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A Brighter Future: The Impact of Charter School Attendance on Student Achievement in Little Rock

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A Brighter Future:
The Impact of Charter School Attendance on Student Achievement in the Little Rock Area

By

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I. Introduction

School choice aims to enhance educational quality and to create opportunities for students who would otherwise be deprived of a better education. Originally introduced by economist Milton Friedman, this idea creates an educational market of public and charter schools. Market forces will, theoretically, increase the quality of public schools because of competition. As school choice becomes more and more popular, pressure is being exerted on the public school system to increase quality so that the best students will not leave their schools for private or charter institutions. This paper will narrow the field of school choice and will examine the impact of charter schools on National Percentile Rankings (NPR) from standardized test scores of charter and public schools in the Little Rock, Arkansas area. The study hypothesizes that charter attendance positively impacts test score NPRs for both elementary and middle school students. It will open with a brief introduction of charter schools and the literature surrounding them. Then, the data and methodology used in this study will be discussed, followed by the results. Lastly, this paper will include suggestions on charter policy based on the outcome as well as avenues for further research.

II. Charter Schools: An Overview

The two main forms of school choice are voucher programs and charter schools. Vouchers award a specific amount of money to successful applicants to cover all or some of the cost of private school tuition. When the income variable is less of a consideration for parents, economics tells us that they will choose to send their student to the best school, usually a private school. Vouchers are considered to be the more controversial of the two forms because public funds are used to pay student's tuition to private, often religious schools. Private schools, in turn, also fear that this paves the way for the government to control their curriculum. Charter schools, or "charters", are "publically funded, privately operated schools that families can select outside of their zoned schools. They promise greater school-level autonomy in exchange for greater accountability" (Loeb, Valant, Kasman, 2011). Charters are less controversial than voucher programs because operate under a management contract in which the authorization agency may revoke the charter and close the school if at any time it doesn't meet its requirements and obligations (Scholmer, Shober, Weimer, Witte, 2007).

There are two types of charter schools: conversion schools and startup schools. Conversions initially start out as public schools and usually retain existing faculty and students. The motivation to convert is explained by either a need to escape bureaucracy from the public school districts or because the school does not like its mandated curriculum. Conversely, startup charter schools are entirely new schools that "acquire facilities, faculty, and students at their inception." The motivation for a startup usually derives from the need to create a new "holistic approach to schools". Because startups tend to be more radical than their conversion counterparts, there is a greater expected difference between startup charters and public schools than conversions and public schools (Buddin, Zimmer, 2005).

III. Review of Literature

There is an abundance of literature on the impact of charter schools not only on student test scores, but also the test scores of public schools, minority student, and student behavior. Since test score gains are the most direct indicator of educational improvements, the majority of

research has been conducted using samples of public and charter schools. A number of studies conclude that charter school attendance leads to some degree of positive test score gains. Studies in Arizona (Nelson, Hollenbeck, 2001) and Boston (Abdulkadiroglu, Angrist, Dynarski, Kane, Pathak, 2011) school districts have determined that charter attendance is positively correlated with an increase in test scores. Another study conducted by renowned school choice researcher, Dr. John Witte, and his colleagues which looks at longitudinal data from schools in the Milwaukee area draws the same conclusion (Witte, Weimer, Shober, Schlomer, 2007). Grosskopf, Hayes, and Taylor (2009) found that Texas schools have positive gains in Math and Reading scores, in which they measured the "value added" to standardized test scores. MacIver and Farley-Ripple declare strong support for the charter school system in Baltimore and say that the city's Knowledge is Power Program (KIPP) charter schools have shown high achievement levels that have greatly surpassed their Baltimore City Public School System (BCPSS) counterparts. Lastly, Curto and Fryer (2011) found that attendance of SEED schools (a combination of a charter school and a five-day-a-week boarding school) increase achievement by 0.189 standard deviations in Reading test scores and 0.230 in Math test scores per attendance with over an 18% return on investment. It is also important to note that SEED schools have a lottery-based admissions system and are therefore less susceptible to selection bias.

Despite the plethora of studies which conclude that charter attendance leads to positive test scores gains, there have also been a significant amount of studies which have concluded just the opposite. Two separate analyses of Michigan charter schools found that students do not reach the same level of achievement as their public school counterparts by 2-9% in Reading, Writing, Math, and Science standardized test scores. In their models, the researchers controlled for student, building, and district characteristics. However, they note that they did not account for selection bias in their study (Eberts, Hollenbeck, 2001). Bettinger (2005) also uses school-level data from Michigan to conclude that test scores are negatively affected. In a paper titled "Explaining Charter School Effectiveness", the authors go as far as to generalize that *all* non-urban charters are ultimately ineffective because of school-level homogeneity (Angrist, Pathak, Walters, 2011).

Given that economists have drawn conclusions on both sides of the spectrum, declaring that charters lead to positive and negative test scores effects, it would be logical to assume that there are a number of "mixed effects" conclusions, which several do. In the paper "Student Achievement in Charter Schools in San Diego", Tang (2007) finds that charter attendance results in the same gains as public schools overall with the exception of elementary charter Math and Reading score, which drop significantly. Another group of researchers believe that test score gains are possible, but only over a certain period of time. Studies conducted in Wisconsin, New Jersey, and Florida have all suggested that although charter scores may start off lower than or equal to public scores, "performance improves as the charter schools gain experience" (Barr, 2007). When analyzing Florida schools, Sass (2006) supports this claim and found that achievement for charters improves after five years and proposes that market forces due to competition may lead to these gains.

