PSJ Policy Studies Journal

The Policy Studies Journal, Vol. 41, No. 1, 2013

School Vouchers and Student Attainment: Evidence from a State-Mandated Study of Milwaukee's Parental Choice Program

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In this article we examine educational attainment levels for students in Milwaukee's citywide voucher program and a comparable group of public school students. Using unique data collected as part of a state-mandated evaluation of the program, we consider high school graduation and enrollment in postsecondary institutions for students initially exposed to voucher schools and those in public schools at the same time. We show that exposure to voucher schools was related to graduation and, in particular, to enrollment and persistence in a 4-year college. These differences are apparent despite controls for student neighborhoods, demographics, early-career test scores and—for a subsample of survey respondents—controls for parental education, income, religious behavior, and marital status. We conclude by stressing the implications for future scholarship and policy, including the importance of attainment outcomes in educational research.

KEY WORDS: school vouchers, student attainment, public program evaluation

Introduction

Policymakers and scholars alike have looked to studies of school choice programs for evidence that students do "better" or "worse" in alternatives to the traditional public sector. Nearly all of these studies have focused largely on the performance of students on standardized tests. Many scholars acknowledge and several actually consider the importance of other outcomes, including the effects of school choice on student and parent satisfaction and civic values (e.g., Campbell, 2008; Dee, 2005; Howell, Peterson, Wolf, & Campbell, 2006; Schneider, Teske, Marschall, Mintrom, & Roch, 1997; Wolf et al., 2009) and the indirect effects of school choice on other socially desirable goals such as racial integration and the narrowing of racial, ethnic, and gender gaps in achievement (e.g., Betts, Rice, Zau, Tang, & Koedel, 2006; Bifulco & Ladd, 2007; Greene, 2005; Neal, 2006; Zimmer et al., 2009). As with other school choice programs, studies of school voucher programs have primarily focused on student test scores. These include evaluations of privately funded programs (Cowen, 2008; Howell, Wolf, Campbell, & Peterson, 2002; Howell et al.,

Published by Wiley Periodicals, Inc., 350 Main Street, Malden, MA 02148, USA, and 9600 Garsington Road, Oxford, OX4 2DQ.

2006) and analyses of public programs (Greene, Peterson, & Du, 1999; Metcalf, West, Legan, Paul, & Boone, 2003; Rouse, 1998; Witte, 2000; Wolf et al., 2013). Some of these studies have also reported to varying degrees on other indicators, often finding large and positive voucher effects on parent satisfaction and views of school safety while also reporting small or marginal effects on test scores (e.g., Witte, 2000; Howell et al., 2006; Wolf et al., 2009).

Perhaps the most important alternative to student test scores as a measure of success in educational policy is attainment: reaching a given level of schooling such as a high school diploma, enrollment in postsecondary education, or earning a bachelor's degree and beyond. Educational attainment is an important indicator for school quality because it may be a direct result of the development of academic and life skills related to a variety of valuable outcomes of interest to policymakers and employers. These include regular employment, aversion to criminal and other dysfunctional behavior, and the generation and growth of personal income and savings. Studies have shown that students who have at least a high school degree can expect higher average life expectancy (Meara, Richards, & Cutler, 2008) and that even 1-year increases in education can reduce the probability of dying in the next 10 years (Lleras-Muney, 2005). College attainment is associated with higher levels of overall health (Wirt et al., 2004) and better health care (Muennig, 2005; Rouse, 2005). Not surprisingly, future wealth is also dependent on educational attainment (Day & Newburger, 2002; Heckman & Carneiro, 2003; Rouse, 2005), and this extends the benefits of higher attainment rates beyond the individual to broader social benefits such as increased tax revenue and economic development (Belfield & Levin, 2007). Beyond pecuniary benefits, governments may also see reductions in crime associated with increases in educational attainment (Belfield & Levin, 2009; Levitt & Lochner, 2001). Although such relationships between attainment and future success may not be surprising, graduation rates are still disturbingly low nationwide, especially for boys and particularly in the nation's largest school districts (Greene & Winters, 2006).

Despite such importance, attainment is generally not well studied in the literature on school choice. Several early studies examined the effect of attending a Catholic high school on student attainment (Coleman & Hoffer, 1987; Neal, 1997). These studies generally concluded that students graduated at much higher rates if they attended Catholic high schools, especially if they were urban minorities. Graduation and postsecondary enrollment are increasingly of interest in studies of other school choice policies. Most notably, a multistate study of charter schools found large attainment gains for students who moved from traditional public schools to charter schools (Zimmer et al., 2009), and a study of public school choice in Chicago indicated modest impacts of choice on the probability of high school graduation (Lauen, 2009). In the school voucher literature, only two studies have examined the association between participating in a voucher program and graduating from high school. A recent experimental evaluation of Washington, DC's federal voucher program concluded that using a voucher increased the likelihood of high school graduation by 21 percentage points (Wolf et al., 2013). An observational study of a limited set of high schools in Milwaukee reported that

they graduated their voucher students at a rate about 12 percentage points higher than the system-wide graduation rate for Milwaukee's public schools (Warren, 2011).

In this article, we consider data from a state-mandated evaluation of the City of Milwaukee's large, publicly funded school voucher program. We provide evidence that attainment may indeed be related to the school choices families make, at least insofar as these choices pertain to a voucher-funded private or traditional public school. That Milwaukee is a large, urban school district only adds to the importance of the question of whether school choice boosts the levels of student attainment. If quality of life is directly related to educational attainment, if attainment is a direct result of certain schooling conditions to which a student is exposed, and if these schooling conditions may vary as a result of individual parent and student decisions, then the long-term social and economic consequences of school choice programs may be far greater than the impact of such policies on more transitory outcomes like individual test scores. We proceed with our analysis by describing the state-mandated evaluation on which it was based, and the data and analytical procedures we employ. Next we present basic tabulations and statistical models of high school graduation and postsecondary enrollment, and consider reasons why students did not complete a high school degree. We then consider the characteristics of postsecondary institutions attended by voucher or public school students. We conclude by presenting several caveats to this work, and by discussing our results in the context of ongoing and future research on public–private differences in student outcomes.

