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The Predictors of School Growth and Closures in Milwaukee

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The Education Marketplace: The Predictors of School Growth and Closures in Milwaukee

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Executive Summary

Despite the fact that improvement to the overall educational marketplace is one of the hallmark arguments of advocates for school choice, few evaluations have focused on the supply and demand within the education marketplace in a school choice environment. Because traditional public schools are not subject to the same level of competitive pressures as private schools, we expect that measures of school quality will be more likely to predict closures for private schools than Milwaukee Public Schools.

We answer this question by performing survival analyses using data from public, private and charter schools in Milwaukee from 2005 to 2016. Data on enrollment trends, demographics, and academic performance from the Wisconsin Department of Public Instruction was combined with data from other sources on school safety and closure. After controlling for several other factors that are likely to impact rates of school growth and closure, we are able to identify several key findings:

- Our survival analyses indicates that enrollment losses drive closure in private schools in the MPCP, charter schools, and Public Schools.
- Academic achievement only predicts closure for private schools in our sample.
- Private and charter schools are safer than traditional public schools.
- Families vote with their feet based on academics across all sectors.
- Academics and school safety are correlated, indicating that safer schools also tend to be better at shaping student achievement.

Keywords: private school; school choice; survival analysis; schooling supply

JEL Classifications: I28, I20

Contents

Introduction

Private school choice programs and public charter schools allow families to opt their children out of residentially assigned public schools to attend schools that better meet their individual needs. Voucher programs can improve the quality of the education system by introducing competitive pressures into the market for schooling (Chubb & Moe, 1988, Chubb & Moe, 1990; DeAngelis & Holmes Erickson, 2018; Friedman, 1955; Friedman, 1997). Traditional public schools generally do not face strong competitive pressures because (1) they have a near-monopoly on funding through property taxes and (2) children are residentially assigned to public schools based on zip-codes. In the traditional system, if families are not satisfied with their child's residentially assigned public schools, they have three options: (1) pay for a private school out of pocket in addition to paying for a public school through property taxes, (2) purchase an expensive house so they can be residentially assigned to a potentially better public school, or (3) remain unsatisfied at their child's current school and hope that things get better. Unfortunately, because options (1) and (2) are extremely costly, most unsatisfied families – especially the least advantaged – are stuck with option (3). Private school choice programs allow education dollars to follow children to whatever school works best for them, meaning that public and private schools have stronger financial incentives to cater to the needs of individual families (Egalite, 2013).

Of course, given that school quality is not uniformly distributed, stronger competition in the education system means that good schools will be financially rewarded for a job well done, while lower-quality schools will lose revenues when children leave them. Lower-quality schools can regain lost revenues and financially benefit if they are able to improve their educational

services; however, sustained financial losses in schools that do not improve could lead to shutdowns over time. The improvement of low-quality schools in the short-run, and the shutdown of persistently low-quality schools in the long-run, is a feature of any market. But are both sectors – public and private – subject to the same competitive pressures when a school choice program is in place?

Traditional public schools do not lose 100 percent of per-pupil funding when a student leaves to attend a private school; however, because all costs are variable in the long-run (or when a large number of children transition to new schools), they lose 100 percent of the costs associated with educating that student, meaning that they actually end up with more funding for each child left behind, on average (Scafidi, 2012). This is true in Wisconsin even when just a few students leave, as districts are allowed to recoup the revenue lost from departing students through the revenue limit for three years.

On the other hand, private schools lose 100 percent of the revenues associated with voucher students when families choose other schools or when government regulators decide their schools should not be able to participate in the voucher program. In addition, private schools must entice all of their customers to apply for vouchers and switch schools, while residentially assigned public schools are the default option for all families. In other words, traditional public schools may not be subject to the same level of competitive pressures as private schools in voucher programs.

Charter schools represent something of a middle ground. In Wisconsin, these schools may be authorized by the school district (instrumentality or non-instrumentality charters) or by the University of Wisconsin System, the Common Council of the City of Milwaukee, the boards of technical colleges, and a few others that don't apply to (Independent charters). Because each

charter sector represents such a small segment of the overall marketplace, statistical power in examining them individually would be quite low. Consequently, we combine non-instrumentalities and independent charters in our subsequent analyses, while instrumentalities are considered along with the school district. These schools receive contracts from the authorizer for a certain term of years, but still stand to lose 100 percent of revenue if students choose not to attend the school.

These theories lead us to two main research hypotheses:

1. Indicators of school quality – enrollment, math achievement, and safety – should be more likely to predict closure in private schools of choice and charter schools in Milwaukee than public schools.
2. Indicators of school quality – math achievement and safety – should predict changes in enrollment in both sectors over time.

Milwaukee Parental Choice Program

The Milwaukee Parental Choice Program (MPCP), enacted and launched in 1990, is the longest-standing modern-day voucher program in the United States.[1] Students are eligible to participate in the MPCP if they come from a family whose income does not exceed 300 percent of the federal poverty level ($75,300 for a family of four in 2018-19). Seventy-Five percent of students in the city are eligible to receive MPCP funding, and the average voucher amount is about 65 percent of per pupil spending in Milwaukee public schools (EdChoice).

In general, participating private schools must not charge tuition above the voucher amount for eligible students; however, parents of students in grades 9-12 with an income greater than 220 percent of the federal poverty level may be charged additional tuition above the voucher amount. Participating private schools must also administer state standardized tests, be

[1] Technically speaking, the first voucher programs in the United States were launched in Vermont in 1869 and Maine in 1873. However, these two *town-tuitioning* voucher programs are unique in that they allow children that live in rural areas without residentially assigned public schools to attend public schools in another town or private schools of their choosing.

accredited by the state within three years of program participation, allow students to opt out of religious activities, require all teachers and administrators to have a teaching license or bachelor's degree, and must admit eligible students on a random basis (EdChoice, 2018). Stuit and Doan (2013) ranked the MPCP as the most heavily regulated voucher program in the nation, which could serve to limit the marketplace features of the program.