If charter schools do in fact have a positive impact on test scores, it seems to be most observable in an urban setting. Several studies suggest that urban areas are the only place which charters can make a significant positive impact. The paper "Explaining Charter School Effectiveness" states "estimates using admissions lotteries suggest that urban charter school boost student achievement, while charters in other setting do not." Angrist, Pathak and Walters reach also this conclusion after studying student and school-level data from schools throughout

Michigan. Zimmer and Buddin propose that this might be the case simply because of demographics. Urban charters tend to serve the most "disadvantaged students" and therefore are more effective because of their impact on below-average achievers.

The objective of charter schools in not only to provide an alternative means of a quality education, but to service those who have less access to it. In "Are High Quality Schools Enough to Increase Achievement Among the Poor?" Dobbie and Fryer use data from Harlem Children's Zone, an experimental program which combines community programs and charter schools. They find that achievement effects are large enough to close the racial gap in elementary, middle, and high schools and believe that "high quality schools are enough to significantly increase academic achievement among the poor". In another study by Fryer, he urges policy-makers to "take these examples to scale" so that they may have a significant positive impact on the disadvantaged communities throughout the country. Just as with overall charter achievement, there are skeptics who believe charters actually increase the racial gap between whites and minorities. In a scathing paper titled "No Excuses: A Critique of the Knowledge is Power Program (KIPP) within Charter Schools in the USA", the author Brian Lack argues that KIPP fosters capitalistic and militaristic ideals that preserve the "status quo" and "institutionalized racism" (Lack). North Carolina charter schools are shown to further segregate white and black students. Bifulco and Ladd used time-series data to track the test scores of individual students and find that charter schools "increase racial isolation for both black and whites…and [widen] the achievement gap". They believe this may be because of asymmetric preferences of each race to attend the charter school where they are the majority. This may explain why there are so few racially balanced charter schools (Bifulco, Ladd). Enrollment of minorities in charters is also the main subject of many other research papers. Along the same lines as the study of North Carolina charter schools, data from 1,006 charter schools households in Texas find that race is a good predictor of parents choose to send their students to a charter school or not. Tedin and Weiher support this argument and say that "Whites, African-Americans, and Latinos transfer into charters schools where there is a 11-14% more of that ethnic group in the student body". One paper pushes the segregation issue even further and proposes that black enrollment in charters is a function of public school district segregation and state policy which determines school choice legislation. In "Choice, Charter Schools, and Household Preferences", Kleitz and Bretten point out that although there are differences in school choice among races and socio-economic strata, they do not show a difference in the concern for academic excellence.

While most researchers of charter schools focus on more debated topics such as achievement gains, others concentrate on the externalities of these schools. Impacts on the surrounding public schools and student behavior are the most discussed externalities. Renowned economist Milton Friedman believed that the introduction of school choice will create a market for education and competitive pressures will force public schools to increase their quality. Numerous studies have shown that charter schools have a positive impact on the test scores of public schools in surrounding areas (Booker, Gilpatric, Gronberg, Jansen). North Carolina public school test scores are shown to have increased by 1% after the introduction of charters (Holmes, DeSimone, Rupp). Evidence from Michigan and Arizon has also found that charters may lead to the same effect. Nevertheless, other researchers have concluded that charters may cause public school test scores to decline because they drain resources. In Arizona, the student-teacher ratio increased by 6% after charters enticed teachers to work in the more flexible charter environment (Dee, Fu). One paper proposes that public schools become less efficient as resources and taken away (Ni).

IV. Data and Methodology

To determine if charter attendance has a significant impact of test score NPRs for both elementary and middle school students, I employ the Ordinary Least Squares (OLS) estimation procedure. The intercept parameter "β_1" denotes that the dependent variable "Test Score" will not take a value of zero if all other independent variables are controlled for. The charter dummy variable is used as an intercept dummy variable where:

Regression 1:

$$E(\text{Test Score NPR})_i = (\beta_1 + \delta) + \beta_2(\%FLP)_i + \beta_3(\%White)_i + \beta_4(\%Black)_i + \beta_5(\%Other\ Minority)_i + \beta_6(School\ English\ Language\ Learner) + \beta_7(School\ Poverty\ Index) + \varepsilon_i, \text{ when C=1}$$

and,

$$E(\text{Test Score NPR})_i = \beta_1 + \beta_2(\%FLP)_i + \beta_3(\%White)_i + \beta_4(\%Black)_i + \beta_5(\%Other\ Minority)_i + \beta_6(School\ English\ Language\ Learner)_i + \beta_7(School\ Poverty\ Index) + \varepsilon_i, \text{ when C=0.}$$

When C=0, it will denote that a particular school is a public school (or a "non-charter") and will be the base group for the models, while a C=1 will denote that a school is a "charter" school. Therefore if δ is significant, it will offer evidence that charter schools to have an impact on the test score NPR of a given subject. It is important to note that the Least Squares Estimator's properties are not affected by the intercept dummy variable. Because "School Percent White", "School Percent Black" and "School Percent Hispanic" and "Percent Other Minority" would all equal to one and "Percent Overall School Minority" would be equal to 1- "School Percent White", I omitted the "School Percent Hispanic" and "School Percent Overall Minority" variables in each of the equations to mitigate multi-collinearity. Collinearity is where economic variables move together in systematic ways. To compensate for this, any significance in "School Percent Hispanic" will be present in the β_1 intercept variable.

Next, I use a more refined regression to determine if poverty significantly impacts test score NPRs in all subjects. These two models throw out all race independent variables as well as "School English Language Learner", only using "School Poverty Index" and "Percent Free Lunch Program". The two did not show signs of collinearity, so they are both used in the model.

