The Effect of Special Education Vouchers on Public School Achievement: Evidence from Florida's McKay Scholarship Program

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Abstract:

This paper evaluates the average treatment effect from exposure to a voucher program for disabled students in Florida on the academic performance of disabled students who remain in the public school system. We study the effect of the largest school voucher program in the United States, the McKay Scholarship Program for Students with Disabilities, on achievement in math and reading for students who have been diagnosed as disabled and remain in the public school system. We find that greater exposure to the McKay program – measured as the number of voucher accepting private schools within a certain radius of a public school – leads to a substantial improvement in the test scores of disabled students.

I) Introduction

School choice has taken a leading role in the discussion of education policy. More than half of all states now have laws allowing public school choice in the form of charter schools. School voucher policies are also becoming more numerous across the states, including the recent adoption of the first federally sponsored voucher program for students in Washington D.C.

The growth of school choice policies in the United States provides greater emphasis that we understand their impact not only on students who take advantage of the opportunity to attend choice schools but also on the larger student body who remain in local public schools. This paper adds to the growing body of research on the effect of school choice policies on public school performance. In particular, we utilize individual-level data on the universe of public school students in Florida to evaluate the impact of the largest school voucher program in the United States on the academic proficiency of eligible students who choose to remain in public schools.

This paper adds to a growing research on the impact of school choice on public school achievement in several important ways. We provide the first estimates of the effect of a voucher program designed in particular for students with disabilities on public school productivity. Focusing on this particular policy is of significant interest because voucher programs for special education students are among the fastest growing type of voucher policies in the nation today. Policies similar to that studied here are currently operating in Florida, Ohio, and Utah and they have been recently considered in other states.

Focusing on the impact of a special education voucher program is also interesting because a consistent criticism of voucher programs is that private schools will decline to accept students with disabilities because they are difficult to educate and will decrease the average ability level of their student body and thus their competitive advantage (Epple and Romano 1998, 2002; Nechyba 1999, 2000; Caucutt 2001; Cullen and Rivkin 2003). If private schools do fail to accept disabled students then the McKay program should have little if any effect on the performance of public schools. Thus, evaluating a special education voucher program is a hard test for effect of school choice on public school achievement.

Another distinguishing feature of the McKay program that makes it of particular interest to study is the size of both its eligible and participating population. Many of the previous papers evaluating the impact of school choice policies on public school performance focus on relatively small school choice programs. For example, in 2006-07 students in twenty-one public schools in the state of Florida were eligible to receive a voucher from the often studied Opportunity Scholarship Program in Florida (Greene and Winters 2004; Chakrabarti 2005; Figlio and Rouse 2005; West and Peterson 2005; Rouse, Hannaway, Goldhaber, and Figlio 2007).[1] In contrast, in 2005-06 about 15% of all public school students in the state of Florida were eligible to receive a McKay voucher.[2] This statewide program is currently the largest school voucher program in the United States with 18,273 students across the state participating during the 2006-07 school year.[3]

The remainder of this paper is divided into seven sections. Section II discusses the previous theoretical and empirical research on the impact of school choice on public

[1] Florida school choice website: http://www.floridaschoolchoice.org/Information?OSP/osp_failing_schools
[2] Digest of Education Statistics 2006, table 50
[3] http://www.floridaschoolchoice.org/Information/McKay/files/Fast_Facts_McKay.pdf

school productivity. In Section III we describe the McKay program evaluated here and provide some descriptive information about its growth over the last several years. Section IV discusses the classification of students into disability categories, which is an important feature of the McKay program and our dataset. In Section V we provide a description of our rich longitudinal dataset and discuss the empirical approach of the paper, and Section VI reports the results of this estimation. Finally, Section VII provides a general discussion of our findings and concludes.

II) Previous Research

There is a wide body of theoretical research in the economics literature evaluating the impact of school choice on educational achievement in public schools. The most influential research in this area has focused on the effect that vouchers could have on the relative quality of an individual's peers in a public school due to the so-called cream-skimming effect (Epple and Romano1998, 2002; Nechyba 1999, 2000; Caucutt 2001).

In general, these papers model school quality in a form:

$$S = f(x, q) \qquad (1)$$

Where school quality (S) is increasing in both in a fixed per-pupil expenditure (x) and in the average ability of the student body (q).

The general result from these models derives from the ability of private schools to selectively admit students while public schools must enroll all comers. Private schools take advantage of this system by accepting vouchers from only higher ability students. This tends to decrease the education provided in public schools as the average ability of peers decreases.

Epple and Romano (2002) allow private schools to have higher production than public schools by choosing more productive inputs. These models alter the educational production function (1) to change form depending on whether the school is public or private:

$$S = \phi_i(f(x,q)) \qquad (2)$$

Where the subscript i indicates whether the school is public or private. Epple and Romano assume that $\varphi_{public} < \varphi_{private}$, and thus that private schools are more productive than public schools. In evaluating this model, Epple and Romano continue to find that vouchers lead to substantial cream-skimming and thus decrease public school effectiveness.

