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Heading for the Exits:

Comparing Characteristics of Leavers from

Charter Schools to Traditional Public Schools in

Denver Public Schools

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Introduction

Charter schools have emerged as a popular and controversial educational reform. A now considerable body of research finds that charter schools are very effective in in some major cities but that their effectiveness varies substantially across localities (see, for instance, Cremata et al., 2013). Recently, researchers have turned attention to the type of student who enters and exits the charter sector. A persistent concern among critics, scholars, and pundits has been that charter schools will create greater racial/ethnic, socioeconomic, and achievement-related isolation or inequities (Bifulco & Ladd, 2007; Cobb & Glass, 1999; Lee & Croninger, 1994; Ravitch, 2010; Wells, 1993). Historically, most attention has focused on how admissions processes may facilitate these inequities, but only recently has scholarly attention focused on student exits and how attrition and mobility in the charter sector may also create the same result (Zimmer & Guarino, 2013). Indeed, as late as 2009, some scholars were noting how little was actually known about factors that predict mobility in charter school populations (Finch, Lapsley, & Baker-Boudissa, 2009). According to Hassell and Terrell's (2009) survey of 59 comparative studies of charter schools, few studies consider outcomes such as mobility, persistence, and attendance rates. Student mobility is often not studied directly but is treated instead as a control variable in analyses that focus solely on achievement.

Some recent evidence suggests mobility may be greater in charter schools than in traditional public schools (Dauter & Fuller, 2011; Finch et al., 2009; Finch, Baker-Boudissa, & Cross, 2008; Hanushek, Kain, Rivkin, & Branch, 2007; Karp, 2010; Powers, Topper, & Silver, 2012). Bifulco and Ladd (2005), for example, found that in North Carolina 14% of students in traditional public schools made nonstructural transfers, but the same was true of more than one-quarter of students in fifth-year charter schools and of an even larger share of students in newer charter schools. In Indiana, Finch, Baker-Boudissa, and Cross (2008) found an even greater percentage of leavers: Of the 647 charter students included in their study, 54% left their schools without completing the highest grade in their schools. One exception in the research thus far comes from New York City, where prior research finds much lower attrition rates within charter schools than traditional public schools (Roy, 2014).

Higher charter school mobility rates seem contrary to theoretical expectations. As Dauter and Fuller (2011) describe, one might expect innovative, small, or less rule-bound schools to engage students more thoroughly and in turn slow the likelihood of families exiting. Liberalized educational markets and more diverse schools should allow for a better match among pupil, family, and school, thereby enriching student engagement and reducing mobility.

Charter school critics frequently contend, however, that a meaningful portion of charter school mobility is purposely induced by the schools themselves. Of particular concern is whether charter schools "push out" certain groups of students (Zimmer & Guarino, 2013). The theorized motivation to do so is improving the school's academic profile and minimizing costs by pushing out low achieving and educationally challenging students (Zimmer & Guarino, 2013). Prominent charter school critic Diane Ravitch, as just one example from many, has written that, "(Charter schools) are also free to push out low-scoring students and send them back to the local public

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schools. This improves their results, but it leaves regular public schools with disproportionate numbers of the most challenging students" (https://groups.yahoo.com/neo/groups/nyceducationnews/conversations/topics/43167, para. 7). This common critique of charter schools was given additional weight when it was recently raised by New York City school's chancellor (http://ny.chalkbeat.org/2014/11/20/farina-implies-some-charter-schools-boosting-scores-by-pushing-out-students/#.VJmreI4DrE), sparking a sharp rebuttal by founder and CEO of New York's Success Academy Charter Schools, Eva Moskowitz (2015).

Yet, little is currently known about the factors that predict student mobility out of charter schools, particularly as it relates to similar attrition out of traditional public schools. Is it in fact the case that low-performing students are particularly likely to exit charter schools? Do the demographic characteristics of students exiting charter schools differ from those of students who exit traditional public schools? To date, research provides surprisingly little evidence addressing those important questions.

Along with the policy consequences of charter schools artificially improving their aggregate test score performance through student attrition, understanding student mobility is an additionally important issue because mobility compromises effective student learning (Heinlein & Shinn, 2000; Rose & Bradshaw, 2012; Scherrer, 2013) and school accountability (Finch et al., 2009), making it a particularly relevant topic for policymakers and educational leaders (Dauter & Fuller, 2011).

In this paper, we use student-level longitudinal data from a large urban school district with a growing and effective charter sector–Denver, Colorado–to expand upon recent research describing the characteristics of students who exit charter schools and comparing them to the characteristics of those who exit traditional public schools. Of particular interest is understanding whether low-performing students are more likely to exit charter schools than they are to exit traditional public schools. We also consider whether mobility rates differ among students according to observed characteristics such as race/ethnicity and English language learner (ELL) status.