Regression 2:

$$E(\text{Test Score NPR})_i = (\beta_1 + \delta) + \beta_2(\%FLP)_i + \beta_3(School\ Poverty\ Index) + \varepsilon_i, \text{ when C=1}$$

and,

$$E(\text{Test Score NPR})_i = \beta_1 + \beta_2(\%FLP)_i + \beta_3(School\ Poverty\ Index) + \varepsilon_i, \text{ when C=0.}$$

Thirdly, this study uses two other models to determine if being a minority significantly impacts test score NPRs in all subjects. The use of "Overall Minority" as a collective group can point towards selection bias in charter schools, which will be discussed in more detail later in this section.

Regression 3:

$$E(\text{Test Score NPR})_i = (\beta_1 + \delta) + \beta_2(\%\text{Overall Minority})_i + \varepsilon_i, \text{ when C=1 and,}$$

$$E(\text{Test Score NPR})_i = \beta_1 + \beta_2(\%\text{Overall Minority})_i + \varepsilon_i, \text{ when C=0.}$$

The final two models employed in this study take into account both poverty and overall minority variables. Unlike the previous regressions, the charter data for both of these models are separated into "poor-performing charters" (Regression 4) and "well-performing charters" (Regression 5). If all other independent variables are controlled for, these models determine how the charter variable impacts these charter categories.

Regressions 4 and 5:

$$E(\text{Test Score NPR})_i = (\beta_1 + \delta) + \beta_2(\%\text{FLP})_i + \beta_3(\%\text{Overall Minority})_i + \beta_4(\text{School Poverty Index}) + \varepsilon_i, \text{ when C=1 and,}$$

$$E(\text{Test Score NPR})_i = \beta_1 + \beta_2(\%\text{FLP})_i + \beta_3(\%\text{Overall Minority})_i + \beta_4(\text{School Poverty Index}) + \varepsilon_i, \text{ when C=0.}$$

The school-level data used for this analysis is provided by the University of Arkansas Office for Educational Policy. The data set includes all public and charter schools in the Little Rock, North Little Rock, and Pulaski school districts for the 2010-2011 academic year. The "test score NPR" data used in the study is taken from the Iowa Test of Basic Skills (ITBS) exam as a Norm-Reference Test for all of the schools used in the data set. The ITBS is administered in conjunction with the Arkansas Criterion-Referenced Exam (CRT) to form the augmented benchmark examination. The ITBS contains subtests in Reading, Mathematics, Language, and Science. Table 1 shows all of the variables used in this paper.

Table 1: Definitions of all Variables

Variable	Description
School Name	School name
District Name	School district name
Charter	A value of "1" denotes that a school is a Charter and a value of "0" denotes that a school is a public school.
Reading NPR	School National Percentile Rank (NPR) on the reading subject area of the Iowa Test of Basic Skills (ITBS).
Math NPR	School National Percentile Rank (NPR) on the math subject area of the Iowa Test of Basic Skills (ITBS).

Language NPR	School National Percentile Rank (NPR) on the language subject area of the Iowa Test of Basic Skills (ITBS).
Science NPR	School National Percentile Rank (NPR) on the science subject area of the Iowa Test of Basic Skills (ITBS).
Overall NPR	Overall School National Percentile Rank (NPR) is the average of the Normal Curve Equivalent for each ITBS Subtest (Reading, Math, Language, and Science).
% FRL	The actual percentage of students in each school who qualify for the Free and Reduced School Lunch Program.
School Poverty Index	The Poverty Index Range is a poverty indicator which gives a greater weight to students with greater need.
% White	Percent of students who identify as White.
% Hispanic	Percent of students who identify as Hispanic.
% Black	Percent of student who identify as Black.
% Other Races	Percentage of students who identify by another race that is not stated above.
% Overall Minority	Percent of overall minority (non-white) students.
% English Language Learner	Percent of students who identify as English Language Learner.

Charter students are not a random sample of public school students. They usually enroll as disproportionate amount of either low-achieving and at-risk student or more astute students who seek the freedom or rigorous environment of charter schools (Buddin, Zimmer, 2005). Therefore a difference in test score NPRs may largely be attributed to selection bias within charters. This model will control for "% FLP", "School Poverty Index", "% White", "Percent Black", "% Other Minority, "% English Language Learner" in order to determine if the "Charter" variable significantly impacts test scores. This paper hypothesizes that attendance of a charter significantly impacts student test score NPRs due to selection bias. An initial comparison shows that charter schools have significantly different demographics, which suggests that selection bias is occurring. Tables 2, 3, and 4 below are the charter's standard deviations for each racial variable:

Table 2: Elementary Charter School Standard Deviation for Race Variables

Elementary School Name	**Standard Deviation of "% White"**	**Standard Deviation of "% Black"**	**Standard Deviation of "% Hispanic"**	**Standard Deviation of "% Overall Minority"**
Arkansas Virtual Academy	2.07	-1.92	-0.69	-2.07

Dreamland Academy	-1.14	1.33	-0.08	1.14
eStem Elementary Charter	0.41	-0.45	-0.32	-0.41
Lisa Academy	0.86	-0.93	-0.32	-0.86

Table 3: Middle Charter School Standard Deviation for Race Variables

Middle School Name	**Standard Deviation of "% White"**	**Standard Deviation of "% Black"**	**Standard Deviation of "% Hispanic"**	**Standard Deviation of "% Overall Minority**
Arkansas Virtual Academy	2.74	-2.46	-0.63	-2.74
Cloverdale Aerospace	-1.08	-0.75	1.78	1.08
Covenant Keepers Charter	-1.16	0.32	3.70	1.16
eStem Middle Charter	0.45	-0.45	-0.31	-0.45
Lisa Academy	-0.02	-1.44	0.17	0.02
Ridgeroad Charter	-0.78	0.79	0.49	0.78

Table 4: Elementary and Middle Public School Standard Deviation for Race Variables

Public Schools	**Standard Deviation of "% White"**	**Standard Deviation of "% Black"**	**Standard Deviation of "% Hispanic"**	**Standard Deviation of "% Overall Minority"**
Elementary	0.26	0.25	0.08	0.26
Middle	0.20	0.20	0.03	0.20

The standard deviations for each race variable disproportionately high for both elementary charters and middle school charters. The highest standard deviation for public elementary and middle schools are only 0.26 and 0.20, respectively. This is in complete contrast to charter schools, which have standard deviations up to 2.74. Although almost all of the charters have high standard deviations in all race variables, eStem Elementary and Middle schools have consistently low deviations. These values, however, are not as low as the highest public school standard deviation. Lisa Academy also has particularly low standard deviations for "% White", '% Hispanic", and "% Overall Minority". We can conclude then that public schools have consistent demographics and charter schools tend to have skewed demographics.