One important limitation of these models is that they assume that school productivity is exogenously given and thus unresponsive to outside factors. Another way other than sorting that vouchers could affect public school achievement is by providing competition for students into an education marketplace. Nechyba (2003) works from equation (2) but allows the productivity of private schools to be endogenously determined by the competition the public school faces from private or some other alternative school.

$$\phi_i = (1 - \lambda_i(PUB)) \qquad (3)$$

Where again the i subscript identifies if the school is public or private. Here we assume that $\lambda_{private} = 0$ and λ_{public} is some positive monotone transformation of the fraction of students attending public schools (PUB). This model utilizes the theory of the firm to suggest that as public schools receive greater competition from the private school sector they will respond by utilizing their resources in a more productive manner.

In this current paper we are not able to evaluate whether any impact of McKay vouchers is due to sorting, competitive pressures, or other factors such as a redistribution of resources across students. The analysis below is best considered an analysis of the average treatment effect of exposure to McKay on the academic proficiency of disabled students in the public school system. Future research is necessary to determine the exact causes for any findings.

This paper adds to a growing body of empirical research evaluating the general relationships discussed above by measuring whether student outcomes in public schools increase as public schools face greater exposure to other sectors. Hoxby (2000), Bayer and McMillan (2005), and Hanushek and Rivkin (2003) find evidence that greater competition between public school districts, often referred to as Tiebout choice, leads to increased public school performance, though McHugh (2003) finds less evidence of this effect. Hoxby (1994) and Dee (1998) find positive effects from unsubsidized private school competition, while Sander (1999) and McMillan (2000) fail to find such an effect.

Several studies have also evaluated the effect of school choice policies such as vouchers and charter schools on public school performance. Utilizing slightly different methods, Greene and Winters (2004), Chakrabarti (2005), Figlio and Rouse (2005), West and Peterson (2005), Rouse, Hannaway, Goldhaber, and Figlio (2007), and Greene (2001) each found that a voucher program in Florida (a different program from the one evaluated in this paper) led to public school gains on math and reading tests.[4] Hoxby (2001) found that public schools improved their performance in response to an influx of charter schools.

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[4] Though Figlio and Rouse found a positive effect from the program, they argue that the primary effect of the derives not from competition but from "shaming" due to a failing label.

III) The McKay Scholarship Program

The John M. McKay Scholarship Program for Students with Disabilities (from here, McKay) is a statewide program in Florida designed to provide parents of disabled students with the resources necessary to attend another public school or a private school if they so choose. McKay scholarships are available to any Florida public school student who has been assigned an Individual Education Plan (IEP) – essentially a contract between the child and the school system that is required to be granted to any student diagnosed with a disability – and was enrolled in the Florida public school system during the prior year. Once a student uses a McKay voucher he remains eligible for the program until he decides to return to the public school, graduates from high school, or he turns 22 years of age.

In order to participate in the program, private schools must meet safety requirements and must employ teachers with at least a bachelor's degree. Unlike many other school voucher programs, private schools are not required to accept the voucher amount as full tuition payment.

Importantly for our circumstances, the McKay program has seen dramatic growth since it was first implemented as a small pilot in the 1999-00 school year. Table 1 reports some basic statistics for the program in each year of its existence. From the time it was first adopted statewide in 2000-01, the number of students using a scholarship has increased from 970 to 18,273 students in 2006-07, making it the largest school voucher program in the nation.[5] This substantial increase in the number of students using a McKay scholarship is in large part due to the increase in the number of private schools

[5] http://www.floridaschoolchoice.org/Information/McKay/files/Fast_Facts_McKay.pdf

willing to accept the voucher, which went from 100 to 811 schools during this six year period.

McKay is distinguished from other voucher programs not only by its eligible population, but also by the generosity of the scholarship amount. Eligible students are provided with a voucher equivalent to the lesser of the total amount of dollars that would have been spent on the child in his current public school or the amount of the tuition at the accepting private school. According to the Florida Department of Education, in 2006-07 the amount of a McKay scholarships ranged from $5,039 to $21,907, with an average of $7,206.[6]

IV) Disability Classifications

Federal statute provides a listing of disability diagnoses for which individuals are required to receive an IEP. Table 2 lists the categories incorporated by the Florida Department of Education and reports the percentage of all students and all special education students in the state that were in each category during the 1999-2000 school year, the year before the McKay program was first adopted statewide. These categories range in severity from the relatively mild Specific Learning Disability (SLD) to the more severe categories such as Traumatic Brain Injury (TBI). As is the case for the nationwide averages, by far the largest special education category is the relatively mild classification of SLD, which accounts for 61.2% of disabled students and 8.5% of all students in Florida.

The ability to disaggregate the type of disability of each individual is a particular advantage of our dataset. First, since disability classifications vary substantially in their

[6] http://www.floridaschoolchoice.org/Information/McKay/files/Fast_Facts_McKay.pdf

severity, and thus for their likely impact on student ability and proficiency, it is useful to be able to control for the specific disability of each student in an analysis.