We find that the relationship between being a low-performing student and exiting one's school differs according to whether the student was enrolled in the charter or traditional public school sector. However, this result appears to be driven by higher-performing students being less likely to exit charter schools rather than from lower performing students being more likely to exit them. Further, when we take into account that charter school students are overall less likely to exit their school than are traditional public school students, we find that low-performing students are equally likely to exit either sector. Although this paper does not directly analyze the motivation behind student exits, these findings are inconsistent with the argument that charter schools systematically push out low-performing students. Findings for characteristics other than test-score performance indicate no differences in the likelihood of exiting charter schools as compared to traditional public schools. Students of different demographic groups appear to exit with the same likelihood no matter what type of school they attend, save for one

group—ELL students. By some measures, English language learners enrolled in charter schools are significantly less likely to exit than their non-ELL peers or those enrolled in TPS.

What Prior Literature Suggests

A small literature has recently emerged evaluating the characteristics of students who exit charter schools. Those concerned about charters "pushing out" students are particularly attuned to differences based on academic performance, but mixed results provide little consensus. Finch et al. (2008), for example, found students with *higher* test scores were more likely to exit Indiana charter schools. Miron, Cullen, Applegate, and Farrell (2007) examined the exit patterns of charter students in Delaware and likewise found leavers at the elementary level reported higher test scores than students who remain in the charter schools, but in other grades patterns differed. No notable differences appeared at the middle school level, and leavers had lower test scores than stayers at the high school level. Considering another type of school choice Cowen, Fleming, Witte, and Wolf (2012) find that lower performing students are more likely to exit private schools where they had used a voucher to pay for tuition.

To date, Zimmer and Guarino (2013) provide the only empirical analysis of which we are aware comparing exit rates of low-performing students in charters and traditional public schools (TPS) for an entire large school district. Their results from an anonymous large school district in the Midwest indicated that although students transferring out of charter schools report slightly lower achievement levels, the same holds true for TPSs. Moreover, when analyzed in formal regression models, the authors found little evidence that low-performing students are more likely to transfer out of charter schools than above-average students or that they are more likely to transfer out of charters than TPSs. Although their results are convincing for the school district they analyze, Zimmer and Guarino call for similar work in other cities in order to determine whether the results are robust across the charter school sector. Such replications in other jurisdictions are particularly important when studying charter schools because their operation and effectiveness varies dramatically across school systems.

Of the small literature that has considered the characteristics of families that leave charter schools, some studies have focused on personal characteristics of families and students, such as income levels or race/ethnicity. Others have focused on school quality. Of the personal characteristics, prior results find no difference in exit rates based on family income (Hanushek et al., 2007), but racial and ethnic minority students appear more likely than their white counterparts to exit charter schools (Finch et al., 2009). Finch et al. (2008), for example, discovered non-white families in Indiana were twice as likely to leave their charter schools as white families. Others have found the differences are not limited to white versus nonwhite. Hanushek, Kain, and Rivkin (2004) and Zimmer and Buddin (2006), for instance, found African American families more than white or Hispanic families were more likely to exit charters in Texas and an unnamed school district respectively. Similarly, Dauter and Fuller's (2011) findings from Los Angeles suggest differences manifest between Hispanic students and their white and Asian peers, where the former exit more often than the latter.

Some prior research has looked particularly at the mobility of students with classifications that suggest they present unique challenges or costs to educate. Contrary to conventional wisdom, that research suggests mobility of students with special needs (Dauter & Fuller, 2011; Winters, 2013, 2015) and English language learners (Winters, 2014) are significantly less likely to exit charter schools than they are to exit traditional public schools, at least in the urban districts analyzed.

Finally, Hanushek et al. (2007) suggest the decision to leave a charter school may be more a function of the quality of the school. In a study of Texas schools, they found that higher achieving charter schools have lower exit rates than lower achieving charter schools, a pattern that was also evident among TPS. The state-derived performance rating was significantly related to the probability of exit for both regular and charter schools, but the effect sizes tended to be much larger for students attending charter schools.

Such findings provide an important initial consideration of the type of student who exits charter schools, but the mixed results and the limited number of studies mean much is left to know about the mobility of students in and out of charter schools. To that end, we contribute a study of charter school leavers in a large urban district—Denver Public Schools (DPS), a district not unfamiliar with assertions of charter school cherry-picking (Carroll, 2015; Gabor, 2014).

Methods

Research Questions

The research was guided by the following questions:

(1) Is there a differential relationship between observed student characteristics (including prior test scores) and the probability that a student exits a charter school relative to the relationship between those characteristics and the probability that a student exits a traditional public school?

