities after all eligible students have had adequate time to opt to transfer to another school or apply for SES.

van (2007: 121) described the market for SES as "a very new market where hundreds of firms are flocking to take advantage of the promise of sizeable revenues." This was precisely the intent of NCLB: to encourage the entry of many providers that would in turn stimulate innovation and result in improvements in students' educational achievement. The benefits of choice in a competitive market are realized, however, only if the purchasers (in SES, the parents of eligible students) have sufficient information to make rational choices (choose effective providers). States and districts have little leverage for disciplining the market (sanctioning or disqualifying ineffective providers) without information on provider performance.

Some school district accountability and evaluation units have attempted to measure program and provider effectiveness with administrative and student record data. They face important challenges, however, to properly evaluate student- and provider-level SES effects. Probably the most significant challenge is that participation in SES is voluntary among students eligible for SES. NCLB requires school districts to determine eligibility for SES using the same information used for making within-district Title I allocations (such as free school lunch eligibility), and then schools notify families of their children's eligibility and the availability of approved SES providers. If more students sign up than there are funds available to serve, districts establish additional eligibility criteria. However, some eligible students do not follow through in registering for and attending SES, and others stop attending before their total SES dollar allocation is expended. Therefore, selection into treatment (or who gets tutored in SES programs) and for how long is influenced by student and family characteristics, and to some extent, program administration. Rigorous econometric methods are required to adjust for this selection. Furthermore, any estimation of the effects of specific providers and provider attributes must not only adjust for student selection into SES, but also their selection into particular types of providers, as the composition of students served by any given provider is likely to vary. Thus, identifying provider-specific effects of SES on student achievement, while controlling for the effects of other classroom and school interventions, is enormously challenging for researchers, and even more so for school districts with limited resources.

We use the most recently available longitudinal data from Chicago Public Schools (CPS), from the 2007-08, 2008-09 and 2009-10 school years, to estimate provider-specific effects and to assess the robustness of alternative estimation techniques that require differing assumptions about student and provider selection. In particular, we address the following questions: Are there effects of attending SES on the achievement of eligible students in CPS, and can we identify provider attributes that are correlated with SES effectiveness? Are there specific providers that are more effective than others in delivering SES and increasing student achievement?

We employ four alternative approaches to estimate the effects of different type of SES providers on changes in student test scores, while controlling for student selection into

SES and into different provider types. We use gains in test scores as our outcome in school value-added, student fixed effects, school and student fixed effects, and propensity score matching models. We control for school and student time invariant characteristics using these four strategies. Each of these modeling approaches makes somewhat different assumptions about selection into SES, and the analytical samples differ to some extent as well. Thus, while we look for consistency in the results from their estimation, which would increase our confidence that the results are robust to alternative assumptions, we also expect some differences due to sample composition.

The specific attributes of SES providers that we examine are: district (A.I.M. High) vs. non-district providers, on-line provision, on-site vs. not on-site providers, and for-profit vs. not-for-profit (non-profit or public) provision. In addition, for SES providers serving at least 30 students in a given school year, we estimate their individual, provider-specific effects on changes in student test scores. SES providers serving fewer than 30 students are combined in a small-provider measure, so that we can also estimate the average effect of smaller SES providers relative to larger ones.

In general, we find that the CPS district provider (A.I.M. High) is more effective in increasing student achievement through SES than non-district providers and also other on-site providers. Students attending SES with on-line providers and for-profit providers gain less in reading and math as compared to other off-line and not-for-profit providers, respectively. We also identify a number of providers that consistently have positive and statistically significant effects on student achievement. Overall, while effect sizes are small (0.09 in math and 0.06 in reading) relative to other educational interventions, there is some limited evidence that the SES program contributes to improving student achievement.

We begin with a review of related literature in the next section followed by a brief description of the data and the four estimation approaches that we employ in the analysis of SES effects. We then present some descriptive statistics on the different types of SES providers serving CPS students and the characteristics of students who receive SES through them. We follow with a discussion of the results of the estimation of SES effects for different provider types and specific providers in CPS, and conclude with policy implications.

2 Background and Literature Review

Private companies have long been involved in the delivery of K-12 public educational services, from textbooks and instructional supports to testing and evaluation, tutoring, and more. More recently, the increasing participation of for-profit entities in direct services provision through vouchers for school choice, charter schools and mandatory out-of-school time interventions has drawn criticism of the prospects for "profiteering" in

public education, where for-profit firms are viewed as willing to compromise on quality and to short-change students to better their bottom line (Horn, 2011). The primary opposing view counters that private firms have considerable potential to cultivate critically-needed innovation in educational practice. In addition, they have the capability and incentives to rapidly expand successful practices and approaches, to attract the required financial and human capital, and to more cost-effectively deliver educational services.

In the context of this debate, Peterson (2003) recounts the compromise between Capitol Hill conservatives who supported vouchers as a key lever of accountability through choice, and liberal politicians who opposed the encroaching private sector role in K-12 public education that led to the creation of SES under NCLB. SES allowed for the "back door" entry of private providers-for-profit, non-profit, secular and religious into public schools that were failing to make adequate yearly progress, while preserving an important role for school districts in arranging access for students to SES and in contracting with private providers. School districts were, for the most part, prohibited from directly providing SES, on the premise that if they were not effective during the regular school day, they would be unlikely to do better after school. Private providers, alternatively, might benefit from the fact that SES is voluntary rather than compulsory, allowing them to potentially work with a more motivated group of students enrolling in an after school academic program. In addition, they are free to hire and fire teachers/tutors (unencumbered by the typical union rules), and have broad leeway in program structure, focus and curricular design.

Previous research on out-of-school-time programs reports mixed findings on the effectiveness of these programs in improving student outcomes (Halpern, 2003; Little, 2007). Many after school programs, particularly those with a greater focus on recreational than educational activities, have been shown to have minimal effects on students' academic progress (Hollister, Mathematica). SES, however, was designed to explicitly address students' educational needs, and the large literature on other after-school/tutoring programs confirms their potential to increase student achievement with sufficient hours of tutoring (Dynarski et al., 2004; Halpern, 2003; Lauer et al., 2006; Little, 2007; Vandell et al., 2005). To date, few studies have attempted to estimate the effects of specific SES (or other out-of-school time program) providers on student academic outcomes. Little is also known about what types or attributes of SES programs are effective, and what policies at state or local level can maximize the potential benefits of SES for eligible students.

Early studies of the effects of SES on student achievement were primarily descriptive and focused on the challenges of implementing the services in an evolving market (Burch et al., 2007), while more recent studies have sought to empirically estimate the effects of SES on student achievement. Chatterji, Kwon and Sng (2006) estimate the effects of SES in one New York school and found small positive effects. Evaluations conducted by Chicago Public Schools (CPS) in 2003-04, 2004-05, 2006-2007 and Jones (2009) reported

larger gains in reading and mathematics for students receiving at least 40 hours of tutoring and for students in grades 4-8 who were not English language learners and who received at least 30 hours of SES tutoring. And consistent with CPS findings, a study by the Los Angeles Unified School District (Rickles and Barnhart, 2007) found fairly small program effects, attributed primarily to improved performance by elementary students. Studies in Minneapolis (Heistad, 2007) and Milwaukee Public Schools (Heinrich, Meyer and Whitten, 2010), where average SES hours attended are particularly low, did not find statistically significant, positive effects of SES participation. Springer, Pepper and Ghosh (2009) caution, however, that very few studies rigorously adjust for student selection into SES, identifying only four studies besides their own that did (Zimmer, 2006 and 2007; Heistad, 2007 and Heinrich, Meyer and Whitten, 2010).

There are likewise few studies that rigorously examine the effects of specific SES providers on students' academic outcomes (Jones, 2009; Zimmer et al., 2007; CREP studies). This is especially problematic given that it was the explicit intent of NCLB to hold providers accountable by giving students and parents the necessary information on provider performance to exercise choice and realize the benefits of a competitive market for services.

Jones (2009) used multilevel modeling to explore SES provider effects on students who attended SES, controlling for student and school level characteristics. He reported moderate effects of attending SES and positive effects of several individual providers in Chicago. Studies by RAND (2007) and Socias et al. (2009) used a difference-in-differences strategy with value added models to estimate SES provider effects across multiple districts after the introduction of district providers in 2006-07. The RAND study found that participation in SES had positive effect on students' achievement in reading and math, with students participating for multiple years realizing larger gains. Although the RAND study did not estimate the effects of specific providers, they did estimate the effects of a district provider and reported mixed results. Socias et al. (2009) found that the district SES provider had no effect on student achievement in Anchorage and Hillsborough.

The Center for Research on Education Policy (CREP) conducted several, multi-year studies in Kentucky, Tennessee and Louisiana on provider-specific effects using a matched treatment-control strategy. Students attending SES were matched on observable characteristics to schoolmates who were eligible for SES but did not participate. They found mixed results for the overall effect of attending SES across different states. Specifically, Muoz et al. (2008) analyzed student-level achievement for those who attended SES in Kentucky and found no significant effects for any individual provider, or for all providers combined. Similarly, Ross et al. (2008) found three providers were significantly worse than the control group in math, but no effects for any providers in reading for 2007-08 school year in Tennessee. Finally, Potter et al. (2006) found most students in Louisiana

who were served by SES providers did no better or worse than their counterparts who were not served.