In an initial comparison of charter and non-charter mean Subtest NPRs, elementary and middle school charter students consistently surpass their non-charter counterparts (Figures 1 and 2). The exception to this trend is the mean NPR of the Language Subtest in which the non-

charter elementary students outperformed the elementary charters by 2 percentage points, as shown by Figure 1.

Figure 1: Elementary School Charter vs. Non-Charter Mean NPR Scores

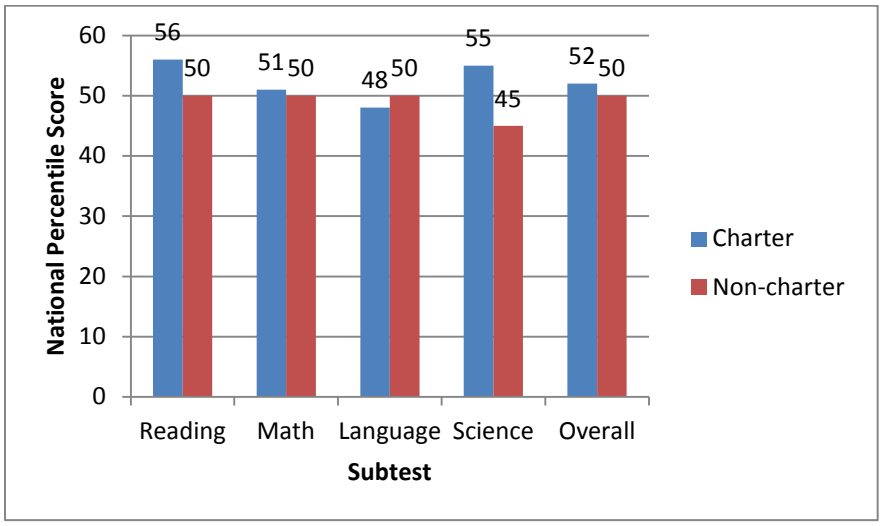
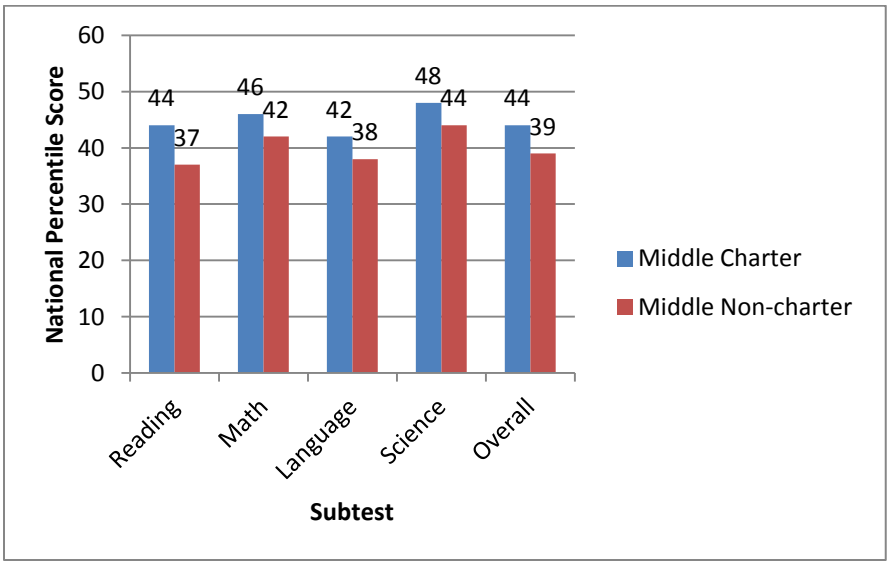


Figure 2: Middle School Charter vs. Non-Charter Mean NPR Scores



The mean test score NPR between charters and non-charters above demonstrate their marked difference as a collective group. Statistical analysis shows that each charter schools has a significantly variance from the mean, the most extreme standard deviation being -2.01 and the least being -0.56. The chart below gives these values for each charter school:

Table 5: Elementary Charter School Test Score NPR Standard Deviation

Elementary Charter School	Test Score NPR Standard Deviation
Arkansas Virtual Academy	0.95
Dreamland Academy	-2.01
eStem Elementary School	0.88

Table 6: Middle Charter School Test Score NPR Standard Deviation

Middle Charter School	Test Score Standard Deviation
Arkansas Virtual Academy	1.70
Cloverdale Aerospace	-1.02
Covenant Keepers	-0.69
eStem Middle School	0.91
Lisa Academy	1.37
Little Rock Prep	-0.69
Ridgeroad Middle	-0.56

A deeper look into specific schools in the Little Rock area shed light on the magnitude of their selection bias. A total of eight different charter school systems were used in this data set: Arkansas Virtual Academy, Cloverdale Aerospace, Covenant Keepers Schools, Dreamland Academy, eStem Schools, Lisa Academy, Little Rock Preparatory Academy, and Rigdewood Charter. Some of these schools contained different schooling cohorts within them, such as the Arkansas Virtual Academy Elementary School and the Arkansas Virtual Academy Middle School. This paper will look for specifically at Arkansas Virtual Academy Middle School, Dreamland Academy, and eStem Schools to point out selection bias in the charter school system.