(2) Are low-performing students more likely to exit charter schools than they are to exit traditional public schools?

Although those two research questions appear very similar, they are substantially different. The first research question speaks exclusively to the specific statistical relationship between student characteristics and test scores and probability of exit. The second research question, however, further takes into consideration across-sector differences in the probability of exit that are independent of the relationship with prior test scores. For instance, it is possible for low-performing students to be more likely than high-performing students to exit charter than traditional public schools but for that effect to be counterbalanced by low performing charter school students generally being less likely to exit their schools than similar students in traditional public schools.

Study Context and Sample

The Colorado Legislature adopted its charter law in 1993 (Carpenter & Kafer, 2013), only two years after the nation's first charter law was adopted in Minnesota (Carpenter & Noller, 2010). More than 80,000 students attend around 200 charter schools in Colorado, which represents approximately 10% of the state's public school enrollment. If all of the charter schools were combined into an imaginary district, the enrollment of that district would be the second largest in the state (Carpenter & Kafer, 2013).

Charter school authorizers in Colorado include local school districts and the Charter School Institute, a non-district, statewide organization. Although the formation of charter schools in districts has historically often been adversarial between school founders and district boards, DPS encourages and facilitates the formation of charters in its district through its Office of School Reform and Innovation (http://osri.dpsk12.org/), fulfills its authorizer role by holding charter schools accountable to performance metrics and their contracts (http://osri.dpsk12.org/quality-assurance-accountability/), and promotes charter schools among its other schools when enabling parents to choose their children's schools (http://osri.dpsk12.org/about-osri/parent-resources/). Although they have not yet been subjected to a randomized field trial, recent evidence using a propensity score matching technique indicates students benefit from attending a Denver charter school relative to how they would have performed in an area traditional public school (Cremata et al., 2013).

Data and Variables

We use longitudinal student-level administrative data provided by Denver Public Schools. We utilize six years of data for each school system from school years 2007-2008 through 2012-2013. Unique (albeit anonymous) student identifiers allow individual students to be tracked over time. Similarly, unique school markers identify whether students are enrolled in charter or traditional public schools. Data include students' demographic information and relevant test scores on state-mandated math and reading assessments. For each school system we use test scores from grades three through eight.

As Table 1 indicates, the students served in both types of schools are quite similar in many respects, such as ELL status, those who qualify for free or reduced lunch, and those with IEPs. Denver charters enroll greater percentages of male, white, and black students, while non-charter public schools serve greater percentages of Hispanic students. Across both school types Hispanic students represent the greatest percentage of students in DPS by race/ethnicity, and approximately two-thirds of students in DPS schools qualify for free or reduced lunch.

Table 1: Sample Descriptive Statistics

	Charter		TPS	
	Mean	SD	Mean	SD
Other race	0.03***	0.18	0.05	0.21
Black	0.20***	0.42	0.15	0.36
White	0.20***	0.40	0.22	0.42
Hispanic	0.57***	0.49	0.59	0.49
Male	0.52***	0.50	0.51	0.50
In ELL program	0.23***	0.42	0.19	0.39
Free/reduced lunch qualifier	0.64*	0.48	0.65	0.48
Student has IEP	0.10***	0.30	0.11	0.31

*$p < .05$, ***$p < .001$

We analyze whether the student is in a different school than the prior year when he is enrolled in grades four, five, seven, and eight. We exclude prior grades because in each system testing begins in the third grade, and thus we do not observe their test scores in the prior year (i.e., grade two). We exclude grades six and nine because they are gateway grades in which the large majority of students in traditional public schools are expected to make a structured transition into a new school.

The study's dependent variable was an indicator for whether a student was observed to have exited her school at the end of a school year. A student was defined as exiting her school if in the following school year she was observed to either be in a different school or if she had exited the dataset all together, which would happen if she left the city's school system.

The independent variables in the study included whether a student was enrolled in a charter upon exiting, the academic performance of each student in the prior year relative to the district and school averages respectively, student race/ethnicity, gender, status as an English language learner,[1] IEP status (i.e., whether a student receives special education services), qualification for the federal free and reduced lunch program as an indicator of family economic status, and prior year test score. Table 2 indicates how each of the variables was coded for the analysis.

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[1] From (2), all else held constant, the exiting probability of a low-performing student in a traditional public school is found from β_3, and the exiting probability of a low-performing student in a charter school is represented by $\beta_1 + \beta_3 + \beta_4$. Subtracting the exiting probability from a TPS from the exiting probability in charter yields: $\beta_1 + \beta_3 + \beta_4 - \beta_3 = \beta_1 + \beta_4$.