The gap in knowledge that we aim to fill is to identify not only effective providers but also their attributes and approaches in delivering SES that contribute to their success. This should help policy makers to better direct the resources that school districts are required to set aside for SES. And although we realize that these results are based primarily on a single school district and have limited generalizability, CPS has one of the largest numbers of students eligible for and receiving SES, accounting for 10% of all SES recipients in the nation's public schools in 2008-09 (Center on Innovation and Improvement report, U.S. Department of Education). It is also one of a small number of school districts that successfully petitioned the federal government to directly provide SES. We more fully explore the implications of direct service provision by districts in the discussion of our findings and the concluding section.

3 Data

We obtained administrative and school record data for all students eligible for SES in CPS for the school years 2007-08, 2008-09 to 2009-10. The longitudinal database includes student test scores, demographics, and information on their registration for and participation in the SES programs. These data allow us to construct measures of students' SES attendance with specific providers, including the number of hours of SES attended and total expenditures from provider invoices. The district also provided information on the SES providers, including whether they were on-line, off-site or on-site; district (A.I.M. High) or non-district; for-profit or not-for-profit, which allows us to explore the types of organizations and methods of service delivery that may contribute to improving student outcomes.

To construct the key outcome measures of student achievement gains (or changes) in student test scores we use data from standardized tests (Illinois Standardized Achievement Tests (ISAT)). For each grade and year, we construct z-scores using the district mean and standard deviation so that the test scores are comparable across grades and years. Table 1 shows the number of students who are eligible, registered and attended SES for the different grades and years in CPS. Table 1 also shows the percentage of students with missing scores. Since the ISAT is taken for grades 3-8 in Illinois, students in grade 3 cannot be included due to a lack of pre-test information for these students (grade 2 being not tested).[3] As seen in this table, in the 2009-10 school year, about 87,500 students were eligible but only about 23% registered to attend SES. Of those registered in 2009-10 school year, 90% attended SES for at least one hour. 6% of students who registered and attended

[3]Some of the students were retained in grade 3. That is the reason why we have some students in grade 3 in year 2008-09.

SES are missing (in grades 4 through 8) because they don't have test scores in the prior year. The loss of data for 2008-09 school year is lower at 4%.

Table 1: The number of students eligible and registered for SES and who attended SES, with and without gain scores for the 2008-09 and 2009-10 school years

Year 2009-10	All students			Students with gain scores			Students with missing scores		
	Eligible	Register	Attend	Eligible	Register	Attend	Eligible	Register	Attend
Grade	Freq.	Freq.	Freq.	Freq.	Freq.	Freq.	Freq.	Freq.	Freq.
3	16,739	8,030	7,652	N/A	N/A	N/A	N/A	N/A	N/A
4	14,380	3,052	2,839	13,142	2,876	2,684	9%	6%	5%
5	13,912	2,726	2,515	12,738	2,571	2,381	8%	6%	5%
6	14,182	2,687	2,448	13,078	2,536	2,314	8%	6%	5%
7	14,074	1,804	1,618	12,991	1,715	1,543	8%	5%	5%
8	14,255	1,737	1,532	13,178	1,626	1,435	8%	6%	6%
Total	87,542	20,036	18,604	65,127	11,324	10,357	8%	6%	5%
Year 2008-09	All students			Students with gain scores			Students with missing scores		
	Eligible	Register	Attend	Eligible	Register	Attend	Eligible	Register	Attend
Grade	Freq.	Freq.	Freq.	Freq.	Freq.	Freq.	Freq.	Freq.	Freq.
3	13,363	7,252	6,530	1497	870	757	N/A	N/A	N/A
4	11,823	5,849	5,279	11,336	5,605	5,070	4%	4%	4%
5	11,581	5,308	4,755	11,149	5,126	4,602	4%	3%	3%
6	13,088	5,567	4,921	12,629	5,379	4,753	4%	3%	3%
7	12,695	4,441	3,818	12,263	4,292	3,697	3%	3%	3%
8	12,698	4,350	3,742	12,297	4,219	3,635	3%	3%	3%
Total	75,248	32,767	29,045	61,171	25,491	22,514	4%	4%	3%

Table 2 shows the characteristics of students who are eligible and registered for SES and who attended SES for the two school years for which we estimate SES effects. Across the three panels and both school years, the distribution of characteristics for those who are eligible, those who register and those who attend look similar to the subset of those with gain scores. Therefore, the missing data (other than grade 3) is assumed to be random. In school year 2009-10, there were equal numbers of Hispanic and African Americans who were eligible, registered and attended SES. A larger percentage of special education (or students with disabilities, SWD) and English language learners (ELL) register to attend SES and an even larger percentage attend SES in 2009-10, which was not the case in 2008-09. Due to limits on funding, the district instituted a policy in 2009-10 to prioritize SWD and ELL students in SES registrations.

3.1 Types of SES providers and the students they serve

Table 3 shows the characteristics of CPS students who were served by SES providers in the 2008-09 and/or 2009-10 school years. We divide the providers into district (A.I.M. High) vs. non-district providers. The non-district providers are further divided depending on the method of service provision or if they were for-profit. A few of the notable

Table 2: Student characteristics of those who are eligible, registered and attend SES.

	School year 2009-10			School year 2008-09		
	All Eligible students	Eligible excl 3rd grade	Eligible with gain scores	All Eligible students	Eligible excl 3rd grade	Eligible with gain scores
# of students	87,542	70,803	65,414	88,353	61,885	61,172
% Af. American	49%	49%	48%	53%	53%	54%
% Hispanic	47%	47%	48%	44%	44%	44%
% Female	49%	49%	49%	49%	49%	49%
% ELL	12%	10%	10%	12%	11%	10%
% SWD	13%	14%	14%	14%	15%	14%
Attended SES last year	42%	42%	42%	26%	27%	28%
% Absent last year	4%	4%	4%	6%	5%	5%
Retained last year	2%	1%	1%	4%	2%	2%
Read Gain	-0.01	-0.01	-0.01	0.00	-0.01	0.00
Math Gain	-0.02	-0.02	-0.02	0.00	-0.01	0.00
	All Register students	Register excl 3rd grade	Register with gain scores	All Register students	Register excl 3rd grade	Register with gain scores
# of students	20,036	12,006	11,393	34,838	25,515	25,492
% Af. American	49%	49%	49%	59%	59%	61%
% Hispanic	46%	46%	47%	39%	39%	38%
% Female	47%	45%	45%	50%	50%	50%
% ELL	20%	18%	18%	14%	12%	11%
% SWD	22%	29%	29%	15%	16%	15%
Attended SES last year	58%	58%	58%	38%	39%	40%
% Absent last year	4%	4%	4%	5%	5%	5%
Retained last year	4%	1%	1%	4%	2%	1%
Read Gain	0.05	0.05	0.05	0.03	0.00	0.03
Math Gain	0.02	0.02	0.02	0.03	0.01	0.03
	All Attend students	Attend excl 3rd grade	Attend with gain scores	All Attend students	Attend excl 3rd grade	Attend with gain scores
# of students	18,604	10,952	10,424	30,306	22,515	22,515
% Af. American	48%	49%	49%	58%	58%	59%
% Hispanic	47%	47%	47%	40%	40%	39%
% Female	47%	45%	45%	50%	50%	50%
% ELL	20%	19%	18%	15%	13%	11%
% SWD	22%	30%	30%	15%	16%	15%
Attended SES last year	59%	60%	60%	39%	40%	41%
% Absent last year	4%	4%	4%	5%	5%	5%
Retained last year	4%	1%	1%	4%	2%	1%
Read Gain	0.06	0.06	0.06	0.03	0.01	0.03
Math Gain	0.03	0.03	0.03	0.04	0.01	0.03

differences across provider types (in both school years) include a higher proportion of ELL students served by the district provider (A.I.M. High), a lower proportion of ELL students served by on-line providers, and a substantially larger proportion of students with disabilities receiving services from off-site providers. In addition, in the 2009-10 school year, the district provider (A.I.M. High) served a significantly larger proportion of students with disabilities relative to 2008-09 and compared to non-district providers.

Students with disabilities were also significantly more likely to attend SES with on-line providers in 2009-10, but they were less likely to attend SES with for-profit providers in 2009-10. These differences in student characteristics across different service provider types were also confirmed in the first stage propensity score matching model (discussed below) that predicted SES attendance with different provider types. Tables 12 and 13 in Appendix A present information on the providers offering services to CPS students, including provider characteristics and the grades and types of students that they serve.[4]

Table 3: Characteristics of CPS students who were served by the different types of SES providers in the 2008-09 and 2009-10 school years.