Literature Review

Two random-assignment evaluations of the MPCP found that it had positive effects on student math and reading test scores (Greene, Peterson, and Du, 1999; Rouse, 1998). The more recent evaluations of the MPCP found that the program slightly increased the likelihood of high school graduation by 3 percentage points (Cowen et al., 2013), decreased the likelihood of adult criminal activity (DeAngelis & Wolf, 2016), increased the likelihood of college enrollment and persistence, but had no effect on college degree attainment (Wolf, Witte, & Kisida, 2018) or adult voting activity (DeAngelis & Wolf, 2018). Six evaluations have found that competitive pressures introduced by the MPCP improved achievement for the children left behind in public schools (Carnoy et al., 2007; Chakrabarti, 2008; Chakrabarti, 2013; Greene & Forster, 2002; Greene & Marsh, 2009; Hoxby, 2001).

While hundreds of evaluations have examined the effects of public and private school choice on student outcomes, very few studies have looked at the overall marketplace. Many of these studies have examined the intersection between government regulations and private school supply. Four studies have found that lower-quality private schools – as measured by tuition, enrollment, and customer reviews – are more likely to participate in private school choice programs, perhaps because the lower-quality schools in need of additional voucher funding are more likely to accept the heavy packages of regulations (Abdulkadiroğlu, Pathak, & Walters, 2018; DeAngelis & Hoarty, 2018; Sánchez, 2018; Sude, DeAngelis, & Wolf, 2018). In

particular, DeAngelis and Hoarty (2018) found that a $1,000 increase in tuition is associated with a 3 percent lower likelihood of participation in the MPCP, while a one-point increase in GreatSchools review score is associated with around a 15 percent lower likelihood of participation in the MPCP.

Few studies have looked at the factors that predict closures of choice schools. Using data from 2003 to 2009, Milliman (2016) found that low-performing public charter schools in Arizona were more likely to close down than low-performing traditional public schools. Ford (2011) found that lower-quality private schools – as measured by enrollment trends – were more likely to exit the Milwaukee voucher program. Ford and Andersson (2016) found that schools with lower enrollment and newer schools were more likely to exit the MPCP. They also found evidence to suggest that lower-performing schools were more likely to leave the MPCP. Flanders (2018) expanded on the analysis provided by Ford and Andersson (2016) by using additional years of data and adding more control variables. Flanders (2018) found significant evidence to suggest that lower-quality schools – as measured by enrollment and standardized test scores – were more likely to exit the MPCP and be closed by the government.

We build on the Flanders (2018) analysis by comparing the predictors of closure across school sectors. We expect that choice and charter schools will be more likely to close than traditional public schools in Milwaukee because they are subject to stronger market forces. We also expect that indicators of quality will be more likely to predict closure in choice schools than traditional public schools.

Data

We use data from private schools participating in the MPCP, charter schools and Milwaukee public schools each year from 2005 (the earliest year for which data is available online) to 2016 to examine school closures in both sectors over time. Data on the academic performance and demographics of public and charter schools comes from DPI's online WiseDash Public Portal. Test score data for private schools are from DPI's "Parental Choice Program WSAS" web page for older data, and the state report card for the 2015-16 and 2016-17 school years. While demographic data on private schools in the choice program have been tracked since 2015 under the state report card, older data for choice schools needed to be gathered from other sources. Much of these data were provided by the Wisconsin Policy Forum, collected as part of their annual survey of private schools in which racial and enrollment data for MPCP schools was collected.[2] Our final variable of interest utilizes the number of 911 calls at a school's address as a proxy for the safety of that school. This measure of safety is preferable to another measure—suspension rates—for at least two important reasons. First, suspension rates are not available for choice schools in Wisconsin, meaning that our analysis as currently constructed would not be possible. Second, suspension rates have been the subject of wide spread manipulation, as suspension of students have been discouraged through federal discipline policy (Flanders & Goodnow, 2018).

A school is considered to have "failed" when it ceases operation in any form. The identification process for failed schools begins with their disappearance from DPI's records of school performance and demographics. From this initial list of failed schools, we removed those

[2] The data was provided in 2016 as part of WILL's previous accountability study focused solely on private schools, "*Accountability in Action."*

for which a name change occurred, the school moved to a new location, two schools were consolidated, or a switch was made between sectors (e.g. from independent charter to public).

As shown in the Table below, our sample of schools in Milwaukee represents a relatively disadvantaged population of students. Four out of every five students in our sample are from an economically disadvantaged family, 86 percent are racial minorities, and 7 percent are labeled as ELL. In addition, 18 percent of students in the sample are labeled as SWD, well above the national average of 13 percent.[3] Nineteen percent of the observations are from private schools in the MPCP, while 78 percent are from traditional public schools in Milwaukee. The average enrollment in the sample is 420 students and the average number of 911 calls in a school per year is 169. Of course, the average proportion of students scoring proficient in math is zero because the measure is standardized to have a mean of zero and standard deviation of one.[4]

Table: Descriptive Statistics

Variable	Mean	Standard Deviation	Minimum	Maximum
Enrollment (Hundreds)	4.20	3.22	0.01	22.77
Standardized Math Proficiency	0.00	1.00	-1.27	5.24
911 Calls (Hundreds)	1.69	2.32	0.00	14.62
Closure	0.03	0.18	0.00	1.00
Year	2011	3.39	2005	2016
White	0.14	0.19	0.00	1.00
Economically Disadvantaged	0.79	0.19	0.00	1.00
ELL	0.07	0.13	0.00	0.76
SWD	0.18	0.09	0.00	0.74
Public	0.78	0.42	0.00	1.00
MPCP	0.19	0.39	0.00	1.00

Note: The total sample size is 2,588 observations.

[3] Children and Youth with Disabilities. National Center for Education Statistics. Retrieved from https://nces.ed.gov/programs/coe/indicator_cgg.asp.

[4] We standardized this measure because Milwaukee experienced changes in their math tests over the time period of the study. Nonetheless, the overall results are identical when the models use the non-standardized measure of math proficiency instead.