Table 2: Variables Used in the Analysis

Variables	Coding
Dependent Variable	
Exit	1 = exited a school, 0 = did not exit
Independent Variables	
Enrolled in a charter upon exit	Enrolled in a charter = 1, not enrolled in a charter = 0
Reading/math performance	Dichotomous: 1 = student performance below district or school average, 0 = not below district or school average
Race/ethnicity	Nominal: Black, White, Hispanic, Multi-race, Other; Dummy coded, multi-race as reference
Gender	Male = 1, Female = 0
English language learner	ELL = 1, non-ELL = 0
IEP status	IEP = 1, non-IEP = 0
Free/reduced lunch	FRL = 1, non-FRL = 0
Prior year test score	Scale score

Analysis

Our primary analysis used a linear probability model to measure the relationship between observed student characteristics and the probability of exiting their school. Formally, we use OLS to estimate:

(1) $exit_{igst+1} = \alpha_0 + \alpha_1 charter_{igst} + \alpha_2 X_{igst} + \alpha_3 Y_{igst} + \alpha_4 (charter * Y)_{igst} + \lambda_t + \delta_g + \varepsilon_{igst}$

(2) $exit_{igst+1} = \beta_0 + \beta_1 charter_{igst} + \beta_2 X_{igst} + \beta_3 belowtest_{igst} + \beta_4 (charter * X)_{igst} + \beta_5 (charter * belowtest)_{igst} + \lambda_t + \delta_g + \varepsilon_{igst}$

where exit$_{igst+1}$ is an indicator that equals one if student i, in grade g, and school s, was observed to have exited his school in year t+1; charter is an indicator for whether the student's school in year t was a charter; X is a vector of observed student characteristics; Y is the student's observed test score in either math or reading; below test is an indicator for whether the student's test score is below a particular chosen threshold (described below); λ and δ are year and grade fixed effects; ε is a stochastic term clustered by school in year t; and the α's and β's are parameters to be estimated.

One difficulty with analyzing the attrition patterns of low-performing students in the framework of (2) is that there are multiple ways to define low-performance. For this paper, we choose two main strategies. The first classifies a student as "low-performing" if her test score falls below the average test score in the district among students in the same grade and year. This definition essentially holds all students in the district to the same academic standard. The second strategy classifies a student as low-performing if her test score falls below the average for other students attending the same school, grade, and year. In order to focus on the lowest

performing students, we also alter the definition of low-performing to consider the attrition patterns of students whose test scores are below the 25th percentile within the state.

We can address our first research question–Is there a differential relationship between observed student characteristics (including prior test scores) and the probability that a student exits a charter school relative to the relationship between those characteristics and the probability that a student exits a traditional public school?–by considering the direction and significance of α_4 from (1) and β_4 and β_5 from (2). These coefficient estimates represent the differential relationship between our measure of prior test score performance and student characteristics and the probability of exiting a charter school relative to the probability of exiting a traditional public school.

We can address our second research question–Are low-performing students more likely to exit charter schools than they are to exit traditional public schools?–by further analyzing the results of Equation 2. The analysis requires taking the sum of the differential relationship between prior low-performance and exit within charter schools (β_5) and the effect of attending a charter school itself (β_1). If this sum is statistically different from zero, then we would conclude that low-performing students are more likely to exit charter schools than they are to exit traditional public schools.[1] This same analysis is also applied to student characteristic variables. The relationship is tested via an F-test.

To be clear, the analysis described is entirely descriptive. We make no causal claims. However, from a policy perspective, such a descriptive analysis is very useful in order to understand the type of student who exits a charter school and thus consider whether real patterns are consistent with claims that low-performing and otherwise difficult-to-educate students exit charter schools at worrisome rates.

Results

We first present results from regression models. We then provide graphical illustrations of the relationships under consideration, which provide important further context for understanding the empirical results.

Table 3 reports results from estimating (1). Test scores have been standardized by grade and year to have a mean of zero and standard deviation of one. Consistent with expectations, in each case, there is an overall significant negative relationship between the student's test score and the likelihood that he exits the school. In addition, in each case the estimate on the interaction coefficient is negative, indicating that as test scores increase in charter schools students are less likely to exit than is the case in traditional public schools. Only in the case of math scores, however, is this result statistically significant.

Table 3: Regression Results with Prior Year Test Scores, Coefficients [standard errors]

	Math	Reading
Charter School in Prior Year	-0.0107	-0.0147
	[0.0289]	[0.0286]
Prior Year Test Score	-0.0199***	-0.0174***
	[0.0035]	[0.0034]
Prior Year Test Score * Charter Prior Year	-0.0279*	-0.0174
	[0.0144]	[0.0127]
n	101,782	101,683
R^2	0.0269	0.0249

*p < .05, **p < .01, ***p < .001; Note: Models estimated via OLS. Standard errors clustered by school reported in brackets. Models also include controls for grade, year, student race/ethnicity, IEP status, free or reduced priced lunch eligibility and whether student is classified as an English language learner.