Year 2009-10	District Provider	Non District Provider	On-line Providers	On-site Providers	Off-site Providers	For-profit Providers	Non-profit Providers
# of students	1,182	10,142	1,105	9,757	75	9,886	255
% Af. American	48%	50%	53%	50%	41%	50%	57%
% Hispanic	49%	46%	41%	46%	31%	46%	38%
% Female	44%	45%	43%	45%	37%	45%	39%
% ELL	20%	17%	14%	17%	17%	17%	14%
% SWD	34%	29%	38%	28%	47%	29%	37%
Attended SES last year	42%	44%	46%	44%	33%	44%	43%
% Absent last year	4%	4%	4%	4%	4%	4%	5%
Retained last year	1%	1%	0%	1%	0%	1%	2%
Year 2008-09	District Provider	Non District Provider	On-line Providers	On-site Providers	Off-site Providers	For-profit Providers	Non-profit Providers
# of students	4,037	21,455	4,166	19,377	91	20,770	626
% Af. American	53%	62%	70%	61%	66%	62%	63%
% Hispanic	46%	36%	28%	37%	34%	36%	36%
% Female	50%	50%	51%	50%	49%	50%	54%
% ELL	13%	11%	7%	11%	7%	11%	7%
% SWD	16%	15%	15%	15%	27%	15%	16%
Attended SES last year	41%	39%	40%	40%	42%	39%	38%
% Absent last year	5%	5%	5%	5%	5%	5%	5%
Retained last year	1%	1%	1%	2%	0%	1%	2%

4 Estimation Strategies

As discussed above, identifying provider-specific effects of SES on student achievement, while controlling for the effects of other classroom and school interventions is challenging. This is because the participation in SES is voluntary among the eligible students. We employ the following four strategies to address the potential for this self-selection bias.

[4]The information is on the total number of students served and is different from the grades we test which is limited to grades 4-8

4.1 Value Added Model

One way that studies deal with selection is using value-added models. The formal value-added model we employ is specified in Equation (1). The value-added strategy allows us to control for other classroom and school interventions which are fixed over time, while identifying provider characteristics. For example, if there is a reading intervention at a school and those students also attend SES, failing to control for the intervention (school fixed effect) would bias the results. The outcome measure is the achievement gain made by a given student, which accounts for the possibility that students with similar characteristics might enter SES with different underlying achievement trajectories (as reflected in their prior test scores). We estimate the following equation,

$$A_{jst} - A_{jst-1} = \alpha SES_{jt} + \beta X_{jt-1} + \pi_s + \mu_{gt} + \epsilon_{jst} \tag{1}$$

where A_{jst} is the achievement of student j attending school s in year t, SES_{jt} is an indicator function if the student j attended SES in year t, X_{jt-1} are student characteristics which include student demographics, percent absent in prior year, retained in prior year, and attended SES in prior year, π_s is school fixed effect, μ_{gt} are grade by year fixed effects, and ϵ_{jst} is the random error term. Identification in this specification comes from the average gain in student achievement after controlling for student characteristics and school and grade year effects.

4.2 Student Fixed Effects Model

The value-added model assumes that selection depends on observed student characteristics. Hence, controlling for them allows us to deal with self-selection. However, if selection is on some unobserved or unmeasured characteristics of the students, then a value-added strategy could still lead to biased results. The student fixed-effects model controls for all time-invariant characteristics of a student including those that are not observed or measured. The following model of a educational production differs from Equation (1) in that it includes student fixed effects (δ_j) instead of school fixed effects,

$$A_{jst} = \alpha SES_{jt} + \beta X_{jt-1} + \delta_j + \mu_{gt} + \epsilon_{jst}. \tag{2}$$

When we take the first difference of Equation (2), we eliminate the student fixed effect (δ_j), and the model estimates the average difference between the gains made by students attending SES with the gains made by similar students in CPS who were likewise eligible for SES. This formulation imposes some restrictions (or assumptions) that are important to note. First, the impact of students' prior experience does not deteriorate over time. This implies, for example, that the effect of the quality of kindergarten has the same impact on student achievement no matter the grade. The second assumption is that

the unobserved effect of attending SES only affects the level but not the rate of growth in student achievement. A concern with this restriction is that if students with lower growth are more likely to choose to attend SES, then this type of selection may bias the estimates obtained from a gains model. In order to relax this restriction, the following equation is estimated,

$$A_{jst} - A_{jst-1} = \alpha SES_{jt} + \beta X_{jt-1} + \delta_j + \mu_{gt} + \epsilon_{jst}. \quad (3)$$

This approach to estimating the fixed effects model controls for any unobserved differences between students that are constant across time. The estimation of this model requires a first difference of equation (3), and therefore needs three or more observations for each student.[5] As students self-select into the SES program, we deal with this selection by using the gain scores made by same student in the prior year. Identification of the impact of SES in this model comes from students who transfer from one SES provider to another over the period of observation. If these students differ in systematic ways from all students who attend SES, then the estimator gives a "local" effect (specific to students with these characteristics) instead of an average effect. Therefore, it is important that we check the robustness of the model results using alternative estimation strategies. Table 16 in Appendix D shows the differences in characteristics between the students who are used for identification and those who are not in this estimation approach.

4.3 School and Student Fixed Effects Model

The base model for this estimation strategy is the combination of the two above methods. A school fixed effect (π_s) is added to Equation (3), which gives,

$$A_{jst} - A_{jst-1} = \alpha SES_{jt} + \beta X_{jt-1} + \pi_s + \delta_j + \mu_{gt} + \epsilon_{jst}. \quad (4)$$

Adding a school fixed effect controls for unmeasured, time-invariant school quality. For example, in CPS, school administrators have a role in choosing the providers that deliver services on-site at their schools. If principals invite providers that they believe are best suited to their students and school environments, provider effects may be correlated with unobservable school characteristics that might affect student performance. The inclusion of school fixed effects facilitates controlling for time-invariant school characteristics such as average school test scores, neighborhood attributes, parental involvement in the school and peer composition, to the extent that these are unchanging over time. The inclusion of student fixed effects effectively controls for student ability and other time-invariant student characteristics. Identification of the impact of SES in this model

[5] As SES providers serve students at multiple grade levels, it is reasonable to pool information across grade levels.

still comes from students who transfer from one SES provider to another, whereas the identification of the school effect comes from students who switch schools. This model is preferred over the value added and the student fixed effects models as it controls for both school and student fixed effects.[6]

4.4 Propensity Score Matching Model

The identification in the fixed effects models comes from those students who switch providers or into or out of SES programs. If the students who switch are different in some time variant unobserved characteristic, then the results from this strategy would be biased. However, matching allows us to get identification from all students (instead of only the switchers) at the expense of using only students who attended SES. Therefore, here we estimate the differential effects of different types of providers. We use a common application of matching called propensity score matching (PSM). PSM is a two-step process in which the probability of participation in SES (or the probability of participation with a particular type of provider) is first estimated based on student characteristics (X), generating predicted probabilities of participation (propensity scores). The matching process is thus reduced to a one-dimensional problem of comparing students who receive SES (or receive it with a particular type of provider) with students with similar propensity scores who do not participate (or participate with other types of providers), rather than requiring matches on all of the student characteristics. In other words, if SES participants and comparison group members have the same propensity scores, the distribution of X across these groups will be the same:

$$Y_0 \perp D|X \implies Y_0 \perp D|P(X), \tag{5}$$

and students can be compared on the basis of their propensity scores alone, where D is the treatment of attending SES.

In applying matching methods, we invoke the conditional independence assumption, which implies that after controlling for observable characteristics (X), a student's treatment status is unrelated to what his outcome would be in the absence of treatment (Rosenbaum and Rubin, 1983). The validity of this assumption depends largely on the set of variables or student characteristics (X) available for the estimation. We expect that there may be some unmeasured factors that influence participation in SES (or participation with particular types of providers); what is important is that participation not be predictive of the outcome that would have occurred without the program (or with a particular provider type). In addition, because our outcome variables are defined as the difference between a pre-program and post-program measure, we use a panel

[6]We also check the results by restricting the analysis to those students who do not change schools and run the student fixed effects estimation using Equation (3), and obtain similar results.

form of the matching estimator (difference-in-difference matching) that allows for time-invariant, unobserved differences between SES participants and comparison students without biasing estimates of program impacts. In estimating this model, we make the assumption that conditional independence holds for the periods both before (t) and after (t_1) treatment:

$$E(Y_{0t_1} - Y_{0t}|D_1 = 1, X) = E(Y_{0t_1} - Y_{0t}|D_1 = 0, X) \quad (6)$$

This model estimates the average difference between the gains made by students attending SES with the gains made by "matched" students in CPS who were likewise eligible for SES, without putting a functional form on the gain equation (3), as in the case of student fixed effects. The primary PSM matching technique we apply in the second stage model is radius matching, which specifies a "caliper" or maximum propensity score distance (0.01 in our analysis) by which a match can be made. It uses not only the nearest neighbor within each caliper, but all comparison cases within the caliper (based on the specified distance), and the common support condition is imposed to exclude poor matches from the analysis. It is important to reiterate that the sample used in this analysis only includes students who attended SES; thus, the estimates produced are relative comparisons between providers (or types of providers) that show their differential effects on student achievement (see Table 11).

5 Results

We start by presenting the overall effects of attending SES for those students who were eligible using the estimation strategies described above. We then focus on estimates of the effects of different types of providers and specific providers in the next subsection.