The table below includes the summary statistics by sector. Here, we make a distinction between traditional public schools and "free" charters that have a large degree of independence from the school district. We consider non-instrumentality and independent charters together for this analysis because they are both similar to traditional conceptions of what constitutes a charter school – a privately run public school of choice – and because they represent such a small share of our sample as to be difficult to analyze otherwise. The proportions of minority and ELL students in schools are not statistically different across sectors. However, students in the MPCP private schools are more likely to be economically disadvantaged – perhaps because the program is targeted to children from low-income families – while students in the Milwaukee public schools are much more likely to be classified SWD. In other words, it is unclear which sector has students that are more disadvantaged overall. This finding aligns with Fleming et al. (2015), who found that families that applied for the MPCP were lower income than those who did not apply for the program. Similarly, Fleming et al. (2015) could not determine which sector was more disadvantaged overall because while the MPCP students were from lower income families, they also had parents with more years of education, on average.

The Table below also shows that Milwaukee public schools were larger, had higher average test scores, and had more 911 calls each year. Of course, these data alone do not mean that Milwaukee public schools are less safe or are better at shaping standardized test scores because these are just overall averages that do not control for school size or student backgrounds. The rates of school closure are nearly identical (3 percent) across sectors. However, the overall rate of closure reported below does not account for differences in student backgrounds or school quality. We examine differential rates of school closure across sectors after accounting for all of these factors in our main econometric analyses. Charter schools were different along similar

dimensions to MPCP schools, with addition of having significantly fewer white students than traditional public schools.

Table: Differences by Sector

Variable	MPCP	Public	Charter
Enrollment (Hundreds)	2.62***	4.96	3.85***
Standardized Math Proficiency	-0.23***	0.00	0.36***
911 Calls (Hundreds)	0.54***	2.17	0.60***
Closure	0.03	0.03	0.02
White (Proportion)	0.15	0.14	0.09***
Economically Disadvantaged (Proportion)	0.82***	0.79	0.75***
ELL (Proportion)	0.07	0.07	0.07
SWD (Proportion)	0.03***	0.19	0.14***
N	~465	~1,757	~203

Note: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$, and connote the differences from traditional public school averages reported in middle column.

Methods

We employ a Cox proportional hazard regression model of the form for our models of closure:

$$h(t) = h_0(t) * exp(\beta_1 enrollment_i + \beta_2 math_i + \beta_3 safety_i + \beta_4 X_i)$$

where $h(t)$ is the hazard function, which is determined by a set of school-level covariates, and $h_0(t)$ is the baseline hazard. The hazard, the probability of closure of a given school, *i*, in a given time period, is predicted by three primary quality characteristics of each school in the sample. *Enrollment* is the total enrollment of school *i* in hundreds, *Math* is the standardized proportion of students within school *i* that score proficient on the state math test, and *Safety* is the total number of 911 calls from school *i* in a given year in hundreds.

Enrollment is a proxy for demand of a given school and year, as it represents the total number of students that decided to attend the school given the costs (tuition) and benefits (education) associated with attendance each year. Other researchers have also found that enrollment trends are associated with the test score value-added of the school, illustrating that enrollment trends may be a reliable proxy for school quality (Abdulkadiroğlu, Pathak, &

Walters, 2018). *Math* is a proxy for school quality as it represents the proportion of students that are proficient on the state math exam after accounting for the types of students that enroll in the school. *Safety* is a proxy for school quality as schools with more 911 calls tend to be less safe. We expect that schools with lower enrollments, lower math proficiency rates, and more 911 calls will be more likely to close over time.

Our models also include vector *X* of controls for each school and year observation. The analytic models each control for the proportions of students identified as: white, economically disadvantaged, English Language Learners (ELL), and Students with Disabilities (SWD). We start with a model examining differential rates of closures across school sectors, and then we examine the predictors of closure within each school sector in Milwaukee. We impute missing values for these four control variables using multiple imputation based on the school, year, enrollment and sector of each missing observation.[5]

For our models of enrollment growth, we employ a change score analysis where the dependent variable is the change in enrollment at each school *i* between year *t* and year *t*-1:

$$(\text{Enrollment}_{it}\text{-Enrollment}_{it-1}) = \beta_1 \mathit{math}_{it-1} + \beta_2 \mathit{safety}_{it} + \beta_3 X_{it} + \varepsilon_{it}$$

Because test scores must be public before families can respond to them, we lag math scores as well in this model. We expect that schools subject to stronger market forces (i.e. private schools) will be more likely to face the shutdown condition than traditional public schools. We also expect that the proxies for quality (enrollment, test scores, and safety) will be more likely to predict closure in private than traditional public schools in Milwaukee.

[5] Six percent of the observations were missing for proportion of white students, 12 percent were missing for the proportion of economically disadvantaged students, and about 21 percent were missing for the proportions of ELL and SWD students.

Results

Overall

The Figure below compares the percentage of schools in each sector that closed over the time frame of our analysis. We conducted a survival analysis including controls for differences in student background across sectors. As shown in the table below, the model controlling for differences in students across sectors finds that MPCP schools are 49 percent less likely to close than traditional public schools, while charter schools are 84 percent less likely to close than traditional public schools; however, only the latter is statistically significant. Statistically significant control variables suggest that schools with higher proportions of SWD are more likely to close, and schools with higher enrollments are less likely to close, as expected.