Secondly, we may expect that McKay vouchers could have a heterogeneous effect on the academic performance of students with different disability classifications. For example, students diagnosed with the relatively mild SLD, by far the largest classification in Florida and nationwide, may have access to more private school alternatives than students with more severe disabilities who require special facilities, etc. Further, there is at least some reason to believe that a substantial portion of students in the SLD category may not truly be disabled. Singer et al. (1989) find substantial variation in the functional status of students with mild disabilities across school systems with different financial incentives for diagnosis. MacMillian and Siperstein (2001) suggest that pubic schools use low achievement alone in the diagnosis of SLD rather than any real clinical diagnosis of a problem learning material. Private schools may be particularly willing to accept these students, who may or may not actually have a processing problem in their brain.

In contrast, we might expect that students with particularly severe or rare disabilities could have fewer private school alternatives, even though the McKay voucher is of a larger amount in order to compensate for the severity of the disability. Serving students with certain disabilities could require an original fixed-cost investment for facilities that only a few private schools in an area have already made. For example, an urban religious school that mostly serves low-income regular education students may not have the facilities or staff necessary to teach a student with severe mental retardation, even if the voucher amount is quite substantial.

If students with different disability classifications have differential access to enrollment in McKay schools, then evaluating the average impact for all students in special education – the alternative in absence of individual diagnoses – would fail to account for an important effect of choice and lead to biased estimates. Our ability to separately evaluate the impact of McKay exposure by the student's disability classification allows us to evaluate whether such a differential competitive effect exists.

V) Data and Method

We utilize information from a rich panel dataset provided by the Florida Department of Education. This dataset contains student-level information for the universe of public school students enrolled in grades 3-10 in the Florida public school system from the 2000-01 to the 2004-05 school year. For each student-year, the dataset contains demographic information and the child's score on the math and reading versions of the Florida Comprehensive Assessment Test (FCAT) – the state's standardized test administered to all students in grades 3 through 10 – and if the student is disabled, the dataset reports the student's disability classification.

We next develop a proxy for the substantiality of the exposure a public school faces from McKay vouchers. We used geographical software to map each public school in the state. Using another dataset provided by the Florida Department of Education, we mapped the location of each private school that participated in the McKay program individually for each year from 2001-02 through 2004-05. For each year, we then counted the number of McKay accepting private schools within 5 miles of the public school, and then the number of such private schools within 10 miles of each public school. Note that private schools that do not accept McKay vouchers are not counted as providing greater impact from the program on the public school. Thus, an increase in the number of McKay accepting private schools within a certain radius of a public school is most often determined by previously present private schools choosing to participate in the program, not necessarily the opening of a new private school.

We matched this information for each student by year in the larger panel dataset. Table 3 reports descriptive statistics for the number of McKay accepting private schools within these limits by year at the student level.

We evaluate whether increased access to McKay voucher for students, measured by the number of private schools who accept McKay vouchers within a certain radius of a public school, produces a differential impact on the test scores of individuals with disabilities. We utilize the panel dataset in order to estimate an educational production function taking the form:

$$\begin{aligned} Y_{i,t} &= \beta_0 + \beta_1\ District_{i,t} + \beta_2\ Year_t + \beta_3 Grade_{i,t} + \beta_4\ Student_{i,t} \\ &+ \beta_5\ IEP_{i,t} + \beta_6\ Exp_{i,t} + \beta_7\ (IEP_{i,t} * Exp_{i,t}) + \alpha_i + \varepsilon_{i,t} \end{aligned} \tag{4}$$

Where $Y_{i,t}$ is the standardized test score of student i in year t; District is a vector of indicator variables for the school district the student attended; Year is a vector of indicator variables for the year; Grade is a vector of indicator variables for the grade level of the student; Student is a vector of time-variant observed characteristics for the student; IEP is a vector of indicator variables indexing a specific diagnosis of a disability; Exp is our proxy variable for the exposure to McKay, i.e. the number of private schools within a certain radius (5 or 10 miles depending on the analysis) of public school attended by the student; α_i is an individual student fixed effect used to account for unobserved student heterogeneity; and ε is a stochastic error term.

We can interpret β_6 as the impact of the number of private schools within the given radius of a public school on test scores for all students, and β_7 as the differential relationship for students with a particular disability category. We can interpret $\beta_6 + \beta_7$ as the overall impact of greater public school exposure to McKay vouchers on the academic performance of individuals in each disability classification. Since there is no theoretical reason to expect exposure to McKay to provide public schools with an incentive to improve the education provided to regular enrollment (not special education) students, if the estimate of β_6 is found to be significant and substantial, we might worry that we have found a spurious relationship.

There are a few complicating factors that could bias the estimation of (4) that are worth considering here. The first potential bias derives from non-random attrition as students use McKay vouchers to attend a private school. Private school students are not required to take Florida's standardized tests, and so our dataset only contains information for public school students. This creates a sample selection issue since students almost certainly use McKay vouchers non-randomly. In particular, a large theoretical research is based on the premise that private schools will only accept, or "cream skim", the most academically advanced students who use vouchers (Epple and Romano 1998, 2002; Nechyba 1999, 2000; Caucutt 2001).