Table 4 reports the results form estimating various versions of (2). We find some evidence of a meaningful across-sector difference in the relationship between being a low-performing student and probability of exit. The positive coefficient on the interaction term indicates that the positive relationship between exiting and low-performance is larger in charter schools than it is in traditional public schools. Thus, for the first research question we conclude that there is a differential relationship between a student having a low test score in the prior year and the probability that she exits a charter school relative to the relationship between a student having a low test score in the prior year and the probability that she exits a traditional public school.

Among the other demographic variables, only in the case of students identified as English language learners by the district is there a consistently significant interaction with charter school attendance. The negative coefficient estimate illustrates that ELL students in charters are less likely to exit their school than are ELL students in TPSs. In all other cases, the relationship between a demographic characteristic and probability of exiting one's school is statistically indistinguishable across sectors. In all but a few cases, the coefficient estimate itself is very close to zero, suggesting that this null result is not primarily driven by imprecision in the estimates.

The p-values resulting from F-tests reported at the bottom of Table 4 address the second research question by evaluating whether the sum of the Charter School in Prior Year and Interaction coefficients differs from zero. In each of the models, when we sum Charter School and Interaction terms we find no statistical difference in the likelihood that low-performing students exit Denver charter schools than the city's traditional public schools. This result occurs because the differential relationship by sector between being a low-performing student and exiting is outweighed by the fact that attending a charter school tends to decrease the likelihood that a student exits her school, regardless of prior test score.

Table 4: Regression Results with Student Characteristics and Low Performing Prior Year, Coefficients [standard errors]

|	Below District Mean, Math	Below District Mean, Reading	Below School Mean, Math	Below School Mean, Reading	Below School 25th Percentile, Math	Below School 25th Percentile, Reading
Other Race	0.00451 [0.0335]	-0.000918 [0.0338]	0.0126 [0.0292]	0.00908 [0.0293]	0.0126 [0.0292]	0.00914 [0.0293]
African American	0.0840** [0.0373]	0.0834** [0.0375]	0.0969*** [0.0325]	0.0967*** [0.0327]	0.0968*** [0.0326]	0.0966*** [0.0327]
White	0.0176 [0.0347]	0.0128 [0.0352]	0.0256 [0.0299]	0.0226 [0.0302]	0.0256 [0.0299]	0.0226 [0.0302]
Hispanic	0.0401 [0.0362]	0.0370 [0.0366]	0.0519 [0.0314]	0.0500 [0.0316]	0.0519 [0.0314]	0.0501 [0.0316]
Male	0.00551* [0.00322]	0.00343 [0.00322]	0.00639** [0.00316]	0.00490 [0.00316]	0.00639** [0.00316]	0.00489 [0.00316]
ELL	-0.0153 [0.0123]	-0.0166 [0.0120]	-0.0147 [0.0114]	-0.0156 [0.0111]	-0.0147 [0.0114]	-0.0156 [0.0111]
IEP	0.0191*** [0.00534]	0.0208*** [0.00566]	0.0267*** [0.00519]	0.0274*** [0.00542]	0.0266*** [0.00518]	0.0273*** [0.00542]
FRL	0.0577*** [0.00562]	0.0588*** [0.00523]	0.0588*** [0.00545]	0.0594*** [0.00516]	0.0587*** [0.00544]	0.0593*** [0.00516]
Charter Prior Year	-0.0160 [0.0251]	-0.0119 [0.0253]	-0.0160 [0.0249]	-0.0124 [0.0250]	-0.0161 [0.0248]	-0.0125 [0.0250]
Low Performing	0.0297*** [0.00594]	0.0239*** [0.00472]	0.0223*** [0.00478]	0.0181*** [0.00423]	0.0223*** [0.00478]	0.0180*** [0.00424]
Interactions						
Low Performing*Charter	0.0525** [0.0223]	0.0399** [0.0176]	0.0509** [0.0205]	0.0377** [0.0157]	0.0509** [0.0205]	0.0376** [0.0156]
African American*Charter	-0.00875 [0.0373]	0.000104 [0.0395]	-0.00615 [0.0379]	0.00268 [0.0399]	-0.00610 [0.0378]	0.00276 [0.0398]
White*Charter	-0.00737 [0.0236]	-0.00366 [0.0230]	-0.00769 [0.0237]	-0.00455 [0.0232]	-0.00792 [0.0237]	-0.00477 [0.0231]
Hispanic*Charter	-0.0250 [0.0284]	-0.0249 [0.0279]	-0.0250 [0.0284]	-0.0242 [0.0280]	-0.0250 [0.0284]	-0.0242 [0.0280]
Male*Charter	-0.00126 [0.00693]	-0.00345 [0.00672]	-0.00223 [0.00702]	-0.00437 [0.00682]	-0.00238 [0.00699]	-0.00453 [0.00679]
ESL*Charter	-0.0331* [0.0186]	-0.0368* [0.0192]	-0.0301 [0.0182]	-0.0332* [0.0186]	-0.0301 [0.0182]	-0.0331* [0.0186]
IEP*Charter	-0.0240 [0.0161]	-0.0195 [0.0151]	-0.0238 [0.0153]	-0.0192 [0.0145]	-0.0232 [0.0154]	-0.0185 [0.0145]