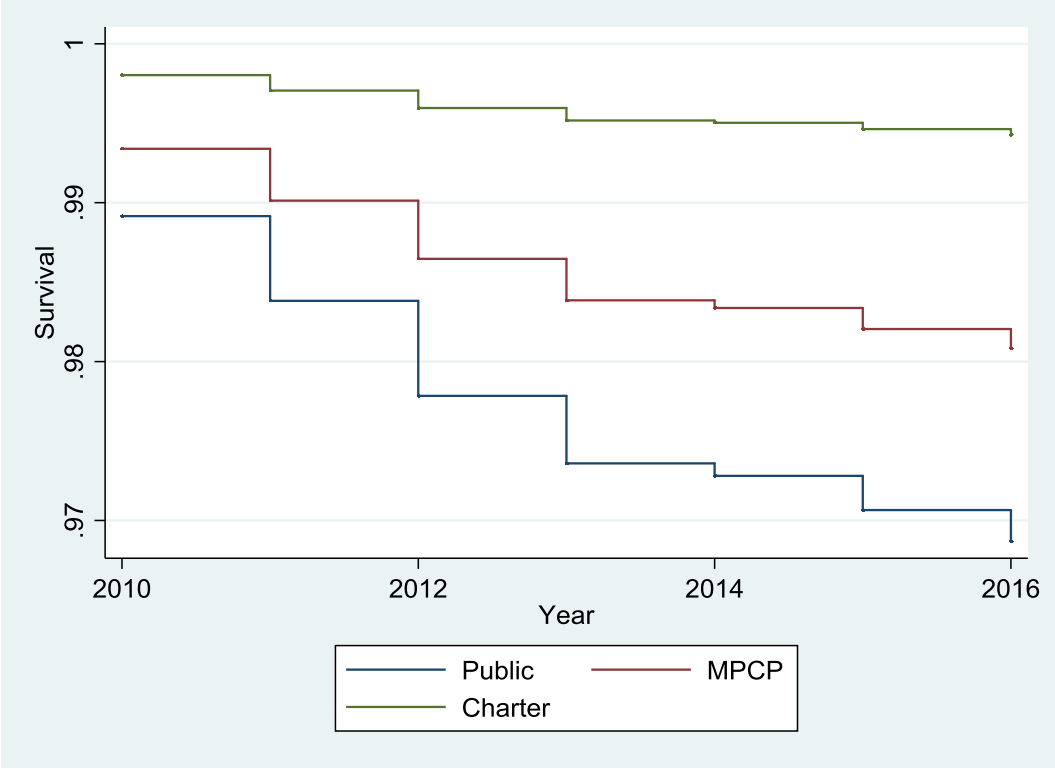
School closures can be explained in two ways: (1) lower-quality schools are more likely to close, so they are closing for good reason, or (2) schools are closing regardless of quality levels, meaning that government regulators or families are closing the schools based on other factors. The explanation for closures is extremely important for the policy implications of the results. After all, the first explanation is more likely to lead to more business-as-usual, while the second explanation would require more research to determine what factors actually close down schools in Milwaukee. To answer this question, we examine the predictors of closure for each sector.

Table: Likelihood of Closure by Sector (Controls)

	Hazard Ratio
MPCP	0.508
	(0.211)
Charter	0.163**
	(0.034)
Controls	Yes
Closures	41
Schools	321
N	1,576

Notes: P-values in parentheses. * p < 0.10, ** p < 0.05, *** p < 0.01. All coefficients are hazard ratios after Cox regression. The model controls for percent of students identified as white, economically disadvantaged, English Language Learners, SWD, and enrollment. Data are from 2010 to 2016.

Figure: Probability of Remaining Open by Sector (Controls)



By Sector

As shown in the Table below, schools with lower levels of demand are more likely to fail in the private sector. Specifically, a 100 student increase in enrollment is associated with a 70 percent decrease in the probability of closure for MPCP schools and a 36 percent decrease in the probability of closure for Milwaukee public schools. The larger negative association between enrollment and closure for MPCP schools suggests that private schools are more likely to close down based on changes in demand than public schools in Milwaukee. Enrollment trends were found to be unrelated to closure among charter schools.

Our model indicates that lower standardized math proficiency rates predict closure in the private sector, while they are unrelated to closure in the public sector or charter school sector. A one-standard-deviation increase in math proficiency rate is associated with a 96 percent decrease in the probability of private school closure, but is associated with no change in the probability of public school closure.[6] The negative relationship between test scores and closure in the private sector could be explained in a couple of ways: (1) the government is applying a higher standard to private schools participating in the MPCP than the traditional public schools when it comes to funding based on test scores, or (2) individual families are voting with their feet away from schools that have lower standardized test scores. However, the first explanation is not possible, as the state is only allowed to take into account financial considerations in evaluating a school's fitness for the program. The second explanation will be expanded upon in the following section.

None of the control variables are statistically significant in the models predicting private school closures, meaning that student background characteristics are not predicting shutdown in the private sector. However, a higher proportion of SWD within a school significantly predicts closure in the public sector (at $p < 0.05$). SWD are generally more costly to educate than other

[6] As shown in Table A1 of the Appendix, all results hold for both sectors when the log of enrollment and the log of 911 calls are used as independent variables.

students, but that doesn't explain why the proportion of SWD only predict closure in the public school sector. It might be because private schools in Milwaukee are better able to specialize in providing services that benefit SWD. It could also be because SWD students are less likely to use vouchers than other students in this sample, or, as found by Wolf, Witte, and Fleming (2012) because private schools in Milwaukee are less likely to classify students as having special needs than Milwaukee public schools.

One of the main assumptions underlying the Cox proportional hazard model is proportionality (Cox & Oakes, 1984). The proportionality assumption means that the ratio of hazards for any two schools in the sample is constant over time. Put simply, the assumption states that if a school has a higher probability of remaining open in one year, given its background characteristics, they should have a higher probability of remaining open in later years as well. As shown in Table A2 in the Appendix, the statistical tests provide evidence to suggest that the models do not fail the proportional hazards assumption. That is, all models report p-values well above the 10 percent threshold of marginal statistical significance, meaning there is no significant evidence to suggest that our models fail the underlying assumption.

Table: Predictors of School Closure (By Sector)

	MPCP Hazard Ratio	MPCP Hazard Ratio	Public Hazard Ratio	Public Hazard Ratio	Charter Hazard Ratio
Enrollment (Hundreds)	0.301**	0.371*	0.639***	0.509*	0.175
	(0.038)	(0.092)	(0.000)	(0.093)	(0.2401)
Standardized Math Proficiency	0.039**	0.015**	0.647	0.802	0.0001
	(0.041)	(0.024)	(0.201)	(0.828)	(0.0007)
911 Calls (Hundreds)	.	0.330	.	1.197	--
		(0.395)		(0.168)	
Controls	Yes	Yes	Yes	Yes	Yes
Closures	9	8	35	5	3
Schools	109	91	204	116	31
N	452	356	1,581	1,189	200

Notes: P-values in parentheses. * p < 0.10, ** p < 0.05, *** p < 0.01. All coefficients are hazard ratios after Cox regression. The models control for percent of students identified as white, economically disadvantaged, English Language Learners, and SWD.