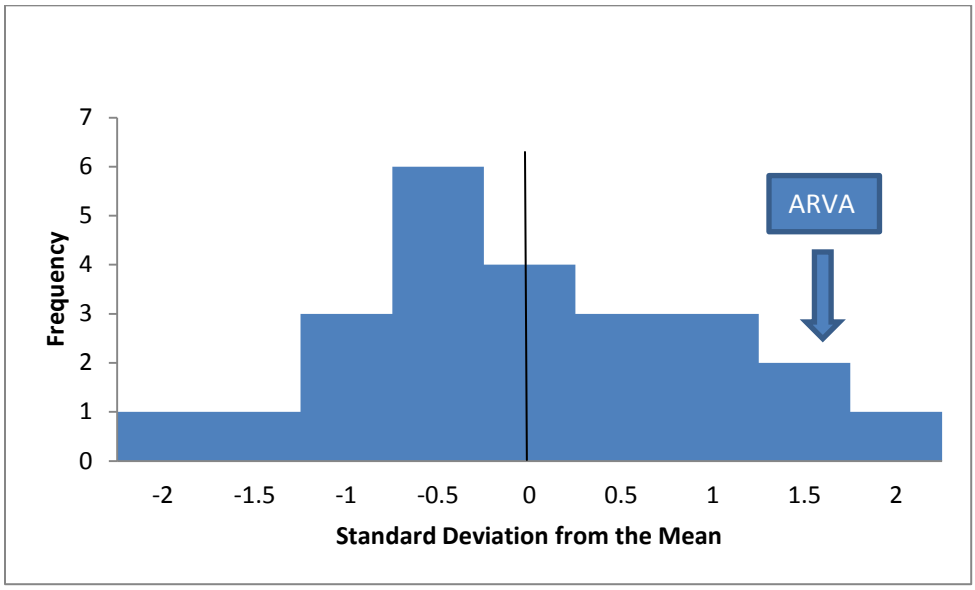
Arkansas Virtual Academy (ARVA) is a particularly unusual case because it is an online charter school which serves grades K-8. The school has a first-come, first-serve policy for open enrollment. When there are more applications than slots available for the year, they use a lottery system to determine who will be admitted. Attendance, daily lessons, and interaction with teacher are all online. ARVA stresses its flexibility because students set their own pace. Below are individual statistics for Arkansas Virtual Academy Middle School:

Table 7: Arkansas Virtual Academy Statistics

Reading NPR	75	% FLP	0%
Math NPR	62	School Poverty Index	0%
Language NPR	58	% White	94%
Science NPR	76	% Hispanic	3%
Overall NPR	67	% Black	3%
Overall NCE	59.2	% Overall Minority	6%

Arkansas Virtual Academy distinguishes itself from other public charters in the Little Rock area because of the exceptional test score NPRs its students receive on all subjects. The school has an overall NPR score of 67 while the mean NPR score of all middle schools in the Little Rock area is 41, lying at 1.70 standard deviations away from the mean.

Figure 3: Overall NPR Score Distribution for Middle School



ARVA not only has outlying test score NPRs, but demographics as well. For the 2010-2011 school year, 94% of the 67 students enrolled were White, where as only 6% of the student body identified as being a minority (3% Black and 3% Hispanic). This figure is far from the mean overall minority statistic in the other charter and non-charters. The mean percentage minority within middle schools in the area is 72% and the mean percentage White is 28%. No students attending ARVA during the 2010-2011 were eligible for the Free Lunch Program, in direct contrast to other schools, whose mean percentage of student eligible for the Program was 67%. Similarly, the School Poverty Index at Arkansas Virtual Academy was 0% while other schools have a mean of 126%. ARVA's Index is 2.51 standard deviations from the mean.

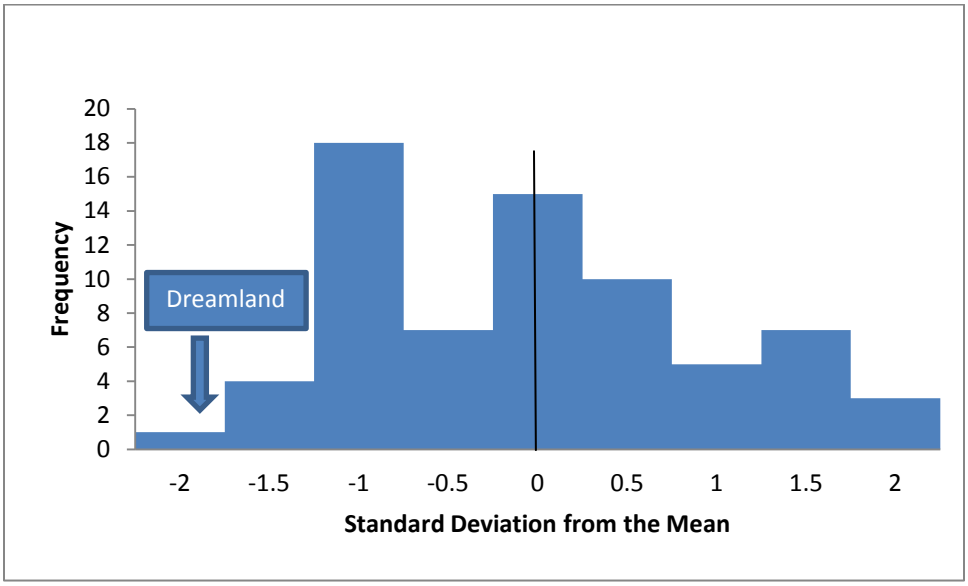
Dreamland Academy of Performing and Communication Arts is another example of an outlying school. Contrary to ARVA however, Dreamland Academy has exceptionally poor scores in all subject areas and has an overwhelmingly minority population. The school serves K-5 and enrolled 264 students for the 2010-2011 school year. Below are individual statistics for Dreamland Academy:

Table 8: Dreamland Academy Statistics

Reading NPR	19	% FLP	98%
Math NPR	20	School Poverty Index	188%
Language NPR	17	% White	3%
Science NPR	22	% Hispanic	8%
Overall NPR	19	% Black	89%
Overall NCE	31.5	% Overall Minority	97%

Dreamland Academy lags far behind both non-charter and charter elementary schools in all test subjects. It has an overall NPR score 19 and is -2.01 standard deviations away from the mean test score of 47.