Background, Data, and Student Matching Procedure

The State-Mandated Evaluation of the Milwaukee Parental Choice Program

The Milwaukee Parental Choice Program (MPCP) is the oldest and largest publicly funded urban voucher program in the United States. The program began in a pilot stage in 1991 and has since been expanded multiple times beginning in the late 1990s. Initial evaluations of the pilot program remain a major component of the literature on voucher impacts, whether from the state's official evaluator (summarized in Witte, 2000) or subsequent analyses by outside scholars (Greene et al., 1999; Rouse, 1998). In 2005, the program was reauthorized and expanded to a maximum of 22,500 students (2005 Wisconsin Act 125). The reauthorization also began the first evaluation of the post-pilot program. The 2005 law directed our independent group of researchers to construct a "representative panel" of voucher students to track over a 5-year period. The first report of this evaluation was presented in 2008 (Witte, Wolf, Cowen, Fleming, & Lucas-McLean, 2008), with subsequent yearly reports occurring through 2011–12. We were also required to track a "comparable" group of Milwaukee Public Schools (MPS) students through the same period. Because randomization into either sector was not provided by statute, we matched the representative panel of voucher students to public school students in the same census tract, with the same

observable demographics, and the same baseline standardized test scores when the study began in 2006.

Although the statutory requirements of our evaluation directed a primary focus on student test scores for students in grades 3 through 8, we also considered students enrolled in 9th grade, with a specific eye toward examining their educational attainment levels 4 years later and beyond. Because less than one third of voucher schools serve high school students, we were able to consider all 9th grade students enrolled in the program in 2006 rather than a representative sample. These 801 students, along with 801 carefully matched MPS students also in 9th grade in 2006, represent the primary sample for the present study. In addition to these 1,602 students, this article includes samples of 290 students in MPCP and 290 students in MPS who were in 8th grade in 2006–07 and who, if proceeding on normal progress, would have completed their 12th grade year of high school as of the summer of 2011. They are the 8th graders originally from the grade-stratified representative samples drawn for the related longitudinal achievement evaluation described above. As with the 9th graders, these 8th grade MPCP students were matched to MPS students per below.

Sample Matching Algorithm: Minimizing Observed and Unobserved Student Differences Associated with MPCP Enrollment

As described above, we were not permitted by state statute to randomly assign our representative panel of students to receive school vouchers. This would have been the preferred strategy to identify internally valid estimates of any subsequent programmatic effects. On the other hand, because we were able—and, indeed, required—to select a comparison sample of MPS students from the outset of our study, we were able to design the process in a way that we believe reduces identification problems faced by observational policy studies.

Neither we nor other researchers evaluating school choice programs believe that students who select alternatives to the public sector do so for random reasons. If nonrandom reasons are also related to the outcome of interest, then any differences attributed to the impact of the choice program could be biased. In the case of this study, we were particularly worried that students who chose to participate in the MPCP at baseline may be more likely to graduate high school and enroll in college naturally, regardless of the school they attend. Such factors could be immeasurable and therefore threaten to bias the analysis. When random assignment is not possible, analysts often rely on matching procedures such as propensity score estimation to balance the effects of observable characteristics between program participants and nonparticipants (e.g., Rosenbaum & Rubin, 1983). We employ such a strategy here, but with additional steps to help reduce the impact of unobservable characteristics as well.

In the first stage we matched students on their home neighborhoods in Milwaukee. We did this in sequence for each MPCP student. Following the advice of demographers and city planners, we used census tracts to identify student neighborhoods. Census tracts are drawn by the U.S. Census Bureau to follow neighborhood boundaries. In our sample, MPCP students come from 175 different census

tracts in the City of Milwaukee. In this stage, for any given MPCP student in our sample, we restricted the list of potential MPS matches to students in the same grade and tract. We prioritized a tract match because we believe that students' initial neighborhoods will serve as a control for a number of unobserved variables that may affect outcomes, including future educational attainment. Our strategy is supported by compelling recent evidence from the sociological literature that not only do students' home neighborhoods play an important role in determining whether students attend high quality public or private high schools (Lauen, 2007), but also that neighborhood location plays a strong role in determining student attainment, even after school-level influences on attainment are taken into account (Owens, 2010). It is precisely a set of variables that are correlated to both private school attendance and attainment that we wish to control for here. In addition, a recent study of an open-enrollment program (Bifulco, 2012) has demonstrated that matches based on geographic location and prior achievement indicators can minimize bias in estimates of choice impacts. More general evidence for neighborhood effects on social outcomes is presented across several social science disciplines.[1]

In the second stage, we matched students in their census tracts who were within the same 5th percentile bandwidth of test scores. We matched students in our longitudinal panel in grades 3–8 using the Wisconsin Knowledge and Concept Exam (WKCE), which 9th graders in Wisconsin do not take. However, 9th grade MPS students do sit for the Benchmark exam, which we obtained from the MPS district to administer to 9th grade MPCP panelists in November 2006, when their counterparts in MPS were sitting for that test as well. The 8th grade students in this report were matched based on the WKCE.

In the third stage of our match, if more than one MPS student was matched to the MPCP student based on census tract and test scores, we matched by estimating propensity scores (Rosenbaum & Rubin, 1983). In this step, we estimated the propensity of MPCP participation as a function of the mean of math and reading test scores, gender, race, and an indicator for students with English Language Learning status. We used the nearest neighbor selection criteria, so the MPS student with the closest propensity score to the MPCP student was then selected. If missing predictors made it impossible to predict a propensity score for the MPCP student, the MPS student was selected at random from MPS students remaining in the running after matching on census tract and prior test. If the missing predictor was student test score, matches were made at random within tract.

To summarize, for each MPCP student our matching algorithm

1. reduced the available MPS matches to students in the same grade within the same neighborhood census tract, then
2. reduced the available matches further to MPS students in the same tract and the same 5-percent bandwidth of 2006 test score, and finally
3. chose the MPS student from the same census tract with the same 5-percent test bandwidth and the nearest propensity score estimated as a function of student demographics.