Figure: Probability of Remaining Open by Enrollment (MPCP)

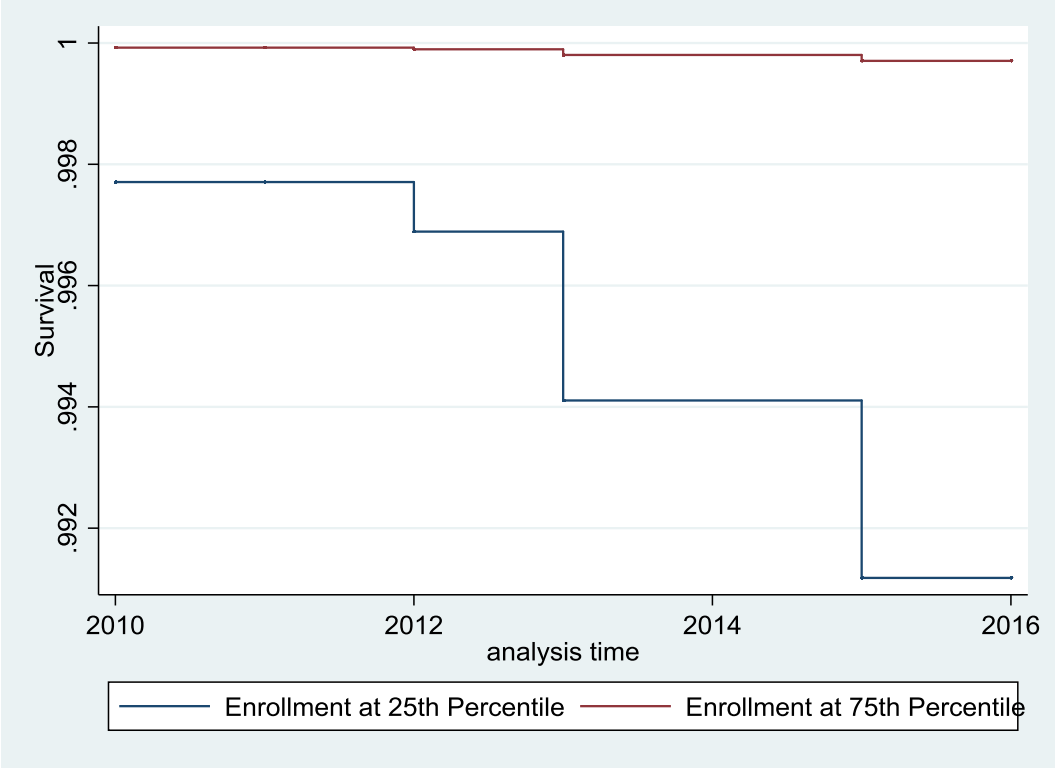


Figure: Probability of Remaining Open by Enrollment (Public)

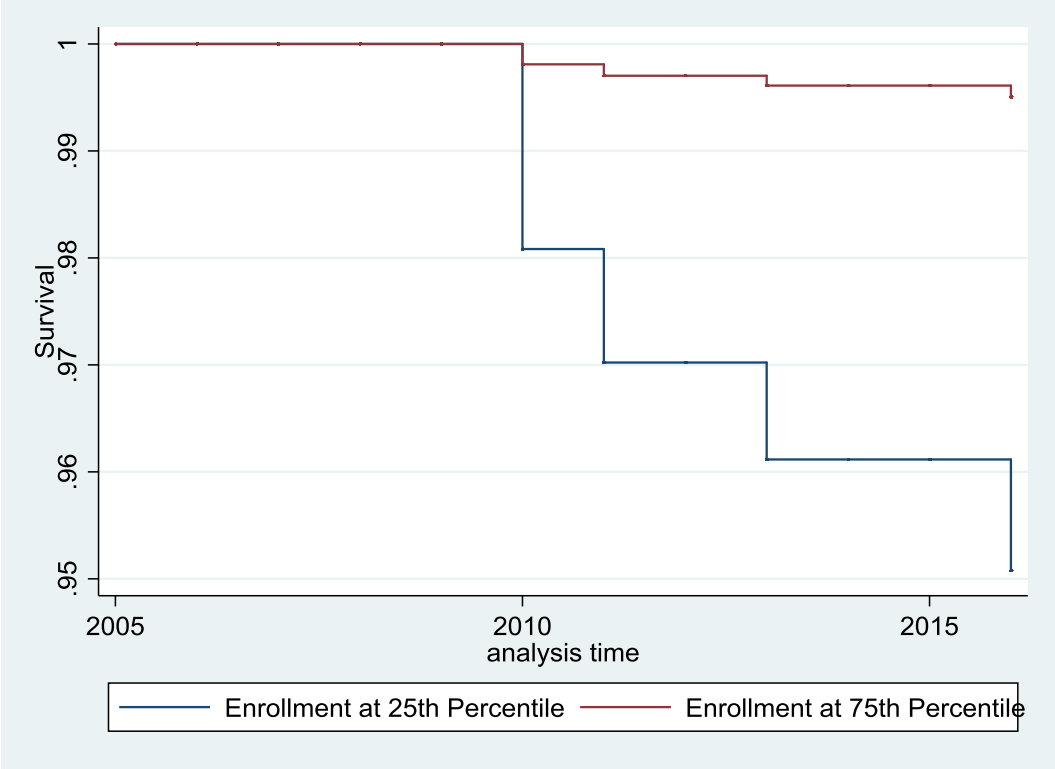


Figure: Probability of Remaining Open by Achievement (MPCP)