Figure 4: Overall NPR Score Distribution for Elementary School



Dreamland's School Poverty Index and percentage of students who quality for the Free Lunch Program are overwhelmingly high, at 188% and 98% respectively. Like ARVA, the school also has skewed demographics, but in the opposite direction. 97% of the school is minority students, which is 25% higher than the mean.

This initial analysis of the data now shows us that charter schools have skewed demographics and social-economic data as compared to their public school counterparts, pointing to selection bias. Their mean test score NPRs also have a tendency to be higher. Now the question is: Does charter attendance have a positive significant impact on both disadvantaged and well-performing students?

V. Results

The most desired outcome is one in which the significant charter variables have a positive coefficient for all regressions, ceteris paribus. Below are the results for each of the Regressions and broken up my elementary and middle school cohorts. The values contain the coefficient as well as the t-statistic in parenthesis for each variable.

Table 9: Regression Results for Reading Subtest

	Regression 1		**Regression 2**		**Regression 3**		**Regression 4**		**Regression 5**	
Variable	Elem.	Middle	Elem.	Middle	Elem.	Middle	Elem.	Middle	Elem.	Middle
Charter	-11.65 (3.57)	3.42 (4.85)	-12.29 (3.2)	1.36 (13.5)	-1.06 (5.4)	8.55 (4.1)	-17.29 (6.0)	5.19 (4.4)	-10.64 (3.9)	-6.55 (7.2)
% FLP	5.01 (39.1)	60.70 (89.2)	-3.95 (36.5)	6.97 (78.8)	-	-	-16.2 (38.4)	3.07 (91.7)	-2.31 (36.7)	37.50 (89.2)
% School Poverty Index	-29.31 (19.8)	-50.90 (44.0)	-25.69 (18.2)	-33.55 (40.1)	-	-	-20.24 (19.3)	-31.00 (45.8)	-27.28 (18.4)	-57.77 (45.5)
% White	23.64 (30.8)	174.88 (84.4)	-	-	-	-	-	-	-	-
% Black	25.58 (28.8)	148.77 (80.0)	-	-	-	-	-	-	-	-
% Other Races	40.51 (39.0)	213.65 (95.0)	-	-	-	-	-	-	-	-
% Overall Minority	-	-	-	-	-44.17 (4.7)	-55.21 (7.8)	2.067 (4.8)	-9.39 (17.0)	2.83 (4.8)	7.27 (13.7)
% English Language Learner	13.19 (30.1)	219.08 (91.0)	-	-	-	-	-	-	-	-
Intercept	62.52 (30.3)	-96.25 (85.0)	88.09 (2.6)	76.06 (4.7)	79.94 (3.4)	76.46 (5.9)	88.11 (2.8)	82.12 (7.7)	87.14 (2.7)	81.09 (6.7)

Table 10: Regression Results for Math Subtest

	Regression 1		**Regression 2**		**Regression 3**		**Regression 4**		**Regression 5**	
Variables	Elem.	Middle	Elem.	Middle	Elem.	Middle	Elem.	Middle	Elem.	Middle
Charter	-14.44 (3.06)	-0.32 (7.6)	-16.54 (2.7)	1.12 (4.6)	-5.92 (4.6)	6.17 (4.8)	-15.25 (4.9)	7.22 (5.7)	-16.09 (3.3)	-12.18 (10.5)
% FLP	-16.35 (33.5)	172.09 (139.0)	-17.24 (31.5)	58.05 (114)	-	-	-41.69 (31.6)	4.26 (120.0)	-17.3 (31.6)	94.94 (131.0)
% School Poverty Index	-13.56 (17.0)	-91.47 (68.6)	-18.36 (15.7)	-53.90 (58.0)	-	-	-3.851 (15.9)	-24.46 (59.7)	-16.21 (15.9)	-88.59 (66.9)

% White	26.23 (26.4)	284.08 (131.4)	-	-	-	-	-	-	-	-
% Black	17.59 (24.7)	227.85 (125.8)	-	-	-	-	-	-	-	-
% Other Races	47.52 (33.4)	253.08 (148.0)	-	-	-	-	-	-	-	-
% Overall Minority	-	-	-	-	-45.60 (4.0)	-44.41 (9.1)	-6.512 (3.9)	-21.04 (22.2)	-5.158 (4.1)	16.42 (20.2)
% English Language Learner	16.04 (25.7)	367.37 (141.7)	-	-	-	-	-	-	-	-
Intercept	59.60 (26.8)	202.61 (134.4)	87.58 (2.2)	71.14 (6.9)	80.79 (2.9)	73.04 (6.9)	89.85 (2.3)	85.27 (10.1)	88.16 (2.3)	78.84 (9.8)