A second potential sample selection bias occurs due to the potential for non-random selection of students into special education programs driven by the McKay program. Some research suggests a relationship between diagnosis into special education programs and changes in the financial incentives for schools to make such placements (Cullen 2003; Singer et al. 1989). Theoretically, exposure to McKay could lead to fewer individuals being identified as disabled because schools are unwilling to risk the chance that the student will use a voucher to leave for a private school.

Though our ability to evaluate the progress of individual students over time through the use of panel-data with individual fixed effects may help to mitigate these sample selection issues by accounting for unobserved student heterogeneity, these techniques do not account for non-random attrition entirely. Unfortunately, there are no variables available in our dataset that could serve as a reasonable instrument to account for these sample selection problems, and thus we are unable to correct for this bias statistically.

However, it is worth noting that theoretically we should expect both of the sample selection issues described above to bias the estimates for the impact of McKay exposure on public school performance downwards. If the non-random attrition is caused by the cream-skimming relationship most often assumed in previous research then schools whose students have more opportunity to attend a McKay school should have less able special education students who remain in the school on average, which would tend to bias the estimate downward. In the case of diagnostic patterns, the theoretical and empirical research suggests that the McKay program should lead to fewer students being placed into special education whose disabilities are mild enough for there to be a choice in the diagnosis. This indicates that the average ability of individuals with disability classifications should decrease in the presence of McKay exposure because the individuals with higher academic ability are now left in regular education. Again, this would tend to bias our estimates of the treatment effect downward.

A final potential bias comes from the fact that the number of private schools choosing to accept McKay vouchers within a certain radius of a public school may be endogenous to the public school's quality. One could theorize that more private schools could participate in the McKay program where public schools are failing to provide an adequate education, and thus students may be more willing to look to change schools. Alternatively, it could be that private schools would accept McKay students only in areas with higher achieving students, in an attempt to acquire these students who will not greatly affect the average peer ability level in the school.

We empirically look for the existence and directionality of such an endogeneity bias. We aggregate our panel dataset to the school level and use it to measure the relationship between the number of private schools accepting McKay vouchers within 5- or 10-miles of a public school in a given year and the value-added performance of the public school in the prior year. Using this school-level panel data we use the within estimator to evaluate an equation taking the form:

$$Exp_{s,t} = \phi_0 + \phi_1 Year + \phi_2 Demographics_{s,t} + \phi_3(\overline{Y}_{s,t-1} - \overline{Y}_{s,t-2}) + \theta_s + \mu_{s,t} \quad (5)$$

Where s indexes the school and t again indexes the year; Demographics is a vector of time variant demographic characteristics for the school; θ is a school fixed-effect; Exp remains the number of private schools within a certain radius of the public school; and μ is a stochastic error term assumed to be clustered by school.

The variable $\overline{Y}$ is a vector of mean achievement of students in the school on the math and reading portion of the state's test. In the equation, we evaluate the relationship between the number of private schools within a certain radius of a public school in year t and the first difference of that school's mean test score gain in t-1. The first difference of average student achievement is an often used measure of a school's value-added achievement, and thus serves as our variable indicating school productivity.

We are interested in this particular timing of the relationship between public school valued added and private school acceptance of McKay vouchers because public schools are administered the FCAT during the spring of each school year. We assume that private schools take into account the public school's most recently available test score gains when deciding whether to accept McKay vouchers. That is, a first difference for the school productivity observed in year t $(\overline{Y}_{s,t} - \overline{Y}_{s,t-1})$ could not Granger-Cause the private school's decision to accept McKay vouchers that year, while $(\overline{Y}_{s,t-1} - \overline{Y}_{s,t-2})$ could inform this decision. We are particularly interested in the significance and sign of φ_3, which will determine whether more private schools are willing to accept McKay vouchers where public schools are higher or lower achieving.

The results of estimating equation (5) for both the within 5-mile and within 10-mile definitions for Exp are found in Table 4. The analyses show a negative relationship between a public school's average growth in reading scores and the number of private schools within 5- or 10-miles willing to accept McKay vouchers. However, this analysis finds no relationship between McKay exposure and math growth within the school at the 5% significance level.[7]

These results suggest that more private schools are willing to adopt McKay vouchers where public schools are less productive in reading. That is, we have found that

[7] An alternative specification using only the lagged first difference in math or the lagged first difference in reading produces similar coefficient estimates. However, in these models the results from math become statistically significant. We have also run models replacing the vector $(\overline{Y}_{s,t} - \overline{Y}_{s,t-1})$ with $(\overline{Y}_{s,t} - \overline{Y}_{s,t-1})$ and results are similar to those reported for the preferred model. All analyses are available from the authors by request.

estimation of equation (4) is problematic because the number of private schools who accept McKay vouchers is endogenous to the public school's achievement.