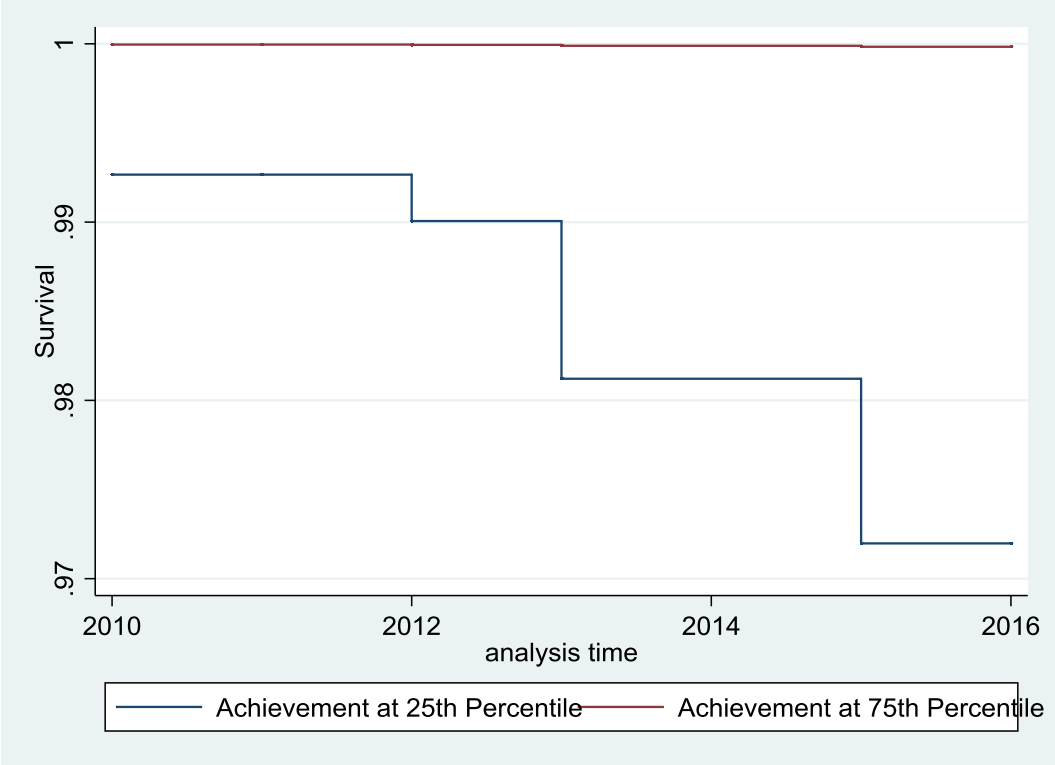
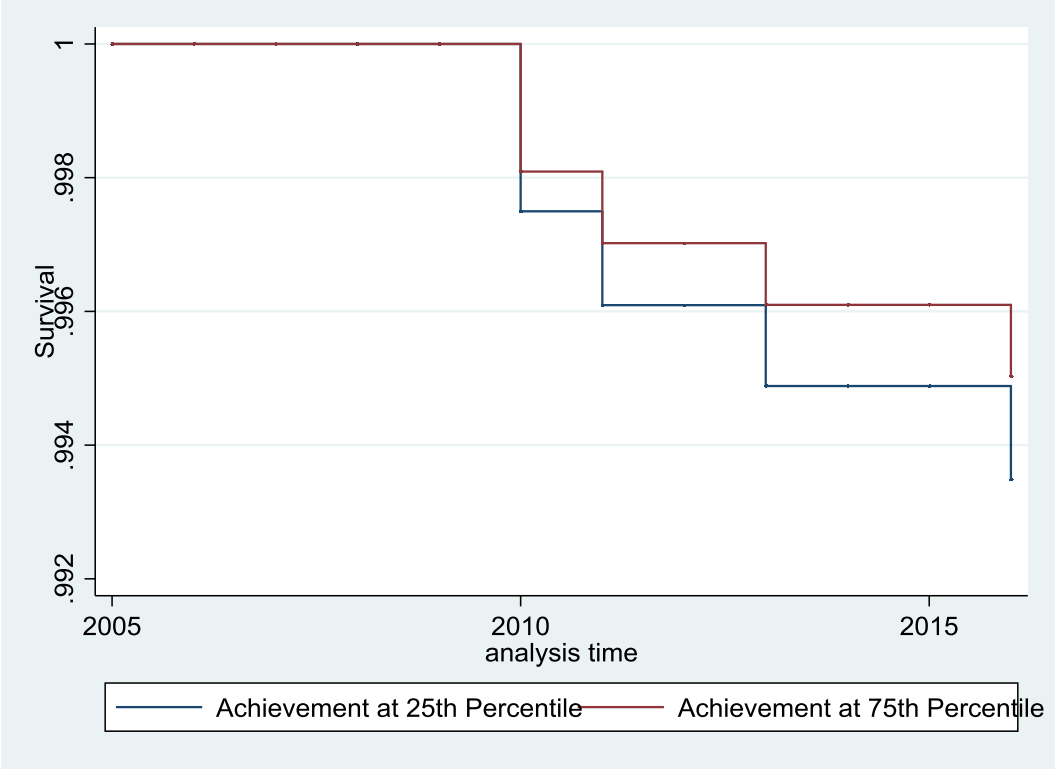


Figure: Probability of Remaining Open by Achievement (Public)



Enrollment Changes

While school closure can be the ultimate result of parents who are unsatisfied with the education that a school is providing, enrollment shifts can be explained by various dimensions of school quality. The Table below demonstrates the factors that predict year-to-year changes in enrollment for each school in our sample. Because parents can only be responsive to information that is already publically available, we use a one-year lag on math scores on all variables. Changes in standardized test scores are positively associated with changes in student enrollment in each sector. A one-standard-deviation increase in student test scores in MPCP schools is associated with a 10 student increase in enrollment the following year. A one-standard-deviation increase in test scores in traditional public schools is associated with around a 4 student increase in enrollment the following year. We also see a relationship between proficiency and

enrollment in charter schools. In those schools, the same change in math scores is related to an increase of 20 students the following year.

Table: Predictors of School Enrollment Change (By Sector)

	MPCP (ns) ΔEnrollment	**(MPCP) ΔEnrollment**	**Public (ns) ΔEnrollment**	**Public ΔEnrollment**	**Charter ΔEnrollment**
Standardized Math Proficiency	7.911	13.186**	4.852**	5.290	20.298*
	(5.529)	(5.4770)	(2.274)	(2.6978)	(10.831)
911 Calls (Hundreds)	--	0.6154	--	0.3657	--
		(6.3643)		(0.7897)	
Controls	Yes	Yes		Yes	Yes
N	463	367	1,169	911	203

Notes: P-values in parentheses. * p < 0.10, ** p < 0.05, *** p < 0.01. The models control for percent of students identified as white, economically disadvantaged, English Language Learners, and SWD.