Table 11: Regression Results for Language Subtest

	Regression 1		**Regression 2**		**Regression 3**		**Regression 4**		**Regression 5**	
Variable	Elem.	Middle	Elem.	Middle	Elem.	Middle	Elem.	Middle	Elem.	Middle
Charter	-20.4 (3.74)	-0.98 (4.5)	-19.9 (3.3)	-0.01 (3.0)	-8.29 (5.5)	5.70 (4.2)	-17.72 (6.1)	2.82 (3.6)	-21.5 (4.1)	-14.7 (5.6)
% FLP	-54.9 (40.9)	18.38 (82.5)	-57.2 (38.4)	-7.71 (75.0)	-	-	-88.48 (39.0)	-62.15 (73.7)	-58.1 (38.8)	-25.3 (70.8)
% School Poverty Index	-0.53 (20.7)	-32.64 (40.7)	0.56 (19.2)	-18.42 (38.2)	-	-	14.425 (19.0)	-5.09 (36.7)	-0.93 (19.5)	-31.9 (36.0)
% White	3.77 (32.3)	118.45 (78.3)	-	-	-	-	-	-	-	-
% Black	8.12 (30.1)	117.51 (74.6)	-	-	-	-	-	-	-	-
% Other Races	27.93 (40.8)	172.27 (88.1)	-	-	-	-	-	-	-	-
% Overall Minority	-	-	-	-	-44.3 (4.9)	-36.90 (8.2)	2.4911 (4.9)	17.89 (14.1)	4.119 (5.1)	34.15 (10.9)

% English Language Learner	-9.16 (31.4)	178.02 (85.4)	-	-	-	-	-	-	-	-
Intercept	84.21 (32.7)	-51.78 (78.7)	90.24 (2.7)	66.88 (4.5)	79.48 (3.5)	63.60 (6.1)	92.248 (2.8)	74.83 (6.2)	90.15 (2.9)	72.49 (5.3)

Table 12: Regression Results for Science Subtest

	Regression 1		**Regression 2**		**Regression 3**		**Regression 4**		**Regression 5**	
Variable	Elem.	Middle	Elem.	Middle	Elem.	Middle	Elem.	Middle	Elem.	Middle
Charter	-9.77 (3.99)	-1.78 (5.62)	-7.07 (3.9)	1.13 (3.5)	1.33 (5.5)	8.18 (5.0)	-7.254 (6.3)	6.37 (4.5)	-5.09 (4.9)	-13.58 (7.3)
% FLP	8.37 (39.8)	21.22 (105.0)	30.76 (40.5)	30.83 (87.8)	-	-	22.137 (40.1)	-20.85 (93.4)	30.76 (39.3)	9.7412 (96.1)
% School Poverty Index	-30.21 (20.2)	-39.64 (52.0)	-44.5 (20.2)	-46.81 (44.7)	-	-	-34.38 (20.1)	-31.12 (46.9)	-38.7 (19.7)	-54.54 (49.3)
% White	-54.26 (30.9)	97.36 (96.8)	-	-	-	-	-	-	-	-
% Black	-61.80 (28.9)	84.27 (92.3)	-	-	-	-	-	-	-	-
% Other Races	-58.51 (39.3)	137.15 (109.0)	-	-	-	-	-	-	-	-
% Overall Minority		-	-	-	-51.9 (4.3)	-55.48 (9.7)	-13.83 (5.1)	5.93 (17.5)	-13.3 (5.1)	22.895 (14.4)
% English Language Learner	-78.39 (30.3)	174.53 (106.0)	-	-	-	-	-	-	-	-
Intercept	139.72 (31.4)	-11.13 (97.4)	83.82 (2.8)	82.27 (5.2)	80.35 (3.1)	82.33 (7.2)	85.604 (2.9)	93.59 (7.7)	85.0 (2.9)	90.66 (6.9)

Table 13: Regression Results for Overall NPRs

	Regression 1		Regression 2		Regression 3		Regression 4		Regression 5	
Variable	Elem.	Middle	Elem.	Middle	Elem.	Middle	Elem.	Middle	Elem.	Middle
Charter	-15.1 (3.19)	0.535 (5.5)	-15.7 (2.8)	1.24 (3.7)	-4.57 (5.0)	7.38 (4.4)	-16.19 (5.2)	6.045 (4.9)	-14.9 (3.5)	-10.6 (8.5)
% FLP	-21.2 (34.9)	55.57 (101.0)	-24.3 (32.0)	29.52 (92.2)	-	-	-46.84 (33.0)	-7.31 (102.0)	-28.3 (33.1)	44.33 (106.0)
% School Poverty Index	-14.9 (17.7)	-46.54 (50.0)	-15.5 (16.0)	-42.05 (46.9)	-	-	-4.124 (17.0)	-25.7 (51.0)	-12.6 (16.6)	-64 (54.0)
% White	16.33 (27.5)	166.62 (95.8)	-	-	-	-	-	-	-	-
% Black	15.04 (25.7)	141.25 (91.7)	-	-	-	-	-	-	-	-
% Other Races	36.53 (34.8)	220.65 (108.0)	-	-	-	-	-	-	-	-
% Overall Minority	-	-	-	-	-45.2 (4.4)	-48.59 (8.4)	-1.255 (4.2)	-8.25 (18.9)	-1.41 (4.4)	16.03 (16.3)
% English Language Learner	4.85 (26.8)	238.73 (103.0)	-	-	-	-	-	-	-	-
Intercept	70.37 (27.9)	-90.37 (96.4)	88.59 (2.3)	72.91 (5.6)	80.18 (3.2)	73.29 (6.4)	90.068 (2.4)	83.14 (8.6)	88.27 (2.4)	79.72 (7.9)

The first regression takes all independent variables into account: the "Charter" dummy variable, "% FLP", "School Poverty Index", "% White", "% Black", "%Other Race", and "% English Language Learner". When controlling for all variables besides the dummy variable, "Charter" is significant in elementary schools. All test subject NPRs for elementary, however, have a negative coefficient, suggesting that the charter variable has a negative impact on test score NPRs. None of the middle school charter coefficients for any subject are significant. However the race variables are significant and positive in the middle school model and particularly in Reading, Math, and Overall NPR. This suggests that race is positively correlated to test scores in middle. This is explored further in the following paragraphs.