	Below District Mean, Math	Below District Mean, Reading	Below School Mean, Math	Below School Mean, Reading	Below School 25th Percentile, Math	Below School 25th Percentile, Reading
FRL*Charter	0.00976	0.00885	0.0112	0.0107	0.0113	0.0108
	[0.0183]	[0.0181]	[0.0187]	[0.0185]	[0.0187]	[0.0185]
Observations	101,835	101,835	108,250	108,250	108,197	108,197
R^2	0.026	0.025	0.025	0.024	0.025	0.024
	Charter in Prior Year + Interaction: Lag Charter and X, F-Test P-values					
African American	0.5506	0.7922	0.6004	0.8303	0.5990	0.8294
White	0.1938	0.3798	0.1889	0.3426	0.1799	0.3299
Hispanic	0.0301	0.0528	0.0329	0.0571	0.0324	0.0563
Male	0.4891	0.5340	0.4559	0.4899	0.4486	0.4823
ELL	0.0767	0.0841	0.0908	0.0976	0.0899	0.0968
IEP	0.1494	0.2548	0.1331	0.2290	0.1392	0.2385
FRL	0.8275	0.9154	0.8675	0.9537	0.8673	0.9538
Low Performing	0.2906	0.3785	0.2962	0.4093	0.2973	0.4122

*$p < .05$, **$p < .01$, ***$p < .001$; Note: Models estimated via OLS. Standard errors clustered by school reported in brackets. Models also include controls for grade, year, student race/ethnicity, IEP status, free or reduced priced lunch eligibility and whether student is classified as an English language learner.

We can further consider the relationships deriving from the models by looking at the entire test score distributions for those who exit and those who do not by sector. Figures 1 and 2 provide kernel density estimates comparing the (normalized) prior test score performance of those who exit charter schools to those students who exit traditional public schools. The blue lines represent charter schools, and the red line traditional public schools. Dashed lines represent students who exited, and sold lines those who remained in their school.

Figure 1: Kernel density estimates comparing the prior test score performance in math of those who exit and stay in charter schools to those students who exit and stay in traditional public schools
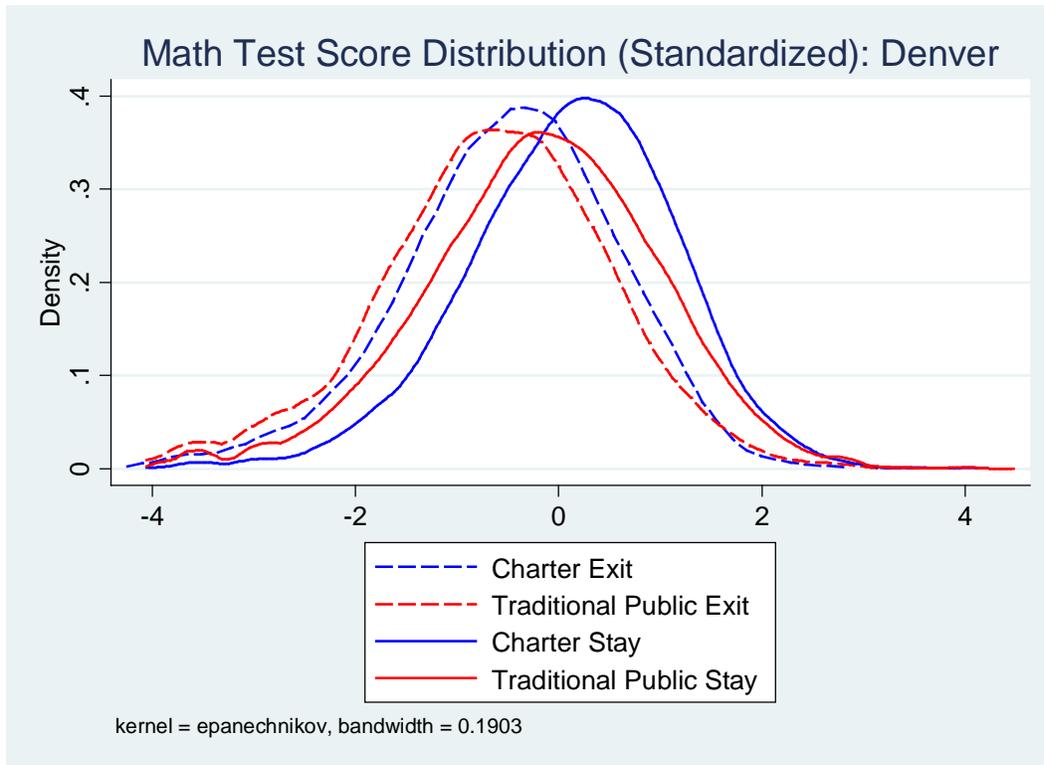
Consistent with the regression results, in both sectors and on both tests there is a leftward shift in the distribution between those who exit and those who stay. What is particularly interesting is that in both subjects the test score distribution of those who exit charter schools appears very similar to that of those who exit traditional public schools. In fact, the results from Kolmogorov-Smirnov tests finds that the test score distributions among exiting students from charter and traditional public schools are statistically equivalent in math ($p = 0.293$), and in reading the distribution among those exiting traditional public schools is slightly but significantly below that of students exiting charter schools ($p = 0.036$).