We were surprised in the lack of relationship between enrollment growth and school safety. Existing evidence suggest that enrollment growth, particularly in choice schools in Milwaukee, is driven by safety concerns (Flanders, 2017). In the following section, we use the data to answer the question of whether there are safety differences across sectors in the city.

School Safety

Despite the importance of school safety to families, none of the above analyses indicate that school safety predicts school closure. This could be because of a lack of variance in school safety within school sectors. However, these analyses do not tell us about the differences in school safety across school sectors. Table below compares the number of 911 calls across school sectors after controlling for differences in enrollment, student achievement, and all student demographics. The results indicate that after accounting for differences in student background and enrollments, MPCP are safer than Milwaukee public schools. In particular, MPCP schools

experience around 118 fewer 911 calls per year than Milwaukee public schools even after controlling for differences in enrollments and student composition. Similarly, our model indicates that charter schools in Milwaukee experience around 136 fewer 911 calls than traditional public schools after including controls. These findings align with the results of the quasi-experimental study using student-level data from the state-mandated evaluation finding that the MPCP reduced the likelihood that students committed crimes as adults (DeAngelis & Wolf, 2016).

Similarly, three random-assignment evaluations have found that private school choice programs lead to higher levels of safety as reported by students and parents in D.C., New York, and Ohio (Dynarski et al., 2018; Howell & Peterson, 2006; Wolf et al., 2013). In addition, a quasi-experimental study found that MPCP parents are more likely to report that their children are in safe schools than parents in Milwaukee public schools (Witte et al., 2008). Further, a study using nationally representative data recently found that private schools have large safety advantages over public schools (Shakeel & DeAngelis, 2018).

Table: School Safety (By Sector)

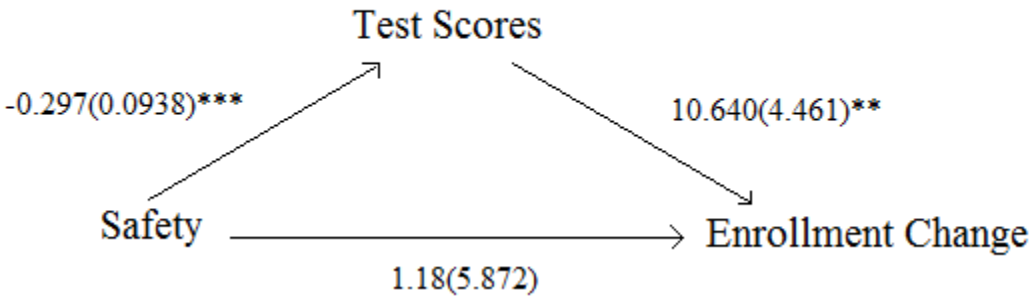
	911 Calls (Hundreds)
MPCP	-1.184***
	(0.000)
Charter	-1.358***
	(0.000)
Controls	Yes
R-Squared	0.2526
N	1,616

Notes: P-values in parentheses. * p < 0.10, ** p < 0.05, *** p < 0.01. Average marginal effects after regression analysis are reported. The model controls for percent of students identified as white, economically disadvantaged, English Language Learners, SWD, standardized math proficiency rates, and enrollment, and includes year fixed effects.

The direct relationship between safety and student achievement suggests that it might be worthwhile to test for the possibility of mediation. Mediation occurs when the effect of a variable that is truly impacting the variable in question has its effect absorbed by another correlated variable. The most common test for mediation is the Sobel-Goodman test (Baron & Kenny 1986), which can account for the indirect effect of safety on enrollment via test scores. This test showed that, indeed, significant mediation occurs when it comes to MPCP schools. Figure X below depicts the results of this analysis.

As shown below, while *Test Scores* have a strong direct relationship with student *Enrollment Change*, *Safety* also has a direct relationship with *Test Scores*. Thus, parents may make enrollment choices based on either factor, because they are closely related to one another among schools in Milwaukee.

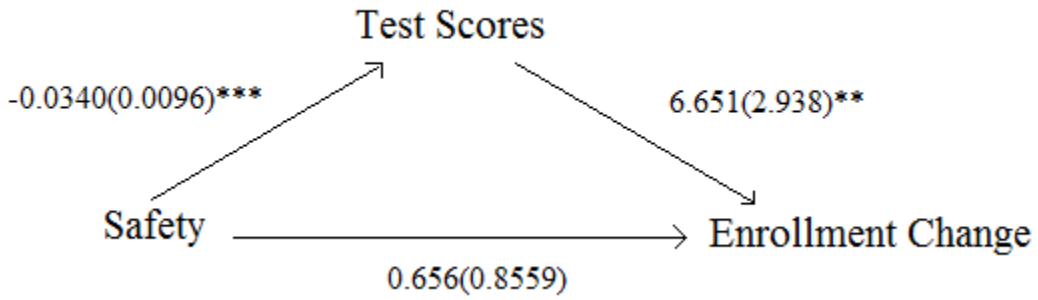
Figure: Sobel-Goodman Test of Mediation between Safety and Enrollment, MPCP



P-values in parentheses. * p < 0.10, ** p < 0.05, *** p < 0.01.

A similar pattern holds for Milwaukee's public schools. The direct relationship between safety and enrollment is insignificant, but the indirect path shows approximately 34 percent of the relationship between safety and enrollment change is mediated by the inclusion of academic outcomes in the model.