The second regression analyzes what affect the poverty variables, "%FLP" and "School Poverty Index", have on test score NPRs. As with Regression 1, the Regression 2 elementary school charter variable is significant but negative, meaning that attending a charter negatively

impacts test scores when controlling for poverty measures. The Regression 2 middle school charter variable is positively correlated to test scores in all subjects, but none are significant at a 0.05 alpha level.

The third regression uses only the "Charter" dummy and "% Overall Minority" as independent variables. Controlling for "% Overall Minority", the Charter variables are insignificant for both elementary and middle. However, with the exception of Science test score NPRs elementary charter variables have negative coefficients and middle charter variables have positive coefficients. That is to say that charter attendance has a positive impact on test scores when being a minority is taken into account. This is consistent with finds in Regression 1 middle school which suggest that race and test scores are positively correlated.

Regressions 4 and 5 use "Charter", "% FLP", "School Poverty Index", and "% Overall Minority" as independent variables. Regression 4 elementary and middle use charter data only from the poorer performing charters: Dreamland Elementary School, Cloverdale Aerospace Middle School, Covenant Keepers Middle School, and Ridgeroad Middle School. Regression 5 uses charter data only from the better performing charters: Arkansas Virtual Academy elementary and middle Schools, eStem Elementary and Middle Schools, and Lisa Academy elementary and middle Schools. Given that Regression 4 takes data from the poorer performing schools, we would expect the Charter independent variable to have a large significant impact on test scores, relative to the better performing schools. Similarly, we would expect the charter variable to positively impact test scores in the better performing schools, but to a lesser degree. All Regression 4 and 5 elementary charter variables are significant, expect for Science. The coefficients are negative however, meaning that for elementary schools, charter attendance has a bad impact on test scores regardless of whether the school performs well or not. All but one of the middle school charter variables is significant. It is important to note that the charter coefficients for poorer performing Middle schools are positive and have an impact on test score NPRs. Conversely, the middle school charter variable has a negative impact on test scores in better performing schools.

All of the regressions as a whole point to the fact that charter attendance negatively impacts *all* test score performance in elementary schools. Middle school charters have a positive impact on test score NPRs when using poverty and minority variables, as demonstrated by Regressions 2 and 3. Regressions 4 and 5 show that charters have a greater impact on test scores in poorer performing schools and a negative impact on schools that perform better.

VI. Policy Implications

The results from this study have vastly different policy implication for elementary and middle school students. Given that charters have a negative impact on test score NPRs for elementary students, these charters must be either improved upon or shut down, depending on the specific school. As discussed in the Literature Review section, some researchers believe that charters experience an initially drop in test scores and then bounce back after a few years. Although this may be the case for some elementary schools, other may need to revise their curriculum on implement drastic changes to improve result.

The outcome from the previous section tells a vastly different story for middle school charter students. Regressions show that charter attendance has a positive impact on test scores of this cohort in poor performing schools and a negative impact in good performing schools. Charter policy should therefore be aimed at "low-achieving" or "at-risk" students and not toward students that are "high-achieving". As demonstrated earlier in the "Data and Methodology

section", the poorer performing charters have a disproportionally high poverty and minority levels. Charter resources should be channeled to meet their needs and that provide this group with more equal and better educational opportunities, just as Milton Friedman had intended.

VII. Avenues for Further Research

As is always the case with research, there are numerous areas to improve this study to generate more accurate results. The data set used in the paper only contains variables for the 2010-2011 academic year. To further assess the impact of charters on test scores, future research should use longitudinal data over as long of a period of time as possible. The use of long-term data will help researchers better determine the long-term effects of charter schools. As stated in the Literature Review section, some studies conclude that charter's test scores initially drop when the school is opened, but then improve over time as the school "learns". Analyses about charters over time may have an impact on policy decisions. The findings may have an effect on curriculum, student admissions, location, resources available, etc.

Other researches on this topic may also consider including other independent variables that impact test scores such as student background, building characteristics including its location within the city, and whether the charter is a start-up or a conversion. Witte and Weimer's (2007) analysis of Wisconsin charter schools takes student-teacher ratios and percent of disabled students, and an indicator if the schools itself is "at-risk". The use of these variables will create a more accurate model and results.

The model would be greatly improved if the sample size of charters in Little Rock was greater. The number of charters has not increased rapidly, but increasing the size of the area the samples are taken from was expanded, more charter data could be available. Another option is to take charter school data from other large and similar cities within Arkansas. If the study were to control for location, there will be more charter data. More data will also mitigate variances.

Lastly, this study only takes into account the direct impact charter attendance has on test scores. More in-depth studies have the potential to analyze the externalities cause by charter policy. This can include impact on public school test scores, student teacher-ratio, resources and budgets as well as charter student behavior and attendance. Charter may also have an indirect impact on the economy of the area around the school, both immediately and over the decades.

VIII. Conclusion

Charter schools, as a form of school choice, are a gateway to better educational quality and equality. An analysis of the data shows that charters have a wider variance of poverty and minority demographics than their public school counterparts, pointing to selection bias. This study of charter and public schools in the Little Rock area concluded that charter attendance negatively impacts elementary test scores and middle school scores in charter that serve higher-achieving students. However, charter attendance has a positive impact on middle schools with disadvantaged students. This implies that charter policy should be shaped towards serving "at-risk" students in more racially diverse communities. It is worth noting that although charter schools as a form of school choice does not positively impact all students, it impacts those who might not have an equal opportunity for a better education. The results demonstrate that charters are an endeavor worth pursuing for those in need.

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