Again, no particular variable lends itself as an obvious instrument for whether a private school would accept McKay vouchers. However, as with the sample selection issues discussed above, we can now say something about the directionality of this bias. The finding that McKay exposure and public school growth in reading are negatively related suggests that private schools are opening in areas where public schools are less productive. Such non-random acceptance of McKay vouchers by private schools will tend to bias estimation of our variables of interest in equation (4) downward.

We have now discussed the three most concerning areas of bias for estimation of equation (4) and found that each should tend to bias our coefficients of interest (β_7 and β_8) downward. Though we would prefer to have an unbiased estimate for the effect of the voucher program on public school achievement, the uniform directionality of the bias suggests that we can consider our estimations of these coefficients to be a lower bound for the impact of McKay exposure on the test score performance of public school students.

VI) Results

We estimate (4) using the within panel data estimator with individual fixed effects using heteroskedastic robust standard errors. We estimate the model first using as our Exp variable the number of private schools accepting McKay vouchers within a 5-mile radius of the public school in a year. In order to test for robustness of our procedure, we then replace this with the number of private schools accepting McKay vouchers within a 10-mile radius of the public school.

The results of our estimation for math are found in Table 5. As will be the case throughout, for space considerations we only report coefficient estimates for the diagnosis and exposure variables.[8]

The first thing to notice about the results is that in both of the analyses the coefficient on the exposure variable (within-5 or within-10 miles) without interaction is statistically significant at the 10 percent. Since this variable estimates the impact of increasing McKay exposure for all students whether or not they are in special education, we may worry that this result indicates a spurious relationship between private schools accepting McKay vouchers and achievement. However, in both analyses the size of the coefficient is quite small, especially relative to the interaction terms. Further, the size of the effect grows from the within 5-mile to the within-10 mile definition of exposure, which is inconsistent with the effect deriving strictly from area composition (for example, urbanicity) and we will see is also inconsistent with the interaction terms. Therefore, while we have some worry about the variable's statistical significance, the relationship between McKay exposure and public school achievement for regular enrollment students does not seem to be a large enough to warrant substantial concern.

We can now look to the interaction terms, which evaluate the differential relationship between McKay exposure and student performance by special education diagnosis. The variables are sorted in the table by the size of the student population in the special education category, which is imperfectly related to the severity of the diagnosis. The coefficient on each of the interaction variables is positive and most (especially among the less severe categories) are statistically significant.

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[8] Full results are available from the authors by request.

The results are similar for both the within 5-mile and within-10 mile specifications. The primary difference appears to be that the coefficients for the within-5 mile estimation are uniformly larger than the coefficients in the 10-mile specification. This finding provides confidence that the school productivity for these students is related to the number of voucher accepting schools close-by. We find that altering the model to include schools that are further away decreases the average effect found in the analysis. These results suggest a relationship between the distance of a private school and the pressure it exudes on the public school.

Table 6 reports the result of our estimation for reading. The results are similar to those found in math, though the impact of McKay exposure on the reading scores of disabled students appears to be larger than in math in most categories. We again see a positive relationship between McKay exposure and academic proficiency in most of the diagnostic categories, especially for the milder disabilities. As in math, the size of this relationship uniformly declines as we expand the variable to include schools within 10-miles rather than within 5-miles. We again note that the coefficient on the exposure variable without interaction is statistically significant, though it is again insubstantial.

Table 7 puts our results of the within 5-miles estimation into a more manageable context. The table first reports the effect of McKay exposure for students with each classification in a school with the average number of private schools accepting vouchers in 2004-05. The second column reports the overall effect for a school with average McKay exposure on test scores by incorporating the coefficient of Exp to each of the interaction terms.[9] Finally, the third column translates the overall effect for students in a school with average McKay exposure as standard deviation units.

The table shows that the overall effect for students in a school with average McKay exposure ranged across the disability classifications. The effect for students identified as having a Specific Learning Disability, which incorporates about 8.5 percent of all students in Florida and 61 percent of students in special education (see Table 2), was about a 0.05 standard deviation increase in math and 0.07 standard deviation increase in reading for students in a school with average McKay exposure. When considering the size of these results, recall that these estimates represent the lower bound of the effect of McKay exposure due to the factors discussed previously.

VII) Conclusion

In this paper we have found some evidence exposure to a voucher program for disabled students improves the education provided to those students. These findings are consistent with most of the previous research, which indicates a positive effect on public school achievement from school choice policies.

The results here help to inform a large policy debate about the implementation of voucher programs for disabled students. Such programs have been recently adopted in Ohio and Utah, and other states have considered the option as well. Our findings suggest that public schools will provide a better education for disabled students if they face greater exposure to these programs. However, future research on these and other programs is necessary to evaluate the robustness of the results in Florida and understand the primary causes for the impact on public school productivity.

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[9] That is, in the language of equation (4), this column reports $\beta_7 + \beta_{8.}$

References

Bayer, P. & McMillan, R. (2005). “Choice and competition in local education markets”. Working paper 11802. NBER.

Caucutt, E. (2001). “Peer group effects in applied general equilibrium”. Economic Theory 17, 25-51.