Figure: Sobel-Goodman Test of Mediation between Safety and Enrollment, MPS



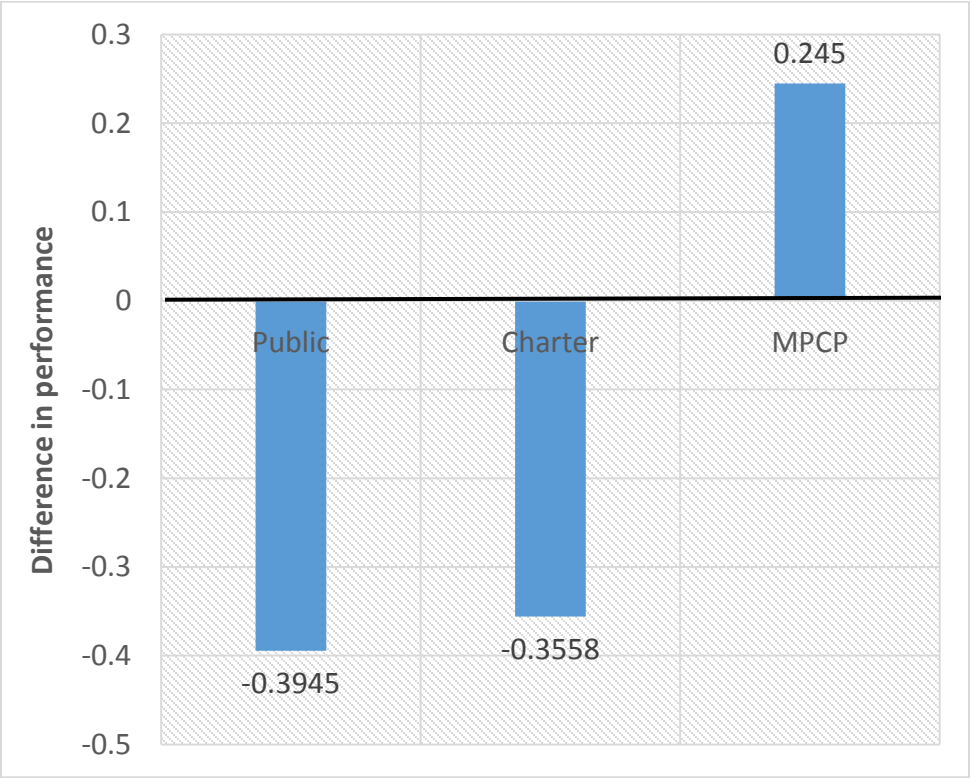
P-values in parentheses. * p < 0.10, ** p < 0.05, *** p < 0.01

Quality of New Schools

One final question is whether long-existing schools have better performance than newer schools. In this section, we compare the average performance on the Forward Exam between "new" schools and older schools. Here, "new" schools are defined as those that opened since 2010 in the charter and public sector, and those that opened since 2013 in the MPCP sector due to the shorter time frame of our MPCP data. The figure below depicts the performance of new schools in the blue bars relative to older schools in that sector. Here, we see some interesting variation. MPCP schools that opened after 2013 have significantly higher performance than older choice schools. On average, proficiency rates in such schools are about 24.3% higher in new MPCP schools. Among both public schools and charter schools, older schools have significantly better performance. In public schools, performance in new schools is approximately 39.4% lower, and 35.6% lower than in more established schools.

This finding is curious, but some speculation can be offered. In recent years, more large operators have begun to participate in the MPCP. Organizations such as Seton and Hope Schools have brought consistent operations and generally higher academic outcomes to the

schools that they have created and taken over. In the public school sector, characterized by significant enrollment declines, new schools are often the result of consolidation and closure of older schools. This means that new schools may have more difficult populations than schools that have stood the test of time.



Discussion

This paper represents the most comprehensive analysis of the school choice marketplace in Milwaukee to date. We have shown that all sectors are responsive, to some extent, to academic performance. Schools across sectors see their enrollments increase when they perform well academically. However, this academic performance is only related to the risk of closure among the MPCP, suggesting that this ultimate form of accountability only holds sway among private schools in the city. That said, given that the academic performance of "free" charter

schools is significantly higher than both the MPCP and public schools over the time frame of our analysis. Of course, given the higher academic outcomes observed on average among charter schools, it may be that front-end regulation of school entry within that sector makes it less likely that a school will fail in general, making identification of the predictors more difficult.

Safety is related to academic outcomes in all sectors. This is perhaps intuitive, as students must have a safe environment to learn before they can concentrate on the lesson. We confirm that choice schools receive fewer 911 calls, on average, and find that safety is an important factor for families in both sectors through our mediation analysis.

This study suggests that market forces play a role across sectors in Milwaukee, even if the extent of that role varies. In what is often ranked as one of the most regulated voucher programs in the country, the identification of marketplace behavior *at all* is an important finding. In a loosened regulatory environment, it is possible that the market forces in Milwaukee education might flourish to an even greater extent.

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Appendix

Table A1: Predictors of School Closure (By Sector)

	MPCP Hazard Ratio	MPCP Hazard Ratio	Public Hazard Ratio	Public Hazard Ratio
Enrollment (Hundreds)	0.181***	0.137***	0.207***	0.095*
	(0.009)	(0.009)	(0.000)	(0.088)
Standardized Math Proficiency	0.037**	0.012**	0.654	0.605
	(0.039)	(0.029)	(0.209)	(0.692)
911 Calls (Hundreds)	.	0.580	.	1.158
		(0.387)		(0.331)
Controls	Yes	Yes	Yes	Yes
Closures	9	7	35	5
Schools	109	85	204	115
N	452	342	1,581	1,187

Notes: P-values in parentheses. * p < 0.10, ** p < 0.05, *** p < 0.01. All coefficients are hazard ratios after Cox regression. The models all control for percent of students identified as white, economically disadvantaged, English Language Learners, and SWD. Public school models use data from 2005 to 2016. MPCP models use data from 2010 to 2016.

Table A2: Statistical Test of Proportional Hazards Assumption (By Sector)

	MPCP	Public
Chi-Squared (Main Models)	6.52	5.27
	(0.48)	(0.63)
Chi-Squared (Logs)	5.15	4.87
	(0.64)	(0.68)
N	342	1,187

Notes: P-values in parentheses. * p < 0.10, ** p < 0.05, *** p < 0.01. All test statistics are chi-squared values reported by the test of proportional hazards assumption after Cox regression. The models control for percent of students identified as white, economically disadvantaged, English Language Learners, SWD. All models include enrollment, standardized math proficiency rates, and the number of 911 calls as covariates. The model in the second row uses logs of enrollment and 911 calls instead of enrollment and 911 calls in hundreds. The public school models use data from 2005 to 2016. MPCP models use data from 2010 to 2016.