5.1 Overall Effects of Attending SES

Table 4 and 5 show the average effect of attending SES (using a dummy variable) and the number of hours of SES attended, respectively. Irrespective of the variable or estimation strategy used, we find positive and significant results of attending SES on math and reading achievement gains for CPS students. The effect size is comparable using the student fixed effects or school and student fixed effects strategies in reading and math as seen in Table 4. The effect for reading is approximately 0.09 standard deviations, and for math, the effect is about 0.06. In comparison with average annual reading and math gains for elementary and middle school students (as reviewed by Hill et al., 2008), these effects are about one-third the effect size of other interventions.[7]

[7]Hill et al., 2008 find average annual reading gain for 5-6 graders of about 0.32 standard deviations. They therefore argue for interpreting a study's effect size estimate in the context of the natural growth rate for the

Table 4: The average effect of attending SES using the different estimation strategies

Reading								
	School Value Added Model				Student Fixed		School and Student	
	Year 2009-2010		Year 2008-09		Effects Model		Fixed Effects Model	
	Coeff	SE	Coeff	SE	Coeff	SE	Coeff	SE
Attend SES	0.094***	0.009	0.043***	0.006	0.085***	0.024	0.087***	0.024
# of Obs	63,506		61,171		124,677		124,677	
# of Schools	454		227		458		458	
# of Students	63,506		61,171		83,945		83,945	
Math								
	School Value Added Model				Student Fixed		School and Student	
	Year 2009-2010		Year 2008-09		Effects Model		Fixed Effects Model	
	Coeff	SE	Coeff	SE	Coeff	SE	Coeff	SE
Attend SES	0.053***	0.008	0.046***	0.005	0.054**	0.021	0.055**	0.021
# of Obs	63,773		61,464		124,059		124,059	
# of Schools	455		227		458		458	
# of Students	63,773		61,464		83,579		83,579	

**** - statistically significant at 1%, ** - statistically significant at 5%*

Table 5 reports the results for the effects of the number of hours of SES received on student achievement in math and reading. We find that there is a positive and statistically significant effect of an additional hour of SES on student achievement. The average number of hours received by those students who attend is around 40 hours. Appendix B shows histograms of the number of hours of SES received by students who attended SES in years 2008-09 and 2009-10. The results obtained using treatment defined as the number of hours of SES received are consistent with the results obtained from Table 4 for the average number of hours received (approximately 40 hours). In general, we find consistent results with prior studies and literature, (Lauer et al., 2006) where the effect sizes of tutoring were larger for programs that were 45 or more hours in duration.

Appendix C shows the analysis of the estimated effects of SES as measured by changes in students' math and reading scores by the different levels of SES hours attended for only those students who attended SES (using propensity score matching).

5.2 Heterogeneous Effects of SES Providers

Across the range of providers that come and go from the SES market and offer services to CPS students, we are interested in understanding if there are characteristics of providers or particular providers that are more effective than others. We begin with a discussion of results that compare the district provider (A.I.M. High) in CPS with other (non-district) SES providers. Under federal regulations, school districts that have been identified for

specific target of students as the gains are largest in elementary grades and then steadily decline into high school years.

Table 5: The average effects of the number of hours of SES received on student achievement in math and reading

Reading								
	School Value Added Model				Student Fixed Effects Model		School and Student Fixed Effects Model	
	Year 2009-2010		Year 2008-09					
	Coeff	SE	Coeff	SE	Coeff	SE	Coeff	SE
Attend SES	0.0026***	0.0002	0.0011***	0.00013	0.0022***	0.0005	0.0022***	0.0005
# of Obs	63,506		61,171		124,677		124,677	
# of Schools	454		227		458		458	
# of Students	63,506		61,171		83,945		83,945	
Math								
	School Value Added Model				Student Fixed Effects Model		School and Student Fixed Effects Model	
	Year 2009-2010		Year 2008-09					
	Coeff	SE	Coeff	SE	Coeff	SE	Coeff	SE
Attend SES	0.0013***	0.0002	0.0013***	0.0001	0.0018***	0.0005	0.0018***	0.0005
Num of Obs	63,773		61,464		124,059		124,059	
Num of Schools	455		227		458		458	
Number of Students	63,773		61,464		83,579		83,579	

**** - statistically significant at 1%, ** - statistically significant at 5%*

improvement are not eligible to be SES providers. However, the U.S. Department of Education granted waivers to some districts to allow them to provide SES, including CPS. In addition, coming policy changes may allow an increasing number of school districts to engage in direct provision of SES.

From our analysis of information from interviews with school district officials and data on SES provider rates across five, large urban districts, we surmise that the CPS role as a district provider (A.I.M. High) has influenced the rate-setting of other (non-district) providers in the Chicago area. CPS charged approximately $28 per hour in 2009-10, which was nearly $20 per hour lower than the average non-district provider. We also observed the same non-district providers operating in other districts charging as much as twice the rate they charged for an hour of their services in Chicago. Because the hourly rate charged directly affects the number of hours of SES students can receive before reaching the district maximum per-student allocation, this leads to CPS students attending more hours of SES (compared to students) in other districts. Thus, in this context, it is possible that having a district provider contributes to higher hours of SES tutoring received, and correspondingly, to the success of the program.

The analysis includes both SES-eligible students who attended and those who did not attend SES in the sample. Therefore, the estimated effects are for district (A.I.M. High) and other (non-district) providers relative to outcomes for eligible students who did not receive SES. The results of this analysis are presented in Table 6. Alternatively, when we restrict our sample to include only those students who attended SES with a provider, in which case our estimated effects are differential effects between the district and other

providers. Those results are presented in Table 11. The value-added (with school fixed effects), student fixed effects and school with student fixed effects, as well as propensity score matching results, all show statistically significant effects of the district-provided services on students' math and reading achievement relative to students who do not receive SES (or who received SES with non-district providers).

Table 6: Results comparing the effects of attending a district provider (A.I.M. High) with a non-district provider of SES

Reading								
	School Value Added Model				Student Fixed		School and Student	
	Year 2009-2010		Year 2008-09		Effects Model		Fixed Effects Model	
	Coeff	SE	Coeff	SE	Coeff	SE	Coeff	SE
District	0.128***	0.019	0.045***	0.013	0.113***	0.039	0.107***	0.040
Non-district	0.088***	0.009	0.042***	0.006	0.078***	0.025	0.080***	0.025
# of Obs	63,506		61,171		124,677		124,677	
# of Schools	454		227		458		458	
# of Students	63,506		61,171		83,945		83,945	
Math								
	School Value Added Model				Student Fixed		School and Student	
	Year 2009-2010		Year 2008-09		Effects Model		Fixed Effects Model	
	Coeff	SE	Coeff	SE	Coeff	SE	Coeff	SE
District	0.065***	0.020	0.067***	0.011	0.114***	0.039	0.104***	0.039
Non-district	0.047***	0.008	0.037***	0.005	0.037**	0.020	0.039**	0.021
Num of Obs	63,773		61,464		124,059		124,059	
Num of Schools	455		227		458		458	
Number of Students	63,773		61,464		83,579		83,579	

**** - statistically significant at 1%, ** - statistically significant at 5%*

Table 6 presents the results of attending a district (A.I.M. High) vs. a non-district provider, including all SES eligible students who registered for services in the 2008-09 or 2009-10 school years, and with students from all grades combined. The coefficients are the changes (measured in standard deviations from district average reading and math test scores) in an average student's outcome that can be expected if the student participates in SES. The results from Table 6 show that attending SES with a district provider (A.I.M. High) has a larger effect on student achievement in both math and reading than attending with a non-district provider. There is a fairly strong agreement between the three models and as well as with the results from the PSM in Table 11. These effect sizes are large and represent about one-third the annual gain scores by students.[8]

Tables 7 and 8 show the effect sizes for the district provider (A.I.M. High) and other providers who have at least 30 students attending SES with them; smaller providers (serving less than 30 students) are grouped into a single "small provider" indicator.[9]

[8]Hill et al., 2008 show that for elementary and middle school students the average annual gain is about 0.32 standard deviation.

[9]Tables 12 and 13 in Appendix A show the average characteristics of the students who attend SES with each

There is fairly strong agreement between the value-added and both types of fixed-effect models results, with a handful of providers standing out as particularly effective in both sets of results and/or in both 2008-09 and 2009-10. Those providers are the district provider (A.I.M. High), Newton Learning, Orion's Mind, School Service Systems and SES of Illinois for reading, and Children's Home+ Aid has significant and positive effects in math. One-to-One Learning Center has particularly large effect sizes for both math and reading in 2008-09, but this provider was not offering services in the 2009-10 school year and is therefore not in the student fixed effects analysis. The provider-specific effect sizes from the school and student effects models are very close to those of the student fixed effects models (with the exception that the provider ASPIRA, which also had positive, statistically significant effects on student achievement).

In Appendix C, we report an average effect size (across all providers) of approximately 0.06, which was statistically significant for providers delivering 40 or more hours of tutoring to students. We should note that the district provider (A.I.M. High) was getting significantly more hours of SES to the students it served (an average of 48 hours, and nearly twice as many as other providers). Thus, it is not surprising that the effect size of the district provider (A.I.M. High) is approximately twice the size of the average for all providers. To test this hypothesis, we interacted the district indicator with the number of hours of SES the students received, and the difference between district and non-district provider disappeared. The effect sizes for Newton Learning, School Service Systems and SES of Illinois are similarly large. We should note that these providers have different hourly rates, and thus students would likely reach their maximum number of hours of SES attended at different levels with these different providers. That said, the hourly rate and number of hours is the part of the treatment (as defined or designed by a given provider), and therefore, we do not include number of hours attended as a covariate.