Table 1. Statistics on Model Covariates

	MPCP in 2006	MPS in 2006
Black	0.70	0.70
Hispanic	0.19	0.18
Asian	0.03	0.04
White	0.07	0.07
Female	0.57	0.53
Math 2006	–0.04*	0.04
Reading 2006	0.15**	0.02
N	1,091	1,091

Notes: Significantly different from Milwaukee Public School (MPS) at $^{**}p < 0.05$, $^{*}p < 0.10$ Statistics are weighted for survey nonresponse for consistency with model estimation, although race and gender based on 801 MPS students and Milwaukee Parental Choice Program (MPCP) students; sources for sector and demographic are MPS official enrollment files, 2006–09 and enrollment confirmations from private schools in the MPCP, 2006–09; source for Benchmark achievement are MPS test files (MPS) and project-administered examinations in 2006. Test score differences based on complete test score N of 1,024 MPS students and 873 MPCP students.

Table 1 provides information on the observable characteristics that we are able to employ in subsequent model estimation below. The table indicates no significant demographic differences, but MPCP students scored higher on math test scores and lower on reading scores in 2006. These differences are accounted for in models below, but we note that together they provide no clear pattern of exceptional performance favoring one sector of our match over the other, and these differences are considerably smaller than raw, unmatched sector comparisons would indicate (Witte et al., 2008). In addition, survey data taken after the first year of testing (Witte et al., 2008) indicated that the two groups were highly similar in other additional family background characteristics that could not be used for the match, although MPCP parents indicated more frequent religious attendance. Finally, readers will note that we have no controls for common measures such as free/reduced lunch or special academic needs. The MPCP program is means-tested according to federal poverty guidelines, but many schools do not participate in free/reduced lunch (Witte et al., 2008), and similarly, many do not flag students with special needs even though the same students may be so identified when they return to the public sector (Wolf, Witte, & Fleming, 2012). For the most part, we must rely on our neighborhood matching and baseline test score matching to proxy for income and academic ability, respectively, an assumption justified through sensitivity analyses using a subsample of survey respondents as we describe in greater detail below.

Our matching algorithm is intended only to reduce confounding explanations associated with attending private school in our baseline year. Thus in the analyses that follow, we focus entirely on *initial status* in public or private school in 2006. From a policy perspective, this requires us to interpret our estimates as exposure to private school rather than sustained participation in that sector. In recently published work (Cowen, Fleming, Witte, & Wolf, 2012), we present a full-scale analysis of students who exited the voucher sector during our time frame of study, showing statistically significant post-match differences in samples of students who left and those who stayed in the voucher program.[2] If, in addition to these observable differences, there

are unobservable characteristics linked to post-match sector sorting, a comparison of outcomes based on final sector location is likely to be biased. Our focus on program exposure is analogous to an intent-to-treat parameter in randomized control trials of policy interventions, where researchers focus on treatment status at the study's inception to preserve internal validity achieved in the original research design.

Data Sources for Graduation and Postsecondary Enrollment

High School Graduation. The panelists described above would have graduated "on time" in the spring of 2010 or 2011, depending on whether they were in 9th or 8th grade in the fall of 2006. We used two primary sources of information to determine student graduation status. The first was a set of administrative files: a graduation list and a supplemental end-of-year enrollment status file from MPS dated after the 2009–10 and 2010–11 school years, and a similar list of 2010 and 2011 graduates from each of the participating MPCP high schools. We examined both lists for all students in our study who were in either 8th or 9th grade in 2006. Specifically, we checked both the MPCP and MPS graduation lists for the original 1,091 MPCP panelists and checked both the MPS and MPCP graduation lists for the 1,091 MPS panelists.

These sources, while valuable for confirming graduation status and current enrollment, did not provide us with all information needed for our analysis. In particular, we could not identify students who may have graduated from schools outside of either MPCP or MPS. For this information, we attempted to contact parents of all original 9th grade panelists via a telephone survey in the summer of 2010. We received responses from 61.3 percent (491/801) of the original MPCP panelists and 62.6 percent (501/801) of the original MPS panelists. These are very high response rates for populations of students in urban areas, particularly for families of students who entered the analysis via a procedure that took place 4 years earlier. Students did not vary by race among respondents and nonrespondents. The respondents were slightly more likely to be female and had higher Benchmark scores in 2006 than nonrespondents. In the analysis below, we use response weights to correct for any baseline differences. In the summer of 2011, we attempted to contact nonrespondents to the 2010 survey, as well as all 580 members of the refresh sample (students who were in 8th grade in 2006). These follow-up rates were considerably lower (27 percent for each sector), although the addition of these follow-up data increases the response of the original 9th grade sample to nearly 75 percent. Among students with both survey and administrative sources of data, attainment status was confirmed in both sources in 94 percent of cases.

Postsecondary Enrollment. The maximum level of attainment that an "on time" student in our data could achieve is enrollment in a postsecondary institution. This information is more straightforward than high school graduation. We cross-checked our list of all 2,182 student panelists against information provided by the National Student Clearinghouse of College Enrollment. We do not have student social security numbers, but we matched our panelists on first, middle, and last name as well as birthday, in a manner similar to studies conducted by the MPS system itself (Carl,

Table 2. High School Graduation and Postsecondary Enrollment Rates (2009–11)

	MPCP in 2006 (%)	MPS in 2006 (%)	Difference
Graduation			
On-time graduates			
2006–07 9th graders	76.0	69.0	7.1***
2006–07 8th graders	73.7	71.6	2.1
Five-year graduates (2006–07 9th graders only)	5.4	9.5	–4.1***
Ever graduated	79.0	76.0	3.0
Postsecondary enrollment			
Two years	12.1	14.0	–1.9
Four years	25.8	21.5	4.2**
Persist in 4-year (baseline 9th grade only)	21.0	17.9	3.1

Notes: ***$p < 0.01$, **$p < 0.05$. Sources for graduation status: Milwaukee Public Schools (MPS) enrollment database as of fall 2011; official 2010 and 2011 graduation lists of all private high schools participating in the Milwaukee Parental Choice Program (MPCP); parent telephone survey regarding student status administered in the summer of 2010 and 2011. Graduation estimates weighted for nonresponse and missing data. Source for postsecondary enrollment: National Clearinghouse Data retrieved September 2011; enrollment rates are for Fall–Spring 2010 or Fall–Spring 2011.