Chakrabarti, R. (2005). “Impact of voucher design on public school performance: Evidence from Florida and Milwaukee voucher programs”. Working paper.

Cullen, J. B. (2003). “The impact of fiscal incentives on student disability rates”. Journal of Public Economics, 87, 1557-1589.

Cullen, J. B. & Rivkin S. G. (2003). “The role of special education in school choice.” In Caroline Hoxby ed. “The economics of school choice”, NBER. Pp. 67-106.

Dee, T. (1998). “Competition and the quality of public schools”. Economics of Education Review 17 (4), 419-427.

Epple, D., Romano, R. (1998). “Competition between public and private schools, vouchers and peer group effects”. American Economic Review 88(1), 33-62.

Epple, D., Romano, R. (2002). “Educational vouchers and cream skimming”. Working paper. Carnegie Mellon University.

Figlio, D. N. & Rouse C. E. (2006). “Do accountability and voucher threats improve low-performing schools?” Journal of Public Economics, 90 (1), 239-255.

Greene, J. P. & Winters, M. A. (2004). “Competition passes the test”. Education Next. 4 (3), 66-71.

Hanushek, E. & Rivkin, S. (2003). “Does public school competition affect teacher quality?”. “Introducing school choice into multidistrict public school systems”. In Caroline Hoxby ed. “The economics of school choice”, NBER. Pp. 23-48.

Hoxby, C. (1994). “Do private schools provide competition for public schools”. Working paper 4978. NBER.

Hoxby, C. (2000). “Does competition among public schools benefit students and taxpayers?”. American Economic Review 90 (5), 1209-1238.

Hoxby, C. (2001). “Rising Tide”. Education Next, 1 (4), 69-74.

Macmillan, D. L., & Siperstein, G. N. (2001). “”Learning disabilities as operationally defined by schools. Paper presented at the 2001 LD Summit: Building a Foundation for the Future. Washington, D.C.

McHugh, C. (2003). “Does competition among public schools benefit students and taxpayers: Comment”. Mimeo. Duke University.

McMillan, R. (2000). “Competition, incentives and public school productivity”. Journal of Public Economics 88, 1871-1892.

Nechyba, T. (1999). “School finance induced migration patterns: The impact of private school vouchers”. Journal of Public Economic Theory 1 (1), 5-50.

Nechyba, T. (2000). “Mobility, targeting and private school vouchers”. American Economic Review 90(1), 130-146.

Nechyba, T. (2003). “Introducing school choice into multidistrict public school systems”. In Caroline Hoxby ed. “The economics of school choice”, NBER. Pp. 145-194.

Rouse, C.E., Hannaway, J., Goldhaber, D., and Figlio, D. (2007). "Feeling the Florida Heat? How Low-Performing Schools Respond to Voucher and Accountability Pressure" National Center for Analysis of Longitudinal Data in Education Research, Working Paper 13.

Sander, W. (1999). “Private schools and public school achievement”. Journal of Human Resources 34 (4), 697-709.

Singer, J. D., Palfrey, J. S., Butler, J. A., Walker, D. K., (1989). “Variation in special education classification across school districts: how does where you live affect what you are labeled?”. American Educational Research Journal 26, 261-281.

West, M. R. & Peterson P. E. (2006). “The efficacy of choice threats within school accountability systems: Results from legislatively induced experiments”. The Economic Journal, 116, C46-C62.

Table 1
Summary Characteristics of McKay Program

	Voucher Using Students	Voucher Accepting Private Schools
2006-07	18,273	811
2005-06	17,300	751
2004-05	15,910	708
2003-04	13,739	687
2002-03	9,130	518
2001-02	5,013	296
2000-01	970	100
1999-00	2	1

Table 2
Percent of Students in Each Disability Category, 2000

	Percent of All Students	Percent of Disabled Students
IEP	13.9%	
Specific Learning Disability	8.5%	61.2%
Speech	1.5%	10.6%
Emotional	1.4%	9.7%
Language	1.0%	7.3%
Emotional Mental	0.6%	4.3%
Other Health Impairment	0.2%	2.1%
Emotional Severe	0.2%	1.7%
Deaf-Hearing	0.1%	0.9%
Orthopedic	0.1%	0.8%
Autistic	<0.1%	0.3%
Visual-Blindness	<0.1%	0.3%
Traumatic Brain Injury	<0.1%	0.1%

Table 3
Summary of Number of McKay Accepting Private Schools Within Radius of Public Schools

	Within 5 Miles	Within 10 Miles
2001-02	3.4	9.5
2002-03	5.5	15.5
2003-04	7.1	20.3
2004-05	7.1	20.3

Table 4
Analysis of the Number of Private Schools Accepting McKay Vouchers Within Radius of Public School