An important goal of this paper is to identify the types of providers that are successful in improving student outcomes. Table 9 reports average effects of the district and other provider types on CPS students' reading and math achievement in 2008-09 and 2009-10, estimated using value-added, student fixed effects, and school and student fixed effects models. Table 11 shows the differential effects of different types of providers for those students who attended SES using the three above mentioned estimation techniques and propensity score matching (respectively). The results are fairly consistent across specifications, suggesting that on average, students attending SES with the district provider (A.I.M. High) generally outperformed other on-site providers, by approximately 0.03-0.05 standard deviations (larger gains) on reading tests, and approximately

of the providers in CPS.

Table 7: Effect of attending SES with the district provider (A.I.M. High) and other providers who have at least 30 students on reading gain scores

Reading gain	School Value Added Model				Student Fixed Effects Model		School and Student Fixed Effects Model	
	Year 2009-2010		Year 2008-09					
	Coeff	SE	Coeff	SE	Coeff	SE	Coeff	SE
District (A.I.M. High)	0.129***	0.019	0.045***	0.013	0.112***	0.040	0.106***	0.040
Small Providers	0.174***	0.048	0.033	0.038	0.135	0.121	0.142	0.124
A+ Tutoring Service, LTD			0.095**	0.044	0.160	0.140	0.159	0.142
ASPIRA			0.009	0.006	-0.066	0.073	-0.059	0.070
Babbage Net School	0.081	0.082	0.043	0.034	0.087	0.098	0.089	0.098
Black Star Project, The	0.051	0.122	0.089	0.069	0.111	0.170	0.119	0.170
Brain Hurricane	0.040*	0.022	0.080***	0.024	0.120	0.079	0.122	0.079
Brainfuse One-to-One	0.044	0.060	-0.005	0.031	-0.037	0.123	-0.027	0.125
Brilliance Academy			0.061	0.047	0.162	0.113	0.168	0.110
Cambridge Educational	0.094**	0.041	0.050*	0.028	0.029	0.102	0.022	0.102
Chess Academy	-0.030	0.026	0.034	0.029	0.059	0.078	0.067	0.081
Children's Home + Aid	0.044	0.099	0.007	0.020	-0.086	0.120	-0.078	0.127
ClubZ! Tutoring Service	0.126	0.083	0.048	0.047	0.162	0.112	0.159	0.115
CSC Julex Learning			0.051	0.051	0.153	0.205	0.129	0.188
Educate Online	0.194***	0.049	0.022	0.016	0.072	0.052	0.067	0.054
Failure Free Reading			-0.029	0.062	0.248	0.242	0.225	0.238
Huntington (ONSITE)	0.035	0.047	0.049**	0.020	0.015	0.082	0.014	0.083
IEP (ONSITE)	0.013	0.059	0.102***	0.037	0.081	0.150	0.090	0.148
Literacy for All	0.082**	0.038	-0.004	0.033	0.085	0.097	0.092	0.097
Mainstream Development	0.033	0.069	0.057	0.059	0.076	0.145	0.082	0.147
NESI			0.000	0.063	0.105	0.114	0.084	0.096
Newton Learning	0.115***	0.019	0.053***	0.013	0.122***	0.041	0.116***	0.040
One to One			0.164***	0.068				
Orion's Mind	0.069***	0.015	0.044***	0.011	0.080**	0.038	0.081**	0.039
Platform Learning			-0.012	0.024	-0.045	0.083	-0.032	0.084
Poder Ser (ONSITE)	0.113	0.088	0.093***	0.035	0.145	0.123	0.144	0.119
Princeton Review			0.038**	0.017	0.008	0.077	0.015	0.077
Progressive Learning	0.082***	0.030	0.045**	0.018	0.023	0.048	0.024	0.048
Rocket Learning Partners	0.058*	0.033	0.025	0.029	0.032	0.079	0.036	0.081
School Service Systems	0.130***	0.032	0.059***	0.018	0.160**	0.073	0.170**	0.076
SES of Illinois	0.128***	0.019	0.044*	0.025	0.131***	0.058	0.138***	0.057
Tutorial Services			0.036	0.042	0.051	0.184	0.049	0.187
Unparalleled Solutions	0.102***	0.037	0.065	0.045	0.114	0.134	0.119	0.138
# of Obs	63,506		61,171		124,677		124,677	
# of Schools	454		227		458		458	
# of Students	63,506		61,171		83,945		83,945	

*** - *statistically significant at 1%*, ** - *statistically significant at 5%*, * - *statistically significant at 10%*

0.02-0.06 standard deviations on math tests.[10]

The results also suggest that on-line providers are generally less effective than other providers. The difference in the coefficients of on-line vs. on-site are statistically significant at 5% significance level. The sample size for off-site providers is pretty small (75 in

[10]In each of the estimations reported, the standard errors of the coefficients are largest for the school and student fixed effects models.

Table 8: Effects for attending SES with the district provider (A.I.M. High) and other providers who have at least 30 students on math gain scores

Math gain	School Value Added Model				Student Fixed Effects Model		School and Student Fixed Effects Model	
	Year 2009-2010		Year 2008-09					
	Coeff	SE	Coeff	SE	Coeff	SE	Coeff	SE
District (A.I.M. High)	0.066***	0.020	0.065***	0.011	0.114***	0.039	0.104***	0.039
Small Providers	0.000	0.044	0.032	0.036	0.015	0.089	0.027	0.092
A+ Tutoring Service, LTD			0.021	0.058	-0.015	0.238	-0.015	0.240
ASPIRA			0.022	0.097	0.052	0.033	0.064*	0.034
Babbage Net School	-0.032	0.025	0.063**	0.028	0.017	0.103	0.035	0.098
Black Star Project, The	0.128	0.111	0.049	0.054	0.015	0.116	0.023	0.120
Brain Hurricane	0.061*	0.033	0.071***	0.025	0.094	0.073	0.076	0.080
Brainfuse One-to-One	-0.032	0.071	-0.022	0.022	-0.078	0.083	-0.084	0.086
Brilliance Academy			0.000	0.058	-0.160	0.152	-0.145	0.158
Cambridge Educational	0.051	0.035	0.090***	0.031	0.079	0.089	0.063	0.087
Chess Academy	0.065***	0.025	0.066*	0.039	0.104	0.101	0.111	0.101
Children's Home + Aid	0.086**	0.037	0.173***	0.021	0.134**	0.067	0.158**	0.065
ClubZ! Tutoring Service Inc.	0.047	0.071	-0.017	0.039	-0.031	0.155	-0.045	0.153
CSC Julex Learning			-0.029	0.060	-0.114	0.169	-0.107	0.169
Educate Online)	0.041	0.044	0.022	0.013	-0.003	0.049	-0.008	0.050
Failure Free Reading			0.027	0.044	0.065	0.226	0.044	0.223
Huntington - ONSITE	0.037	0.036	0.016	0.016	0.011	0.051	0.013	0.052
IEP (ONSITE)	0.020	0.038	0.037	0.049	0.019	0.128	0.042	0.130
Literacy for All	0.092***	0.031	-0.003	0.035	0.013	0.111	0.018	0.111
Mainstream Development	0.033	0.044	-0.012	0.040	-0.024	0.104	-0.010	0.104
NESI			0.071*	0.038	0.057	0.223	0.028	0.215
Newton Learning	0.031*	0.017	0.061***	0.016	0.061	0.046	0.056	0.046
One to One			0.157*	0.083				
Orion's Mind	0.037***	0.013	0.050***	0.010	0.049	0.033	0.052	0.033
Platform Learning			-0.018	0.031	-0.006	0.087	0.005	0.088
Poder Ser (ONSITE)	-0.010	0.034	0.007	0.072	0.002	0.031	-0.002	0.040
Princeton Review			0.050***	0.017	0.083	0.075	0.092	0.075
Progressive Learning	0.046*	0.023	0.008	0.017	-0.005	0.049	0.004	0.049
Rocket Learning Partners	-0.013	0.034	0.005	0.024	-0.087	0.054	-0.082	0.055
School Service Systems	0.106***	0.022	0.012	0.023	0.063	0.058	0.065	0.060
SES of Illinois	0.086***	0.023	0.046*	0.026	0.086	0.062	0.091	0.063
Tutorial Services			-0.005	0.047	-0.064	0.138	-0.056	0.141
Unparalleled Solutions	0.026	0.041	0.072**	0.032	0.043	0.091	0.051	0.090
Num of Obs	63,773		61,464		124,059		124,059	
Num of Schools	455		227		458		458	
Number of Students	63,773		61,464		83,579		83,579	

*** - *statistically significant at 1%, ** - statistically significant at 5%, * - statistically significant at 10%*

2008-09 and 91 in 2009-10), and they serve a larger percentage of SWD students. Thus, their effects should be interpreted with caution.