Figure 2: Kernel density estimates comparing the prior test score performance in reading of those who exit and stay in charter schools to those students who exit and stay in traditional public schools
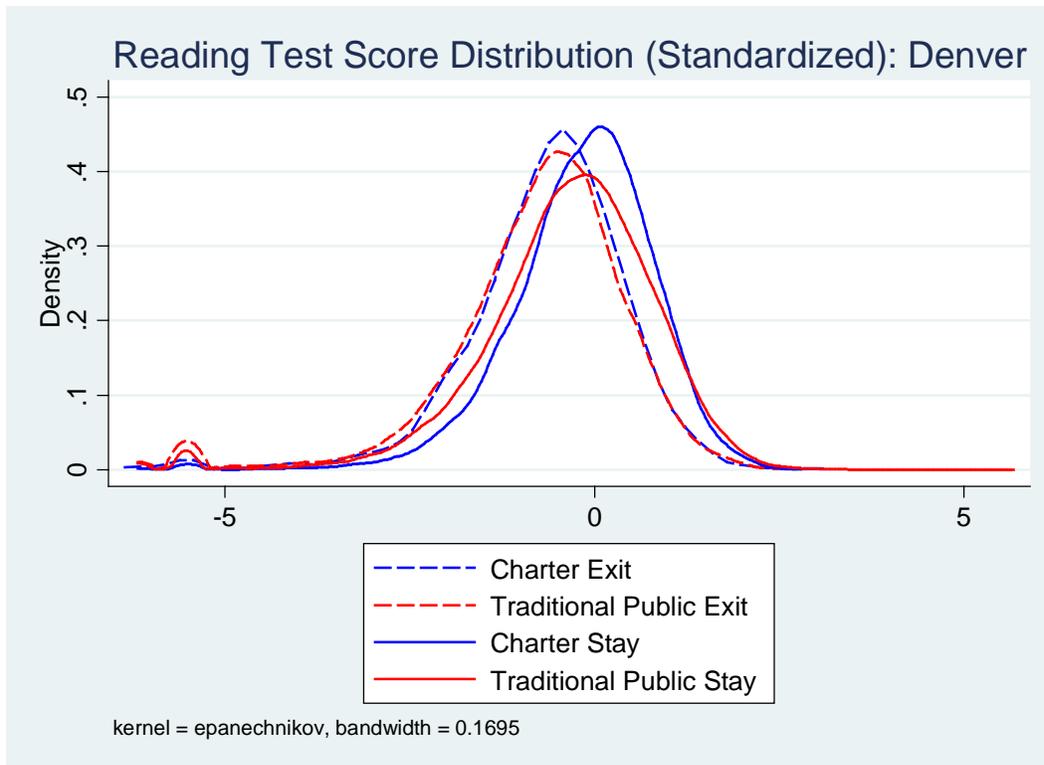
Where the across-sector differences in the test score distributions occur is for students who remain within their school. In both math and reading, the distribution of prior test scores among those who stay within a traditional public school the following year is significantly below that for students who stay within their charter school (p = 0.000 for each subject).