Goldrick-Rab, Lexmond, & Lindsey, 2009). We cross-checked enrollment in technical, 2- and 4-year institutions nationwide, and examined lists as early as 18 months prior to an on-time graduation in 2010 or 2011 through September 2011. We considered "enrollment" to be any time during the 2010–11 or the 2011–12 academic year. We also considered whether the original 9th graders who enrolled in college on time (2010) persisted in college in 2011. Unlike high school status, where we could not strictly consider students to be nongraduates simply because they did not graduate from MPS or MPCP, we consider non-enrollment in Clearinghouse records to be an affirmative sign of failure to enroll in a technical, 2- or 4-year institution located anywhere in the United States. Thus we have no missing data on this outcome in the sample.

Graduation and Postsecondary Enrollment Rates

Descriptive Statistics of Graduation and Enrollment Rates

Table 2 presents our estimated graduation, 2-year/technical, and 4-year college attainment rates based on the initial status of panelists during our 2006 baseline. These rates are calculated excluding students with unknown status from the denominator but weighted for missing data.[3] The MPS rates of 69 to 72 percent (depending on the cohort) are well within the range reported in an official MPS analysis of student attainment released in 2009 based on earlier cohorts of students (Carl et al., 2009). The MPCP rate is higher than the MPS rate, at 74 to 76 percent (depending on the cohort). Of the nongraduates, some may still be enrolled in school—these would be students who take longer than the expected 4 years to graduate—or they may have dropped out.[4] Table 2 indicates that MPS students are more likely than MPCP students to graduate in 5 rather than 4 years, and that after these graduates are accounted for, the overall difference with MPCP in graduation rates is reduced. Finally, the table also indicates that MPCP students were marginally more likely to

enroll and persist in a 4-year institution, and somewhat less likely to enroll in a 2-year institution, although only the 4-year initial enrollment difference is statistically significant at conventional levels.

Why Did Students Not Graduate?

We now consider explanations for students who did not graduate. As we have discussed, these students fall into two general categories: those who did not graduate because they were no longer enrolled in school, and those who did not graduate because they were still enrolled. Twenty-two percent of our original MPS panelists did not graduate but were classified as still in school, while 18 percent of our original MPCP panelists did not graduate but were classified as still in school. We place much less confidence in our ability to accurately estimate dropout rates than we do graduate or enrollment rates. Graduation with a high school diploma is a discrete event that can be verified. Dropping out of high school, on the other hand, is more of a process. Students on the path to dropping out may begin by missing multiple days of school, and then attend only occasionally. Finally, they may stop showing up altogether. Throughout the process of dropping out students may remain officially registered at the school. Some students who disappear from administrative data may simply have enrolled elsewhere. Thus, instead of reporting complete dropout rates, we simply allow readers to infer who has yet to graduate from the reported graduate rates and explore here some of the reasons that survey respondents gave for leaving school.

Combining responses from both surveys described above, we have responses from 110 parents of dropouts. Thirty-nine of the responses come from the survey in 2011, and 71 responses are from the 2010 survey. Approximately 83 percent (91 responses) of the respondents are parents of original 9th grade students, while 17 percent (19 responses) of the respondents are parents of original 8th grade students. Table 3 reports the results of several questions to which parents of high school dropouts responded. These answers provide explanations for why their children left high school. Answer categories were not mutually exclusive, and parents could cite more than one.[5] As Table 3 indicates, the most common explanation for dropping out in both sectors of original panelists was that their child did not like school. Similar answers—that students disliked a new school, did not like their teachers, or were bored in school—were less common but still relatively prominent among the explanations.

MPCP parents were more likely to list these as reasons than were MPS parents. For example, approximately 32 percent of MPCP parents said that their child dropped out of school because he or she was bored, while only 21 percent of MPS parents answered similarly. These are general, somewhat ambiguous answers because the reasons *why* a child did not like school (or was bored) could be myriad, ranging from an overall perception that school was a waste of time to problems with teachers or peers. A second potential reason for disliking school could be genuine difficulty understanding the coursework. An inability to keep up with school work

Table 3. Reasons for Leaving High School Prior to Graduation

	MPCP	MPS
"My child didn't like school"	38.30	34.92
"My child thought it would be easier to get a GED"	34.04	31.75
"My child was bored in school"	31.91	20.63
"My child could not keep up with the schoolwork"	27.66	19.05
"My child needed to take care of or support his/her family"	21.28	17.46
"My child changed schools and didn't like the new school"	21.28	12.70
"My child didn't get along with his/her teachers"	19.15	9.52
"My child was suspended or expelled from school"	17.02	14.29
"My child didn't get along with other students"	8.51	9.52
"Child incarcerated"	6.38	11.11
"Child was too ill to attend school" or "Child has mental health issues"	6.38	7.94
"Child is/was pregnant" or "Child got married" or "Child had a baby"	6.38	6.35
Number of respondents	47	63
Number of responses	95	106

Notes: Figures based on the 110 survey respondents whose child left high school between 2006–07 and 2010–11. Sector designation pertains to original baseline sector. Categories are not mutually exclusive (respondents could give more than one answer). Source: parent telephone survey regarding student status administered in the summer of 2010 and the summer of 2011.

was indeed a relatively frequent response for both sectors. In fact, for almost one third of the respondents, the notion that obtaining a GED would be easier than graduating high school was a reason for dropping out. In the sample, only nine survey respondents among MPS panelists (1.8 percent) and six MPCP respondents (1.2 percent) had actually obtained a GED.

Behavioral problems also appear to be prevalent explanations for dropping out. Dropping out because the student was suspended or expelled was somewhat more common among MPCP children (17 percent versus 14 percent), while MPS students were almost twice as likely to have dropped out because of incarceration (11 percent versus 6 percent). It is difficult to directly compare the expulsion/suspension figures between the two sectors, however, because expulsion/suspension is a formal process within MPS—one that may involve legal implications as well. On the MPCP side, while some students could be formally removed from their school, they may also be "counseled out" or "asked not to return" in lieu of such a formal measure. Our full-length analysis of student transfers (Cowen et al., 2012) has indicated that these explanations were among the reasons why students left their original MPCP schools (regardless of whether they actually dropped out of school entirely). Similar numbers of students dropped out because of pregnancy or marriage—about 6 percent in each sector. On the other hand, MPCP students were more likely to quit school in order to take care of their families (21 percent) than were MPS students (17 percent).