The results in Table 10 show effect sizes of attending SES with for-profit providers versus other providers (non-profit or district). The information in Table 3 shows that only about 2.5% of students attended SES with a non-profit provider (another 10-16% attended with the district provider); clearly, the largest share of students attend SES with

Table 9: Effect of attending SES with the district provider (A.I.M. High) and on-line, on-site and off-site providers

Reading								
	School Value Added Model				Student Fixed		School and Student	
	Year 2009-2010		Year 2008-09		Effects Model		Fixed Effects Model	
	Coeff	SE	Coeff	SE	Coeff	SE	Coeff	SE
District Provider	0.128***	0.019	0.044***	0.013	0.108***	0.040	0.102***	0.040
On-line Provider	0.033	0.024	0.007	0.011	-0.006	0.033	-0.007	0.034
Onsite Provider	0.081***	0.009	0.042***	0.006	0.071***	0.025	0.074***	0.025
Offsite Provider	0.350***	0.077	0.082	0.073	0.427*	0.228	0.436*	0.236
# of Obs	63,506		61,171		124,677		124,677	
# of Schools	454		227		458		458	
# of Students	63,506		61,171		83,945		83,945	
Math								
	School Value Added Model				Student Fixed		School and Student	
	Year 2009-2010		Year 2008-09		Effects Model		Fixed Effects Model	
	Coeff	SE	Coeff	SE	Coeff	SE	Coeff	SE
District Provider	0.065***	0.020	0.064***	0.011	0.112***	0.039	0.102***	0.039
On-line Provider	-0.001	0.018	-0.010	0.010	-0.036	0.034	-0.034	0.035
Onsite Provider	0.049***	0.008	0.038***	0.005	0.043**	0.021	0.045**	0.021
Offsite Provider	-0.064	0.053	-0.001	0.059	0.032	0.170	0.051	0.179
Num of Obs	63,773		61,464		124,059		124,059	
Num of Schools	455		227		458		458	
Number of Students	63,773		61,464		83,579		83,579	

**** - statistically significant at 1%, ** - statistically significant at 5%, * - statistically significant at 10%*

for-profit providers. In light of this, it is regrettable that the results suggest that for-profit providers are generally less effective than district/public providers in increasing student achievement, particularly for math. Students attending with for-profit providers gain about 0.03 standard deviations less than the district providers in reading and about 0.07 standard deviations less in math.

Finally, the results in Table 11 show the differential effects between the district and other providers, as well as the effects of other provider types, from the analysis that only includes students who attended SES. As the analysis is done for only those students who attend SES, a smaller sample size leads to larger standard errors in the fixed effects strategies, leading to insignificant results. However, PSM allows the identification of effects to come from all students attending SES (not only "switchers"), an advantage over these other strategies. The differential impacts can also be calculated from the previous tables, and the results are consistent across these different estimation strategies.

The first four rows of results in Table 11 present the average differential effect between the district provider (A.I.M. High) and other SES providers serving CPS students in 2008-09 and 2009-10, estimated using value-added models, student fixed effects models, school and student fixed effects models, and propensity score matching (respectively). The results are fairly consistent across specifications, suggesting that on average,

Table 10: Effect of attending SES with the district provider (A.I.M. High), for-profit and not-for-profit providers

Reading								
	School Value Added Model				Student Fixed Effects Model		School and Student Fixed Effects Model	
	Year 2009-2010		Year 2008-09					
	Coeff	SE	Coeff	SE	Coeff	SE	Coeff	SE
District provider	0.129***	0.019	0.045***	0.013	0.114***	0.039	0.108***	0.040
For profit provider	0.089***	0.009	0.042***	0.006	0.080***	0.025	0.081***	0.025
Not for profit provider	0.099	0.061	0.054**	0.025	0.056	0.090	0.070	0.091
# of Obs	63,506		61,171		124,677		124,677	
# of Schools	454		227		458		458	
# of Students	63,506		61,171		83,945		83,945	
Math								
	School Value Added Model				Student Fixed Effects Model		School and Student Fixed Effects Model	
	Year 2009-2010		Year 2008-09					
	Coeff	SE	Coeff	SE	Coeff	SE	Coeff	SE
District provider	0.065***	0.020	0.067***	0.011	0.115***	0.039	0.105***	0.039
For profit provider	0.048***	0.008	0.037***	0.005	0.039*	0.021	0.041*	0.021
Not for profit provider	0.036	0.036	0.063**	0.031	0.020	0.061	0.034	0.062
Num of Obs	63,773		61,464		124,059		124,059	
Num of Schools	455		227		458		458	
Number of Students	63,773		61,464		83,579		83,579	

**** - statistically significant at 1%, ** - statistically significant at 5%, * - statistically significant at 10%*

students attending SES with the district provider gain approximately 0.03-0.06 standard deviations more on reading tests and approximately 0.04-0.06 standard deviations more on math tests than students attending with non-district providers.

We also restricted the sample to only students who attended SES with an on-site provider, either the district or another on-site SES provider, to determine if the district provider performance differed from that of other on-site providers. These findings (in the fifth to eighth rows of results in Table 11) suggest that the district provider generally outperformed other on-site providers, particularly in math, with students who attended SES on-site with the district provider realizing larger gains of 0.03-0.04 standard deviations more than other on-site providers; only one estimate is statistically significant for reading test scores (for the PSM model, with a differential effect of 0.059).

The next analysis of provider attributes compares providers that deliver SES instruction on-line with other (off-line) providers. The results suggest that on-line providers are generally less effective than other providers, although the coefficients (differential effect sizes) are statistically significant only for the 2008-09 school year and in two of the specifications. The estimated (negative) differential effects for 2008-09 are highly comparable between the value-added and PSM models, suggesting students attending with on-line providers gain approximately 0.03 less in reading and 0.04 less in math than students attending SES with other providers.

Table 11: Summary of differences in SES effects by provider types (for students who attended SES)

	Reading				Math			
	Year 2009-2010		Year 2008-09		Year 2009-2010		Year 2008-09	
	Coeff	SE	Coeff	SE	Coeff	SE	Coeff	SE
District vs. Non-district								
Value Added	0.027	0.030	0.020	0.018	-0.003	0.027	0.039**	0.017
Student Fixed Effects	Results are		0.038	0.171	Results are		0.065	0.153
School and Student Fixed effects	for both years		0.009	0.182	for both years		0.064	0.159
Propensity score matching	0.065***	0.020	0.029***	0.012	0.049***	0.018	0.041***	0.011
District vs. other onsite providers								
Value Added	0.032	0.032	0.016	0.019	-0.014	0.026	0.040**	0.018
Student Fixed Effects	Results are		0.046	0.179	Results are		0.066	0.168
School and Student Fixed effects	for both years		0.017	0.194	for both years		0.066	0.175
Propensity score matching	0.059***	0.019	0.016	0.011	0.043**	0.017	0.033***	0.010
On-line vs. Not-on-line								
Value Added	0.025	0.029	-0.028**	0.013	-0.005	0.002	-0.042***	0.012
Student Fixed Effects	Results are		-0.099	0.134	Results are		-0.047	0.129
School and Student Fixed effects	for both years		-0.088	0.143	for both years		-0.048	0.139
Propensity score matching	-0.009	0.022	-0.027***	0.011	-0.024	0.019	-0.038***	0.010
For-profit vs Not-for-profit								
Value Added	-0.028	0.032	-0.022	0.015	0.016	0.022	-0.041**	0.016
Student Fixed Effects	Results are		-0.034	0.166	Results are		-0.058	0.138
School and Student Fixed effects	for both years		0.032	0.505	for both years		0.001	0.297
Propensity score matching	-0.067***	0.020	-0.009	0.011	-0.055***	0.017	-0.024**	0.011

**** - statistically significant at 1%, ** - statistically significant at 5%, * - statistically significant at 10%*

The final set of results in Table 11 compares effect sizes of attending SES with for-profit providers versus other providers (non-profit or public). As stated before only about 2.5% of students attended SES with a non-profit provider (another 10-16% attended with the district provider (A.I.M. High)); clearly, the largest share of students attend with for-profit providers. In light of this, it is unfortunate that the results suggest that for-profit providers are generally less effective than non-profit and district/public providers in increasing student achievement, particularly for math.

6 Conclusion

Supplemental educational services are a core provision of NCLB. The law mandates the district to pay for the cost of provision of after-school tutoring for low income and disadvantaged students that attend schools that fail to make "adequate yearly progress" for two or more years. A key feature of the SES mandate is its reliance on the private sector to offer eligible students greater choice in a competitive market that is expected to encourage innovative service approaches and squeeze out ineffective providers. Identifying

provider effects on student achievement is essential to generating the information necessary for students and parents to make informed choices of SES providers, but efforts to estimate provider effects are complicated by the fact that participation is voluntary. Therefore, in this paper, we draw on non-experimental methods to estimate the effects of SES providers on student achievement in a large urban school district (Chicago Public Schools), which accounts for a significant share of students receiving SES under NCLB.

The findings of our empirical analyses of the effects of SES providers who served eligible CPS students in the 2008-09 and 2009-10 school years suggest that there is a statistically significant effect of attending SES on student achievement, particularly for those who receive at least 40 hours of tutoring. These effect sizes represent about one-third of the annual gains made by students in these schools. If these effects persisted and cumulated over at least 3 years, it is possible that the average student attending SES could improve one grade level, helping to close the achievement gap for disadvantaged students.

Additionally, we find that the district provider is more effective than non-district and other on-site SES providers in increasing the math and reading test scores of students who attend SES. Students attending SES with on-line providers, however, gain less in reading and math than students attending SES with other providers. Students attending SES with for-profit providers gain less than those attending with non-profit providers or the district provider, particularly in math. We also identified individual SES providers that were significantly more effective in producing math and reading gains for CPS students, including the district provider (A.I.M. High), ASPIRA, Newton Learning, One-to-One Learning Center, Orion's Mind, School Service Systems and SES of Illinois.