Dependent Variable	Private Schools Within 5 Miles				Private Schools Within 10 Miles			
	Coefficient	Robust Standard Error	t		Coefficient	Robust Standard Error	t	
Year 2003	1.572852	0.0404638	38.87	**	4.394468	0.1005519	43.7	**
Year 2004	1.607939	0.0483672	33.24	**	4.433395	0.1124918	39.41	**
Percent LEP LF	1.225624	1.308788	0.94		5.27951	2.941811	1.79	
Percent LEP LN	-15.19763	5.791	-2.62	**	-65.8653	11.8241	-5.57	**
Percent LEP LP	-11.20108	4.8807	-2.29	*	-34.2166	13.27843	-2.58	**
Percent LEP LY	0.892644	1.298995	0.69		9.49799	2.851287	3.33	**
Percent LEP LZ	8.482662	1.674656	5.07	**	25.26379	3.771531	6.7	**
Percent Male	-0.4000739	0.514896	-0.78		-0.95082	1.250125	-0.76	
Percent Asian	-1.292456	2.842063	-0.45		-7.48276	6.232006	-1.2	
Percent Hispanic	-3.170049	0.9215876	-3.44	**	-9.49699	2.509718	-3.78	**
Percent African American	0.9813436	0.5095629	1.93		3.65575	1.344927	2.72	**
Percent Multiple Race	-1.365937	1.702276	-0.8		-9.36291	3.953683	-2.37	*
Percent Indian	-0.8646237	4.76349	-0.18		-10.3391	11.5901	-0.89	
Percent FRL 1	-1.352216	0.2488491	-5.43	**	-3.28582	0.6287409	-5.23	**
Percent FRL 2	-0.3691402	0.3491565	-1.06		-2.47617	1.004986	-2.46	*
Percent FRL 3	-1.878239	0.674679	-2.78	**	-5.22027	1.555923	-3.36	**
Percent FRL 4	-0.0133739	0.2544687	-0.05		-0.1355	0.6259476	-0.22	
Lag Percent IEP	-0.5807656	0.3601287	-1.61		-2.3788	0.8382109	-2.84	**
Average Math Gain Previous Year	-0.0002944	0.0004075	-0.72		-0.00179	0.0010192	-1.75	
Average Reading Gain Previous Year	-0.0006518	0.0003241	-2.01	*	-0.00205	0.0008052	-2.54	*
Constant	5.79009	0.3736929	15.49	**	15.91119	0.8605871	18.49	**
Within R-Square	0.3896				0.4965			
Number of Observations	8,445				8,445			
Number of Groups	2,961				2,961			

**Significant at p<.01
*Significant at p<.05

Table 5
Effect of McKay Competition on Student Math Test Scores

	Coefficient	Robust Standard Error	t		Coefficient	Robust Standard Error	t	
McKay Accepting Schools Within 5 Miles	-0.05	0.03	-1.71	*				
McKay Accepting Schools Within 10 Miles					0.15	0.01	11.41	***
Specific Learning Disability	14.29	1.28	11.21	***	9.78	1.31	7.44	***
Speech	4.95	1.13	4.39	***	4.09	1.19	3.43	***
Emotional	-19.50	2.89	-6.76	***	-21.37	2.99	-7.15	***
Language	-17.96	2.11	-8.50	***	-20.57	2.22	-9.28	***
Emotional Mental	-9.20	6.09	-1.51		-9.20	6.19	-1.49	
Other Health Impairment	-1.83	3.48	-0.53		-2.82	3.63	-0.78	
Emotional Severe	-49.56	6.49	-7.64	***	-51.58	6.69	-7.71	***
Deaf-Hearing	3.61	9.84	0.37		-4.75	10.16	-0.47	
Orthopedic	-20.72	11.11	-1.86	*	-22.65	11.54	-1.96	*
Autistic	2.10	14.38	0.15		-0.27	15.41	-0.02	
Visual-Blindness	-1.65	14.67	-0.11		-6.01	15.01	-0.40	
Traumatic Brain Injury	-57.45	27.34	-2.10	**	-50.83	27.55	-1.84	*
Specific Learning Disability * Within Radius	2.30	0.10	23.58	***	1.13	0.04	26.97	***
Speech * Within Radius	0.24	0.17	1.38		0.14	0.07	2.14	**
Emotional * Within Radius	1.20	0.24	4.97	***	0.56	0.11	5.36	***
Language * Within Radius	2.78	0.26	10.54	***	1.19	0.11	11.28	***
Emotional Mental * Within Radius	0.86	0.47	1.83	*	0.31	0.19	1.60	
Other Health Impairment * Within Radius	0.97	0.35	2.73	***	0.41	0.14	2.99	***
Emotional Severe * Within Radius	0.87	0.48	1.83	*	0.41	0.19	2.14	**
Deaf-Hearing * Within Radius	1.98	0.75	2.64	***	1.18	0.31	3.77	***
Orthopedic * Within Radius	1.51	0.95	1.59		0.64	0.40	1.61	
Autistic * Within Radius	0.75	1.12	0.67		0.37	0.42	0.88	

Visual-Blindness * Within Radius	-0.49	1.36	-0.36	0.14	0.50	0.28
Traumatic Brain Injury * Within Radius	-0.41	2.28	-0.18	-0.51	0.97	-0.53
Within R-Square	0.5240			0.5242		
Number of Observations	6,219,617			6,219,617		
Number of Groups	2,398,331			2,398,331		