Overall, it appears that the most important reasons for dropping out of high school were relatively common in both sectors. Dropping out was most clearly related to a general dislike of school, and/or problems that could be related to learning difficulties or even underlying ability. This explanation was particularly common on the MPCP side. These explanations should surprise neither policymak-

ers nor educators. If there is anything unexpected in these results, it is the fact that the dominant reasons for dropping out are similar in both sectors.

Estimates of Attainment Models

Initial Estimates

Table 2 suggests that exposure to the MPCP marginally increases the likelihood that a student graduates, especially on time, and similarly increases the likelihood of attending a 4-year college. Our matching algorithm was designed to minimize the possibility that student characteristics might confound and therefore bias the impact of exposure to private school on the probability of attaining a certain educational level, but we proceed with model-based estimates of the differences in Table 2 to confirm whether graduation probabilities still differ after other factors such as race, gender, and academic ability are explicitly taken into account.

Our basic model conditions the probability that a given student, *i*, reached a certain attainment outcome as follows:

$$\text{Prob}(Attain) = \beta_0 + \delta_1 MPCP06_i + \beta_1 X_i + \beta_2 test_{2006} + \varepsilon_i \quad (1)$$

which we estimate via probit, where for each attainment outcome of interest (completing high school, enrolling in a 2- or 4-year institution, or persisting in a 4-year institution), δ_1 is the difference associated with exposure to MPCP (enrolled in the program in 2006) after accounting for the vector *X* of student race, gender, and baseline grade (8th or 9th) indicators; and $test_{2006}$, a vector of student math and reading test scores measured in 2006, standardized to have a mean of zero and standard deviation of one.[6] We intend these test scores as a control function for unobservable student characteristics that may influence subsequent attainment decisions. This is useful because, despite our matching procedure in 2006, the MPCP effect on graduation may be explained by student differences that may be correlated with student ability as expressed by baseline student achievement in that sector. Our data, while valuable in many respects, do not contain the sort of rich administrative detail on the MPCP side that other studies based solely on administrative public-school records contain. As a result, $test_{2006}$ may proxy for other covariates related to both sector exposure at the time of the test and attainment status 4 or more years later. Finally, we cluster the standard errors of estimates of equation (1) by neighborhood, to adjust for shared variance associated with these locales (e.g., Lauen, 2007; Owens, 2010).

Table 4 provides the estimates of equation (1), and these indicate that the graduation difference associated with attending MPCP in 2006 is statistically significant at $p = 0.12$, but not at the $p < .10$ or $p < 0.05$ levels. The probit coefficient translates into a marginal effect of 0.03 that is comparable to the on-time graduation rates reported in Table 2. Table 4 also indicates that MPCP students are slightly less likely to attend a technical or 2-year college, but there is a significant and positive MPCP difference for enrolling or persisting in a 4-year college, where persistence is defined as enroll-

Table 4. Predicting Attainment Outcomes (2009–11)

Variables	Graduate from High School	2-Year College	4-Year College	Persist in 4-Year College
MPCP in 2006	0.13 + (0.081)	–0.13* (0.075)	0.20*** (0.065)	0.20** (0.081)
Black	0.07 (0.144)	0.22 (0.145)	0.00 (0.127)	–0.19 (0.151)
Hispanic	0.04 (0.149)	0.01 (0.161)	–0.14 (0.140)	–0.26 (0.166)
Asian	0.99*** (0.274)	0.23 (0.214)	0.17 (0.207)	0.19 (0.250)
Female	0.24*** (0.079)	0.04 (0.080)	0.39*** (0.066)	0.34*** (0.088)
Math 2006	0.19*** (0.056)	0.09* (0.055)	0.17*** (0.049)	0.18*** (0.062)
Reading 2006	0.17*** (0.047)	0.04 (0.046)	0.40*** (0.051)	0.35*** (0.059)
Constant	0.65*** (0.141)	–1.14*** (0.148)	–1.01*** (0.127)	–1.07*** (0.153)
N	1,475	1,830	1,830	1,263
Marginal MPCP effect	0.034	–0.026	0.054	0.052

Notes: ***$p < 0.01$; **$p < 0.05$; *$p < 0.10$; + $p < 0.15$ two-tailed. Estimates are probit coefficients. Standard errors are clustered by 2006 census tract. Sources for sector and demographic are Milwaukee Public Schools (MPS) official enrollment files, 2006–09 and enrollment confirmations from private schools in the Milwaukee Parental Choice Program (MPCP), 2006–09. Sources for Benchmark achievement are MPS test files (MPS) and project-administered examinations in 2006. Source for postsecondary enrollment is the National Student Clearinghouse, enrollment verified at any time during the 2010–11 or 2011–12 academic years. Persistence in 4-year college is restricted to students who were part of the original 9th grade panel. Estimates weighted for nonresponse and missing data. Models adjust for baseline grade (primary 9th or 8th grade refreshed samples). Estimated marginal MPCP effect calculated based on MPCP in 2006 coefficient in corresponding column.

ment in a 4-year college in both 2010 and 2011. Translated into marginal effects, the probit coefficient indicates that a student in MPCP in 2006 was approximately 5 percentage points more likely to attend or persist in a 4-year institution 4 to 5 years later. Other characteristics are in the expected directions: African Americans were considerably less likely to enroll or persist in college, and female students were more likely. Higher scores on math and reading exams in 2006 were also strongly correlated with the probability of graduation and college enrollment

Subsample Controls for Parental Characteristics

As noted above, one of the motivations for our original matching algorithm was to reduce differences between the MPCP and MPS students on characteristics that we could not observe. The matching scheme relied primarily on the neighborhood and 2006 test scores to proxy for unobserved attributes that may be related to both sector choice and to the outcome of interest. In many program evaluations, analysts also employ the lagged value of the outcome as a predictor for its current level and interpret estimated post-program differences as the "value added" of the intervention. Although prior achievement levels are strongly correlated with attainment, per Table 4, they are not actually measures of attainment. Indeed, such a prior measure is by definition all but impossible to obtain. However the next best thing could be the educational attainment of a student's parents. Indeed, as Table 5 indicates for our study, the college enrollment rates of MPCP and MPS students alike are much higher for those whose parents received a college degree. Our baseline 2006 and 2007 surveys included information on parental education, and we are able to test whether

Table 5. Student 4-Year Enrollment by Parental Education Level

Maximum Parent Education Level	% Enrolled in 4-Year College
Less than high school degree	17.7
High school degree	22.8
Some college	26.5
College degree	38.2

Notes: Source for student postsecondary enrollment is the National Student Clearinghouse, enrollment verified at any time during the 2010–11 or 2011–12 academic years. Source for parental education is project-administered surveys in 2006 and 2007.