Given that unmeasured differences in students who attend SES or attend with particular types of providers could still introduce bias in these results, we are encouraged by the fact that the findings are fairly consistent across the four different rigorous estimation methods that make different assumptions. We are also encouraged that the findings on provider-specific effects are consistent with the most recent CPS evaluation of SES as well (Jones, 2009), which identified many of the same providers as being among the most effective in CPS. Finally, we believe that our research has identified some basic characteristics of successful approaches to the organization and management of SES programs (district, on-site and non-profit providers) that might be more widely adopted among other school districts required to offer SES.

By design, if NCLB is to achieve its broader goal of reducing the academic achievement gap through after-school tutoring for students in under-performing schools, SES program administrators must provide adequate information on provider effectiveness to guide students' and parents' choices. We developed readily adaptable estimation strategies that can be used by school districts to generate information on provider effectiveness for students and parents that will help them to make better informed choices. We also

show that SES has potential to be an effective intervention in reducing student achievement gaps if students get sufficient hours of SES.

However, the different levels of program administration - primarily district and state - could improve on the coordination, oversight and monitoring of the performance of the primarily non-district SES providers to realize the full potential of the competitive market in improving student outcomes. For example, states and districts might introduce performance-based contracts to exert more control over provider rates, minimum levels of SES delivered and other parameters of service delivery that research suggests should contribute to improved outcomes. In this regard, we expect this study to more broadly speak to the viability of education and other policy interventions that employ a private market model to improve public sector outcomes.

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Appendix A

Table 12: Summary Statistics of SES Providers in CPS in School Year 2008-09

Provider Name 0809	Total Number	Grade K-5	Grade 6-8	% of ELL students	% of Sp. Ed students	On-line provider	On-site provider	Offsite provider	For profit provider	Number schools
Orion's Mind	4177	47%	53%	15%	14%	0	1	0	1	126
A.I.M. High	3069	47%	53%	14%	16%	0	0	0	0	91
Newton Learning	2382	47%	53%	15%	16%	0	1	0	1	70
Princeton Review	1833	44%	56%	14%	15%	0	1	0	1	77
Progressive Learning	1648	46%	54%	8%	15%	1	1	0	1	89
SES of Illinois	1103	46%	54%	5%	14%	0	1	0	1	22
School Service Systems	1036	39%	61%	1%	13%	0	1	0	1	17
Educate Online (formerly Catapult)	999	41%	59%	3%	15%	1	0	0	1	169
Huntington - ONSITE	888	51%	49%	17%	18%	0	1	0	1	51
Rocket Learning Partners, LLC (ONSITE)	720	48%	53%	2%	15%	0	1	0	1	28
Cambridge Educational Services	544	45%	55%	10%	16%	0	1	0	1	26
Brain Hurricane	520	58%	43%	10%	16%	0	1	0	1	22
Platform Learning	431	51%	49%	15%	18%	0	1	0	1	21
Unparalleled Solutions	379	46%	54%	2%	14%	0	1	0	1	19
Brainfuse One-to-One	346	36%	64%	11%	16%	1	1	0	1	23
Chess Academy	297	53%	47%	18%	19%	0	1	0	1	12
Babbage Net School	282	34%	66%	12%	11%	1	0	0	1	42
Literacy for All	258	44%	56%	16%	19%	0	1	0	1	13
ClubZ! Tutoring Service Inc.	221	52%	48%	7%	12%	0	1	0	1	14
Black Star Project, The	145	54%	46%	0%	12%	0	1	0	0	17
Children's Home + Aid Society, Inc.	131	80%	20%	10%	11%	0	1	0	0	3
Mainstream Development Educational Group	130	44%	56%	3%	11%	0	1	0	1	4
A+ Tutoring Service, LTD	120	60%	40%	4%	9%	0	1	0	1	11
Brilliance Academy	108	41%	59%	14%	11%	0	1	0	1	14
ASPIRA	92	0%	100%	9%	10%	0	1	0	0	3
CSC Julex Learning	85	61%	39%	32%	20%	0	1	0	1	7
Tutorial Services	83	24%	76%	6%	18%	1	0	0	1	24
NESI	71	54%	46%	31%	14%	0	1	0	1	5
IEP (ONSITE)	63	51%	49%	0%	16%	0	1	0	1	7
Poder Ser (ONSITE)	50	44%	56%	34%	14%	0	1	0	0	4
Failure Free Reading (ONSITE)	49	80%	20%	14%	12%	0	1	0	1	5
One-to-One	38	45%	55%	0%	29%	0	1	0	0	6
Failure Free Reading (OFFSITE)	35	57%	43%	9%	20%	0	0	1	1	9
Brainfuse Online Instruction	29	24%	76%	0%	21%	1	0	0	1	19
African American Images	25	60%	40%	0%	8%	0	1	0	1	6
Train Up A Child (ONSITE)	23	39%	61%	0%	9%	0	1	0	0	2
Reach for Tomorrow	22	0%	100%	5%	27%	1	1	0	0	1
BSG Training & Consulting, Inc.	18	0%	100%	0%	0%	0	1	0	1	1
Breakthrough Urban Ministries	11	55%	45%	0%	27%	0	0	1	0	3
KnowledgePoints Learning Center	11	64%	36%	9%	27%	0	1	0	1	2
ATS Project Success	6	17%	83%	0%	33%	1	0	0	1	5
Spanish Learning Center, Inc.	6	83%	17%	83%	17%	0	1	0	1	2
A+ Education Centers (OFFSITE)	5	20%	80%	0%	40%	0	0	1	1	1
C&T After School Programs (ONSITE)	5	60%	40%	0%	20%	0	1	0	0	2
Huntington - Oak Lawn	5	80%	20%	0%	40%	0	0	1	1	3
Smart Kids, Inc.	5	60%	40%	40%	20%	0	0	1	1	3
Huntington - Lincoln Park	4	25%	75%	0%	25%	0	0	1	1	4
KnowledgePoints Learning Center (OFFSITE)	4	75%	25%	0%	50%	0	0	1	1	2
Center of Higher Development	3	33%	67%	0%	0%	1	1	0	0	1
Total number =49	**22515**	**46%**	**54%**	**11%**	**15%**	**9**	**36**	**7**	**38**	**221**

Table 13: Summary Statistics of SES Providers in CPS in School Year 2009-10

Provider Name 0910	Total Number	Grade K-5	Grade 6-8	High School	% of ELL students	% of Sp. Ed students	On-line provider	Onsite provider	Offsite provider	For profit provider	Number of schools
Orion's Mind	4434	76%	22%	0%	21%	18%	0	1	0	1	127
SES of Illinois	3637	54%	23%	22%	10%	14%	0	1	0	1	95
Newton Learning	2905	73%	26%	0%	22%	18%	0	1	0	1	95
A.I.M. High	2802	56%	23%	18%	17%	17%	0	0	0	0	132
Cambridge Educational Services	1643	40%	9%	41%	10%	9%	0	1	0	1	89
Babbage Net School	1408	10%	3%	77%	1%	2%	1	0	0	1	42
Progressive Learning	1278	70%	28%	0%	16%	24%	1	1	0	1	73
Rocket Learning Partners, LLC (ONSITE)	1190	55%	29%	12%	2%	14%	0	1	0	1	52
School Service Systems	1131	59%	37%	1%	1%	17%	0	1	0	1	38
Educate Online (formerly Catapult)	910	28%	14%	54%	5%	12%	1	0	0	1	180
Brain Hurricane	805	75%	23%	0%	25%	19%	0	1	0	1	42
Huntington - ONSITE	771	66%	32%	1%	22%	21%	0	1	0	1	36
Mainstream Development Educational Group	655	24%	11%	63%	0%	4%	0	1	0	1	14
Literacy for All	581	78%	20%	0%	31%	14%	0	1	0	1	24
Unparalleled Solutions	486	65%	22%	10%	7%	18%	0	1	0	1	26
Chess Academy	482	74%	26%	0%	22%	15%	0	1	0	1	15
ClubZ! Tutoring Service Inc.	413	43%	7%	37%	4%	8%	0	1	0	1	11
IEP (ONSITE)	325	76%	23%	0%	20%	19%	0	1	0	1	19
Children's Home + Aid Society, Inc.	189	77%	20%	0%	8%	16%	0	1	0	0	6
Tutorial Services	161	22%	11%	63%	4%	11%	1	0	0	1	48
Brainfuse One-to-One	115	49%	29%	19%	10%	23%	1	1	0	1	12
Black Star Project, The	114	39%	33%	27%	2%	23%	0	1	0	0	18
Poder Ser (ONSITE)	91	43%	32%	25%	29%	16%	0	1	0	0	6
Smart Kids, Inc.	73	44%	29%	26%	12%	16%	0	0	1	1	10
Babbage Net School (ONSITE/ONLINE)	71	0%	0%	93%	0%	0%	1	1	0	1	8
NESI	55	75%	25%	0%	15%	7%	0	1	0	1	5
Brilliance Academy	52	46%	10%	44%	25%	13%	0	1	0	1	4
Spanish Learning Center, Inc.	40	100%	0%	0%	38%	3%	0	1	0	1	1
Educational Specialties (ONSITE)	39	74%	26%	0%	8%	23%	0	1	0	0	8
A+ Tutoring Service, LTD	34	53%	18%	26%	12%	29%	0	1	0	1	6
Ahead of the Class Services (formerly Spectra)	22	68%	32%	0%	0%	23%	0	1	0	1	1
Breakthrough Urban Ministries	22	41%	59%	0%	0%	36%	0	0	1	0	2
Carter, Reddy & Associates, Inc.	22	0%	0%	91%	0%	0%	0	1	0	1	1
Reach for Tomorrow	21	0%	0%	95%	0%	0%	1	1	0	0	1
Grade Results	20	0%	0%	65%	0%	0%	1	0	0	1	1
Rocket Learning Partners, LLC (OFFSITE)	20	90%	0%	0%	0%	35%	0	0	1	1	8
Association House of Chicago	19	42%	26%	26%	5%	37%	0	0	1	0	10
ATS Project Success	12	83%	17%	0%	8%	17%	1	0	0	1	11
ASPIRA	11	0%	27%	73%	18%	9%	0	1	0	0	1
All Children Can Learn (OFFSITE)	11	64%	36%	0%	0%	36%	0	0	1	1	5
KnowledgePoints Learning Center (OFFSITE)	11	73%	27%	0%	36%	9%	0	0	1	1	6
Train Up A Child (ONSITE)	11	73%	27%	0%	0%	9%	0	1	0	0	1
KnowledgePoints Learning Center	10	30%	20%	50%	0%	20%	0	1	0	1	2
A+ Education Centers (OFFSITE)	8	88%	0%	13%	0%	13%	0	0	1	1	3
Academic Advantage- (OFFSITE)	8	50%	13%	38%	13%	25%	0	0	1	1	7
Brainfuse Online Instruction	6	17%	33%	50%	0%	33%	1	0	0	1	5
iLEARNED Online	4	25%	0%	75%	0%	0%	1	0	0	1	4
Black Star Project, The (OFFSITE)	3	67%	33%	0%	100%	67%	0	0	1	0	1
Huntington - Lincoln Park	3	67%	33%	0%	33%	67%	0	0	1	1	3
Academic Solutions, Inc. (OFFSITE)	1	0%	0%	100%	0%	0%	0	0	1	1	1
Education Masters in Illinois	1	0%	100%	0%	0%	0%	1	0	1	1	1
Total Number of Providers = 51	**27136**	**58%**	**22%**	**17%**	**14%**	**15%**	**12**	**31**	**12**	**40**	**378**