Thus, it does not appear that the significant negative coefficient on the interaction between prior math test scores and probability of exit, reported in Table 2, results from a higher probability that low-performing students exit charter schools. Rather, what is driving the differential relationship is that higher performing students are more likely to remain in Denver charters than they are to remain in the city's traditional public schools.

Conclusion

For those concerned that charters may contribute to comparably greater levels of student mobility, these results suggest that is not the case in Denver. Contrary to research from the past several years (Dauter & Fuller, 2011; Finch et al., 2009; Finch et al., 2008; Hanushek et al., 2007; Karp, 2010; Powers et al., 2012), results from the present study indicate students are overall either equally or less likely to exit charter schools than they are to exit traditional public schools, holding other factors constant. Moreover, where some prior findings suggest

characteristics such as race/ethnicity and income may act as significant predictors of exiting charter schools (Finch et al., 2009; Zimmer & Guarino, 2013), our results generally found few characteristics have a differential relationship to attrition in charter schools relative to their relationship to attrition within traditional public schools.

Most importantly for current policy conversations, we find that there is a differential relationship between attrition and academic performance in the charter and traditional public school sectors. However, this result appears to be driven by higher-performing students being less likely to exit charter schools rather than from lower performing students being more likely to exit them. Further, when we take into account that charter school students are overall less likely to exit their school than are traditional public school students, we find that low-performing students are equally likely to exit either sector. Thus, if attrition of low-performing students is worrisome for charter schools as evidence of school "pushing out" students, it appears to be as worrisome for traditional public schools.

We hasten to add, however, that these results do not provide evidence that schools are or are not affirmatively pushing students out. The analyses in this paper are not able to determine whether and how many students have been inappropriately removed from either sector in part because of their low test score performance. Additional research within schools is needed in order to understand what goes on within that black box. Nonetheless, our analyses do suggest that persistent claims that urban charters systematically remove low-performing students—whether directly or indirectly, through "counseling out"—are likely, at the very least, overstated.

Relative to the other variable with a significant coefficient, results indicate ELL students appeared less likely to exit charter schools than traditional public schools, all else equal. This finding is similar to recent analyses from New York City (Winters, 2014) and is particularly noteworthy for at least two reasons. First, if, as those concerned about charters "pushing out" students express, charters "counsel out" students who are difficult or expensive to educate, or if charters fail to provide a high quality or meaningful education to students with particular needs, it is logical to expect English language learners to exit at a significantly greater rate compared to others. Indeed, as Ramirez, Carpenter, and Breckenridge (2014) discuss, the cost of educating English language learners in Colorado is non-trivial, and the state provides only a fraction of the monetary resources necessary. This means schools and districts bear the greatest share of the cost, possibly creating an incentive to "push out" such students. Our results suggest not only is this not happening, but quite the opposite appears to be true—ELL students in charters are less likely to exit.

Second, in Colorado, this population of students is particularly relevant, as the state has seen in recent years significant growth in the number of ELL students educated in its school districts. The number of ELL students in the Centennial State has grown by 250% compared to only 12% growth in the overall K-12 population (Colorado Department of Education, 2011). DPS specifically serves almost 43,000 English learners whose native languages span more than 170, primarily Spanish but also including Vietnamese, Arabic, Karen, Burmese, Somali, Amharic,

Russian, and Nepali (http://ela.dpsk12.org/). The growth is not, of course, isolated to Colorado. Nationally, between 1980 and 2009, the number of school-age children who spoke a language other than English increased from 4.7 to 11.2 million (National Center for Education Statistics, 2011), making the mobility of this population an increasingly important issue. Results from this study suggest that concern about the relationship between school type and the mobility of this population, however, may be more accurately directed toward traditional public schools, rather than charter schools. Indeed, further research on why ELL students tend to exit charters comparably less often would be beneficial.

Finally, the prevailing assumption throughout this study has been that student mobility is a harmful and undesirable phenomenon. As Dauter and Fuller (2011) discuss, however, increased migration may be a positive trend. Consistent with the theory of school choice, greater rates of mobility may be an indicator of parents seeking schools—whether charter, TPS, magnet, or private, in the case of voucher or tax credit programs—that provide the best "fit" for their needs of their children. Indeed, larger districts, both urban and suburban, including DPS, now actively facilitate this kind of mobility, seeing parental choice as a means to retaining families, catalyzing innovation, and increasing quality and student performance (in DPS, see, for example, http://static.dpsk12.org/gems/osri/CallforNewQualitySchools2013final.pdf). What remains unclear is what amount or part of mobility is productive and what is disadvantageous. As scholarship on mobility and charter schools, or any type of choice, progresses, future research measuring, defining, and differentiating productive from disadvantageous mobility would be particularly beneficial.

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