Table 6. Attainment Differences After Adjusting for Parental Characteristics

Variables	Graduate from High School	2-Year College	4-Year College	Persist in 4-Year College
Student characteristics				
MPCP in 2006	0.16* (0.095)	–0.05 (0.090)	0.14* (0.080)	0.16 (0.106)
Black	–0.03 (0.176)	0.11 (0.173)	0.01 (0.150)	–0.14 (0.172)
Hispanic	0.18 (0.206)	0.11 (0.191)	–0.06 (0.169)	–0.20 (0.205)
Asian	1.05** (0.443)	0.06 (0.423)	0.29 (0.291)	0.11 (0.393)
Female	0.30*** (0.099)	0.01 (0.094)	0.48*** (0.089)	0.50*** (0.117)
Math 2006	0.11* (0.068)	0.02 (0.066)	0.14** (0.059)	0.17** (0.068)
Reading 2006	0.19*** (0.055)	0.05 (0.060)	0.36*** (0.065)	0.30*** (0.071)
Parent characteristics				
Two-parent home	0.16 (0.131)	0.02 (0.127)	0.08 (0.104)	–0.00 (0.128)
Inc. > $50 K	0.26 (0.200)	0.20 (0.173)	–0.12 (0.139)	0.04 (0.183)
Inc. $35–49 K	0.13 (0.148)	0.13 (0.137)	0.06 (0.121)	0.15 (0.145)
Inc. $25–34 K	–0.14 (0.124)	–0.08 (0.147)	–0.06 (0.118)	0.04 (0.143)
High school degree	0.14 (0.135)	0.23 (0.141)	0.25* (0.130)	0.06 (0.166)
Some college	0.28** (0.132)	0.37*** (0.142)	0.28** (0.121)	0.05 (0.167)
College degree	0.30 (0.199)	0.38** (0.182)	0.58*** (0.157)	0.39** (0.192)
Attend church	–0.13 (0.101)	0.07 (0.098)	–0.02 (0.097)	0.10 (0.121)
Constant	0.44** (0.207)	–1.51*** (0.226)	–1.29*** (0.186)	–1.33*** (0.250)
N	1,012	1,200	1,200	842
Marginal MPCP effect	0.041	–0.009	0.038	0.043

Notes: ***$p < 0.01$; **$p < 0.05$; *$p < 0.10$, two-tailed. Estimates are probit coefficients. Standard errors are clustered by 2006 census tract. Sources for sector and demographic are Milwaukee Public Schools (MPS) official enrollment files, 2006–09 and enrollment confirmations from private schools in the Milwaukee Parental Choice Program (MPCP), 2006–09. Source for Benchmark achievement are MPS test files (MPS) and project-administered examinations in 2006. Source for postsecondary enrollment is the National Student Clearinghouse, enrollment verified at any time during the 2010–11 or 2011–12 academic years. Persistence in 4-year college is restricted to students who were part of the original 9th grade panel. Source for parental education, income, marital status, and religious attendance is project-administered surveys in 2006 and 2007. Estimates weighted for nonresponse and missing data. Models adjusted for baseline grade (primary 9th or 8th grade refreshed samples). Estimated marginal MPCP effect calculated based on MPCP in 2006 coefficient in corresponding column.

the MPCP–MPS differences reported in Table 4 remain after adjusting for this important parental characteristic among the subsample of survey respondents.

Table 6 reports estimates of equation (1) with additional adjustments for parental education. We also include indicators of family income, religious behavior, and the presence of two parents in the home, characteristics that may be particularly related to voucher use (Cowen, 2010). All results are weighted to adjust for survey nonre-

sponse. As expected, whether a parent has a college degree is among the most important attainment predictors, even after accounting for other student characteristics: for example, the results indicate that the probability of attending a 4-year institution increased considerably for students whose parent had a college degree when compared with students with parents who did not graduate high school. All of the estimates of the MPCP–MPS difference remain positive and of approximately the same magnitude as those reported in Table 4, although only the high school graduate and 4-year enrollment differences remain statistically significant at a level approaching convention ($p < 0.10$, two-tailed). That the coefficient estimates are similar to those in Table 4 indicates that the reduction in significance is due at least partly to reducing the sample size to survey respondents, but it could also indicate that MPCP and MPS differences are more difficult to discern once these other attributes are taken into account. Nevertheless, the results in Table 6 generally confirm the positive MPCP difference in educational attainment, even after adjusting in particular for the attainment level of a student's parent.

Differences in College Destination

Because the data we collected on postsecondary enrollment came from the National Student Clearinghouse, we were able to link the student records to data on individual schools using the U.S. Department of Education's Integrated Postsecondary Education Data System (IPEDS). It is possible that MPCP and MPS students are more likely to attend different types of colleges. *A priori*, we might expect that if some MPCP students are attending elite private schools in the city of Milwaukee, they might be more likely to attend analogous institutions once they went to college. There are two ways to consider this question. The first is by simply examining the prominent schools in the data. As Table 7 indicates, MPCP students attended 48 different 4-year institutions, and MPS students attended 51 different 4-year institutions. The five most prominent are remarkably similar between the two sectors: University of Wisconsin-Milwaukee, Alverno College, University of Wisconsin-Whitewater, and Marquette University are four of the five most common in each sector. The only difference is that University of Wisconsin-Madison was slightly better represented among MPS students, and Mount Mary College was slightly better represented among MPCP students.

Table 7. Most Common 4-Year Institutions by Initial Sector (Baseline 9th Graders)

MPCP in 2006	MPS in 2006
University of Wisconsin-Milwaukee (25.8%)	University of Wisconsin-Milwaukee (26.5%)
Alverno College (7.2%)	Alverno College (8.2%)
University of Wisconsin-Whitewater (6.2%)	University of Wisconsin-Whitewater (6.2%)
Mount Mary College (6.2%)	University of Wisconsin-Madison (6.2%)
Marquette University (4.2%)	Marquette University (4.3%)
Total Different Institutions Attended: 48	Total Different Institutions Attended: 51

Notes: Source for postsecondary enrollment is the National Student Clearinghouse, enrollment verified at any time during the 2010–11 or 2011–12 academic years.