Appendix B

Figure 1: Histogram of the number of hours of SES received in 2008-09 school year

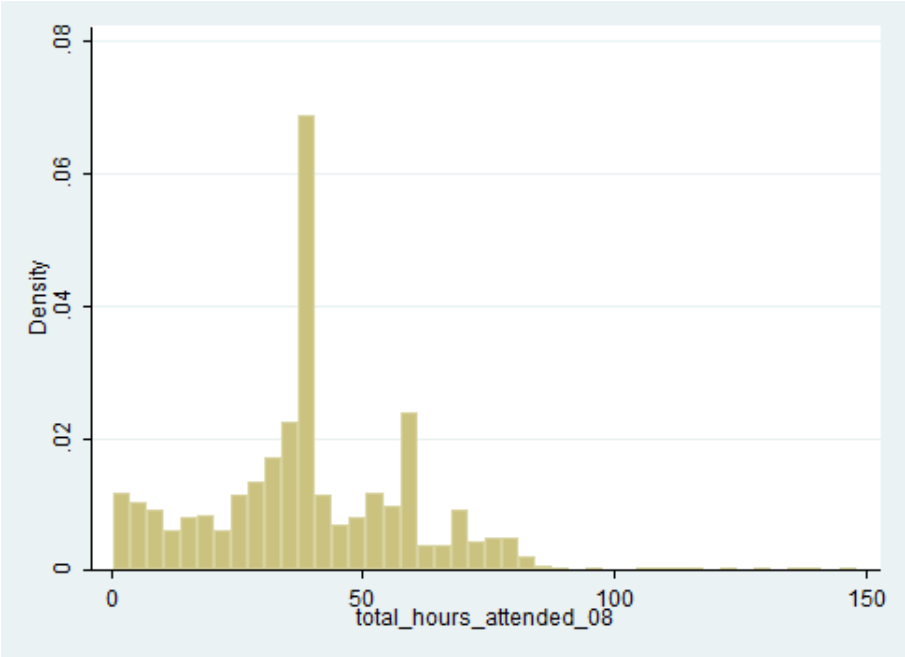
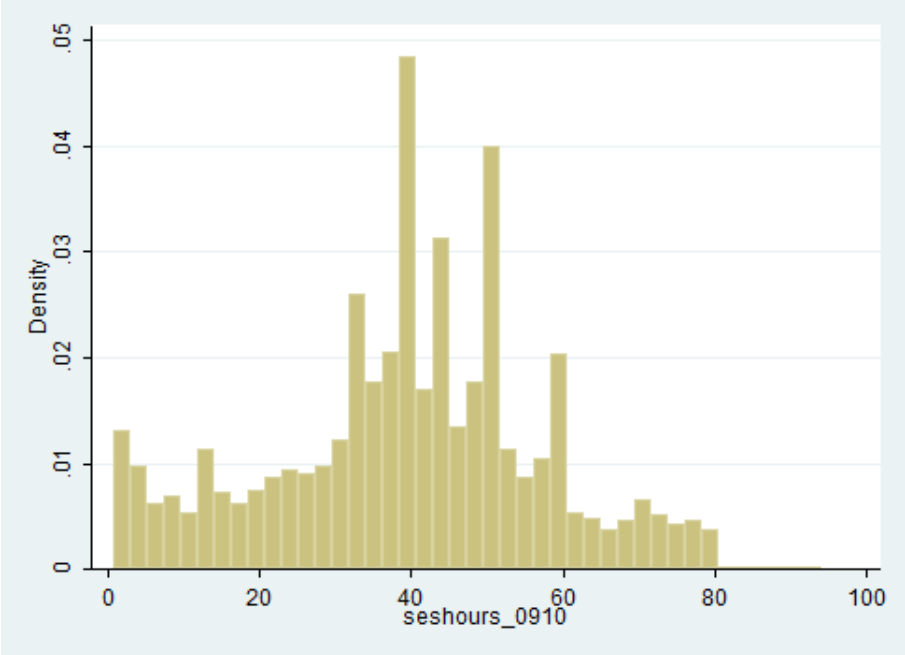


Figure 2: Histogram of the number of hours of SES received in 2009-10 school year



Appendix C

Table 14 in Appendix C reports the estimated effects of SES as measured by changes in students math and reading scores, by the different levels of SES attended, by elementary and middle schools, and comparing only students who attended while controlling for their probability of registration and attending SES, and other characteristics. The histograms in Appendix B show that there are distinct spikes in the distribution of SES hours attended, typically close to 40 and 60 hours of SES attended. As noted before, this reflects, in part, the fact that the number of hours attended is a function of the rate the providers charge and the maximum dollars allocated per student by CPS.

The implication for the PSM analysis is that we estimate the effects of SES attendance at these common peaks (40 and 60 hours attended), separately matching students with attendance levels above and below each of these points and report the results where there is appropriate balancing and adequate support for the matches. Table 14 shows the summary of the estimates SES effects for CPS, separately for elementary and middle schools. For elementary school students, we find comparably sized effects for both math and reading: effect sizes of approximately 0.06 standard deviations (range: 0.54 - 0.68). In comparison, these effect sizes are about one-fifth the size of the average annual reading and math gains in elementary students (Hill et al., 2008). For middle school students, the estimated effect sizes are statistically significant only in the case of math (0.053-0.067). As average annual math gains trend downward as grade level increases (Hill et al., 2008), these effects are substantively greater than for elementary students (about one-fourth of the average annual gains in math).

Table 14: The average effect of attending SES from Propensity Score Matching Analysis

Year 2008-09	**Reading**	
	Grades 3-5	Grades 6-8
	Coeff	Coeff
Attend 40 or more hours of SES vs $<$ 40 hours	0.054**	0.018
Attend 60 or more hours of SES vs $<$ 60 hours	0.057**	0.022
	Math	
	Grades 3-5	Grades 6-8
	Coeff	Coeff
Attend 40 or more hours of SES vs $<$ 40 hours	0.068**	0.067**
Attend 60 or more hours of SES vs $<$ 60 hours	0.058**	0.053**

** - *statistically significant at 5%*

Appendix D

Table 15: Number of students who either changed status or changed SES providers

	Changed providers		
Changed SES Status	0	1	Total
0	21,254	4,119	25,373
1	140	15,309	15,449
Total	21,394	19,428	40,822

Changed SES status is a dummy variable which takes a value of 1 if the student attended SES last year but not this year and vice-versa. Changed providers is a dummy variable which takes a value of 1 if the student changed providers.

Table 16: Summary of students who either changed status or changed SES providers

	Changed SES status		Changed Providers	
	No	Yes	No	Yes
Number of Obs	25,373	15,449	21,394	19,428
Af. American	48%	56%	46%	57%
Hispanic	49%	42%	51%	41%
Female	49%	50%	49%	49%
ELL status	7%	8%	6%	8%
F/R L status	100%	100%	100%	100%
Sp. Ed. Status	13%	14%	11%	16%
% Absent last year	4%	4%	4%	4%
Retained last year	2%	2%	1%	2%

Changed SES status is a dummy variable which takes a value of 1 if the student attended SES last year but not this year and vice-versa. Changed providers is a dummy variable which takes a value of 1 if the student changed providers.