***Significant at p<.01
**Significant at p<.05
*Significant at p<.10

Table 6
Effect of McKay Competition on Student Reading Test Scores

	Coefficient	Robust Standard Error	t		Coefficient	Robust Standard Error	t	
McKay Accepting Schools Within 5 Miles	0.068283	0.0364464	1.87	*				
McKay Accepting Schools Within 10 Miles					0.22	0.02	12.77	***
Specific Learning Disability	19.16709	1.638665	11.7	***	11.74	1.68	6.97	***
Speech	2.464136	1.540308	1.6		2.02	1.63	1.24	
Emotional	-10.33439	3.535281	-2.92	***	-13.44	3.66	-3.67	***
Language	-20.74014	2.574338	-8.06	***	-23.48	2.71	-8.66	***
Emotional Mental	-19.05447	6.608148	-2.88	***	-20.37	6.71	-3.04	***
Other Health Impairment	-3.6152	4.363033	-0.83		-3.70	4.54	-0.81	
Emotional Severe	-45.57523	8.03292	-5.67	***	-50.47	8.28	-6.10	***
Deaf-Hearing	18.39157	11.82365	1.56		12.36	12.25	1.01	
Orthopedic	-26.67317	13.0691	-2.04	**	-26.35	13.73	-1.92	*
Autistic	-24.32053	16.60619	-1.46		-26.11	17.76	-1.47	
Visual-Blindness	3.541657	18.1543	0.2		2.16	18.41	0.12	
Traumatic Brain Injury	-68.42958	29.96436	-2.28	**	-53.52	30.18	-1.77	*
Specific Learning Disability * Within Radius	3.377997	0.1214082	27.82	***	1.72	0.05	32.98	***
Speech * Within Radius	0.0440374	0.2217133	0.2		0.04	0.09	0.47	
Emotional * Within Radius	0.1922976	0.2775664	0.69		0.26	0.12	2.19	***
Language * Within Radius	2.391393	0.3159964	7.57	***	1.07	0.13	8.30	***
Emotional Mental * Within Radius	1.585794	0.5015176	3.16	***	0.67	0.21	3.24	***
Other Health Impairment * Within Radius	1.270033	0.4155005	3.06	***	0.47	0.16	2.86	***
Emotional Severe * Within Radius	0.6513608	0.5621964	1.16		0.46	0.23	2.04	**
Deaf-Hearing * Within Radius	1.380605	0.866282	1.59		0.86	0.36	2.35	**
Orthopedic * Within Radius	0.7317186	1.038647	0.7		0.21	0.44	0.49	
Autistic * Within Radius	2.655537	1.11179	2.39	**	0.99	0.45	2.20	**

Visual-Blindness * Within Radius	1.747482	1.976992	0.88	0.71	0.79	0.89
Traumatic Brain Injury * Within Radius	0.7106963	2.323991	0.31	-0.59	1.01	-0.58
Within R-Square	0.3714			0.3716		
Number of Observations	6,296,617			6,296,617		
Number of Groups	2,406,010			2,406,010		

***Significant at p<.01
**Significant at p<.05
*Significant at p<.10

Table 7
Overall Results -- School With Average Competition Within 5 Miles

	Math				Reading			
	Differential Effect from Average Exposure	Overall Effect from Average Exposure	Overall Effect from Average Exposure in Standard Deviation Units		Differential Effect from Average Exposure	Overall Effect from Average Exposure	Overall Effect from Average Exposure in Standard Deviation Units	
Specific Learning Disability	16.31	15.99	0.05	***	23.98	24.47	0.07	***
Speech	1.68	1.36	0.00		0.31	0.80	0.00	
Emotional	8.52	8.20	0.03	***	1.37	1.85	0.01	
Language	19.71	19.38	0.06	***	16.98	17.46	0.05	***
Emotional Mental	6.10	5.77	0.02	*	11.26	11.74	0.03	***
Other Health Impairment	6.87	6.54	0.02	***	9.02	9.50	0.03	***
Emotional Severe	6.20	5.88	0.02	*	4.62	5.11	0.01	
Deaf-Hearing	14.05	13.72	0.04	**	9.80	10.29	0.03	*
Orthopedic	10.75	10.43	0.03		5.20	5.68	0.02	
Autistic	5.33	5.01	0.02		18.85	19.34	0.05	**
Visual-Blindness	-3.47	-3.79	-0.01		12.41	12.89	0.04	
Traumatic Brain Injury	-2.92	-3.24	-0.01		5.05	5.53	0.02	

Average 7.1 McKay Accepting Private Schools Within 5 Miles in 2004-05
Standard Deviation on FCAT Math test in 2004-05 = 311.2186
Standard Deviation on FCAT Reading test in 2004-05 = 389.9618

***Significant at p<.01
**Significant at p<.05
*Significant at p<.10

Significance of overall relationship tested with F-test