Table 8. Four-Year Institutional Characteristics by Initial Sector

	MPCP in 2006	MPS in 2006	Diff.
Out of state	0.06	0.06	0.00
Private	0.35	0.28	0.08**
Catholic	0.18	0.12	0.06**
Other religious	0.07	0.04	0.03**
Secular	0.75	0.84	–0.10***
Average % admitted	74.19	74.48	–0.29
Average tuition	11,234	9,775	1,479**
Average 75th percentile SAT Math	600.52	621.36	–20.84*
Average 75th percentile SAT Reading	580.90	595.88	–14.98
Average 75th percentile ACT Math	24.47	25.20	–0.74**
Average 75th percentile ACT English	24.47	25.12	–0.64**

Notes: ***$p < 0.01$; **$p < 0.05$; *$p < 0.10$. Private, Catholic, Other religious categories are sample proportions of students in each sector attending schools of each type. Other cells are sample averages of each institutional characteristics. Source for postsecondary enrollment is the National Student Clearinghouse, enrollment verified at any time during the 2010–11 or 2011–12 academic years.

The second way to consider the question is by features of each institution. Table 8 provides summary statistics of all 4-year schools attended by panelists, by sector control, religious affiliation, admission rate, entrance exam scores, and tuition. The table indicates that MPCP and MPS students are unlikely to attend institutions outside of Wisconsin. MPCP students are more likely to attend religious institutions—especially Catholic colleges—and, correspondingly, less likely to attend secular schools. Average tuition at schools attended by MPCP panelists is slightly higher, while the average percent admitted is similar for both types of students. Average ACT and SAT scores are somewhat higher at schools attended by MPS students.

Discussion and Study Limitations

The results here suggest that students who used a voucher to attend private school in 8th or 9th grade were more likely to graduate high school. They were also more likely to enroll in a 4-year postsecondary institution after graduating and, when applicable, to persist in that 4-year institution beyond the first year of enrollment. The matching algorithm on which our study is primarily based is largely justified by recent evidence suggesting that neighborhood location is related to both private school choice (Lauen, 2007) and educational attainment (Owens, 2010). In addition, our match on 2006 test scores and our reliance on propensity scores (e.g., Rosenbaum & Rubin, 1983) further reduces bias, as does our regression-based adjustments of the MPCP difference. Finally, a recent analysis of school choice data from Bifulco indicates that matching students by "geography" and initial test scores, as we did here, reduces self-selection bias to a trivial amount (Bifulco, 2012). We fully concede, however, that these are not substitutes for a strictly controlled randomized field trial of such a program—an option that was statutorily unavailable to our official evaluation of the program. Readers who are, as a consequence, not persuaded that we have identified fully valid programmatic effects of exposure to MPCP should con-

Table 9. Predicting 9th Grade Private School Enrollment by 8th Grade MPCP Students

Variables	Enrolled in MPCP in 9th Grade
Black	0.26 (0.356)
Hispanic	0.38 (0.407)
Female	0.32 (0.205)
Math 2006	–0.05 (0.171)
Reading 2006	0.16 (0.171)
Two-parent home	–0.15 (0.272)
Inc. >$50 K	–0.42 (0.572)
Inc. $35–49 K	0.24 (0.292)
Inc. $25–34 K	0.03 (0.245)
High school degree	–0.59* (0.299)
Some college	0.07 (0.296)
College degree	0.05 (0.344)
Attend church	0.26 (0.209)
Constant	–0.66 (0.426)
N	180

Notes: ***$p < 0.01$; **$p < 0.05$; *$p < 0.10$, two-tailed, based on standard errors reported in parentheses. Estimates are probit coefficients, Asian coefficients dropped due to perfect prediction. Sources for sector and demographics are Milwaukee Public Schools (MPS) official enrollment files, 2006–09 and enrollment confirmations from private schools in the Milwaukee Parental Choice Program (MPCP), 2006–09; source for WKCE exams are MPS test files (MPS) and project-administered examinations in 2006. Source for parental education, income, and religious attendance is project-administered surveys in 2006 and 2007.

sider our results to be descriptive differences between students who otherwise shared the same demographics, earlier levels of achievement, neighborhood location and—for those for whom we have the information—parental education, income, and religious behavior.

There are additional caveats to these findings. There are far fewer high school students and schools in the MPCP than students and schools in the K-8 range. The 801 9th grade panelists we examined in 2006 were the population of 9th graders in the MPCP that year. In total, the students in the MPCP numbered more than 17,000 in 2006. Less than a quarter of more than 110 MPCP schools served high school students in 2009–10. These small numbers could exacerbate the selection bias problems described above, if students who enter or who stay in the MPCP for high school are doing so specifically to increase their attainment chances, or if MPCP schools implicitly or explicitly select the better students. The latter possibility is frequently raised in academic research if the best private schools can "counsel out" or even expel students that public schools cannot, or if 8th graders in voucher programs must apply to highly selective college preparatory high schools. Although we cannot test these possibilities directly, we can consider a likely result of such forms of "cream-skimming" by examining MPCP students who were in 8th grade in 2006. We find no systematic evidence that those students who remain in the MPCP for 9th grade are dramatically different in terms of demographics or prior achievement from MPCP students who switch to the MPS for high school (Table 9). At present, this suggests that if there is an unobservable selection effect driving the MPCP differences noted above, it does not appear to be related to a host of student characteristics

Table 10. Predicting 12th Grade Voucher Use

Variables	Basic Model	With Parental Controls
Black	–0.06 (0.165)	0.05 (0.181)
Hispanic	0.31 (0.188)	0.61*** (0.213)
Asian	0.14 (0.282)	0.07 (0.402)
Female	0.09 (0.092)	0.06 (0.108)
Math 2006	0.08 (0.053)	0.05 (0.073)
Reading 2006	0.20*** (0.053)	0.17** (0.070)
Two-parent home		–0.17 (0.126)
Inc. > $50 K		–0.13 (0.318)
Inc.$35–49 K		0.03 (0.157)
Inc. $25–34 K		0.04 (0.123)
High school degree		–0.02 (0.156)
Some college		0.18 (0.163)
College degree		0.46** (0.227)
Attend church		0.22** (0.108)
Constant	–0.15 (0.176)	–0.40 (0.252)
N	864	617

Notes: ***$p < 0.01$; **$p < 0.05$; *$p < 0.10$, two-tailed. Estimates are probit coefficients. Standard errors are clustered by 2006 census tract. Sources for sector and demographics are Milwaukee Public Schools official enrollment files, 2006–09 and enrollment confirmations from private schools in the Milwaukee Parental Choice Program, 2006–09. Sources for Benchmark achievement are MPS test files (MPS) and project-administered examinations in 2006. Source for parental education, income, marital status and religious attendance is project-administered surveys in 2006 and 2007. Estimates weighted for nonresponse and missing data. Models adjusted for baseline grade (primary 9th or 8th grade refreshed samples).

we would expect to be relevant if MPCP schools were selectively enrolling the better students, or displacing other students between 8th and 9th grade.

A second caveat is that less than half (44 percent) of the original MPCP panelists examined were enrolled in a voucher school by the time they reached 12th grade. As we have stressed repeatedly above, the results of this article as a whole should therefore be interpreted as the difference associated with *exposure* to the MPCP several years before graduation or college enrollment rather than with a long-term career in that sector. Table 10 indicates (and a full-length treatment of exiting students in Cowen et al., 2012, demonstrates in greater detail) that students who remain in the voucher sector over time are more likely to be higher performing students. Students who remain in private school after initially using a voucher may be considerably different in important ways from those who are exposed at one period of time, and although such "stayers" may be of substantial policy interest in their own right, we are unable to identify the impact of such behavior on college enrollment beyond the controls we use in our "exposure" models in Tables 4 and 6. Such a limitation is present even in randomized control trials of voucher impacts (e.g., Howell et al., 2006; Wolf et al., 2013), which necessarily focus on "exposure" to a voucher; since randomization cannot force students to accept or remain in private school, those who leave may be far different from those who stay (Howell, 2004).

Finally, we have yet to fully consider why voucher schools should have higher attainment rates. It is possible that some private schools operate specifically to

promote graduation and higher education, and attending such schools even for a short time simply raises student and family expectations. Our controls for student background and our emphasis on exposure rather than duration in the voucher sector mitigate some of the unobserved explanations that may link students to these schools, but we cannot eliminate the possibility that private schools are better able to select and retain students they believe will succeed in their program. These schools may also be able to selectively focus on students at the margins, giving additional attention to those in danger of dropping out or additional assistance to those choosing between 2- and 4-year colleges. Prior to 2010, voucher schools were not subject to the high-stakes testing requirements faced by their public counterparts, and those that tested did not have to report their scores. Thus other factors—graduation rates, college enrollment rates among them—may represent a key portion of these schools' marketability. As a result, private schools participating in voucher programs may focus more attention and resources on pushing students through to graduation and college enrollment. For example, qualitative research on some of the high schools in the MPCP suggest that they employ a variety of interventions and strategies to help students keep up with their course work, accumulate sufficient credits, and take seriously the postsecondary educational opportunities available to them (Stewart, Jacob, & Jensen, 2012).

The direction of these results is broadly consistent with research in other cities and other school choice programs (Wolf et al., 2013; Zimmer et al., 2009). In earlier school choice studies, the positive difference in educational attainment was apparent even when standardized test scores appeared to be relatively unaffected by the choice program (e.g., Wolf et al., 2013). Likewise, in all but 1 year of our analysis of student test scores (Witte, Carlson, Cowen, Fleming, & Wolf, 2012) we found that students exposed to MPCP did no better on those exams than students in traditional public schools. If policymakers should interpret these results as evidence that voucher students are performing slightly better on one metric—attaining a given level of education—the results nonetheless *do not* support a comprehensive conclusion that the Milwaukee voucher program necessarily provides a better learning environment than its public school counterpart. These results do not imply a trade-off between test scores and attainment, but they do suggest that policymakers and advocates alike should focus on a variety of outcomes when assessing school effectiveness. Such a focus may necessarily require weighing short-term costs against long-term benefits: if one of the primary benefits associated with school choice programs is an increase in educational attainment, several years of sustained investment in such programs may be required before these outcomes begin to reflect real improvement in the lives of the children they serve.

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Notes

All authors gratefully acknowledge the research support of the Annie E. Casey, Joyce, Kern Family, Lynde and Harry Bradley, Robertson and Walton Family Foundations. Responsibility for the content of this article remains the authors' alone. Address correspondence to Dr. Joshua Cowen, Martin School of Public Policy andAdministration, University of Kentucky. 859-257-4387; joshuacowen@uky.edu.

1. See, for example, Aaronson (1998) for evidence of neighborhood effects on educational outcomes even after family characteristics are taken into account; Ludwig, Ladd, and Duncan (2001) and Leventhal and Brooks-Gunn (2004) for experimental evidence linking neighborhood improvements to improvements in student outcomes; and Sampson, Morenoff, and Gannon-Rowley (2002) for a general discussion. See also Cullen, Jacob, and Levitt (2005) for use of census tract information in research on school choice.
2. In the sample we employ in this attainment analysis, 44 percent of original panelists remained in the voucher sector through 12th grade.
3. If unknowns were to be included, the rates would obviously be lower, but this would be tantamount to assuming that all unknowns did not graduate. If a greater percentage of unknowns graduated than knowns, our reported rates are too low. If the reverse, our rates are too high. For comparative purposes between sectors, to be biased one would have to assume that more unknowns graduated in one sector than the other. We have no evidence that is true.
4. They may also have completed a GED, although given the short period of time between the end of the school year (June) and our surveys (midsummer), this is highly unlikely. Only 1 percent of respondents indicated that they had already received a GED.
5. On average, the MPCP parents provided more reasons for why their child dropped out than did MPS parents. This leads to the percentage for many of the reasons to be higher for MPCP parents than for the MPS parents.
6. We use 9th grade student Benchmark scores and 8th grade student WKCE scores, each standardized by test type, grade, and year. The baseline grade indicator 8th or 9th in the X vector accounts for intercept differences pertaining to whether the student was in our refreshed or primary samples, respectively.

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