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Aftermath of Hurricane Katrina: Measuring the Impact of the Recovery School District on Student Outcomes

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Aftermath of Hurricane Katrina: Measuring the Impact of the Recovery School District on Student Outcomes

Abstract

This article builds on a recent body of research relating to the development of charter schools in New Orleans. In particular, this article employs two multivariate Ordinary Least Squares models as well as a Propensity Score Matching design to predict selected student outcomes based on given school characteristics. Although past research has determined that school outcomes in New Orleans have improved since Hurricane Katrina, this study finds that Recovery School District charter schools continue to perform worse than traditional New Orleans schools ten years after the disaster.

Keywords

Economics of Education, Education Policy, Education Reform, Charter Schools, Recovery School District

Cover Page Footnote

I am deeply grateful for all of the help from my advisers throughout the course of this project. Without the encouragement of Professors Jere R. Behrman and Holger Sieg, this paper would not have developed from a mere idea.

I Introduction

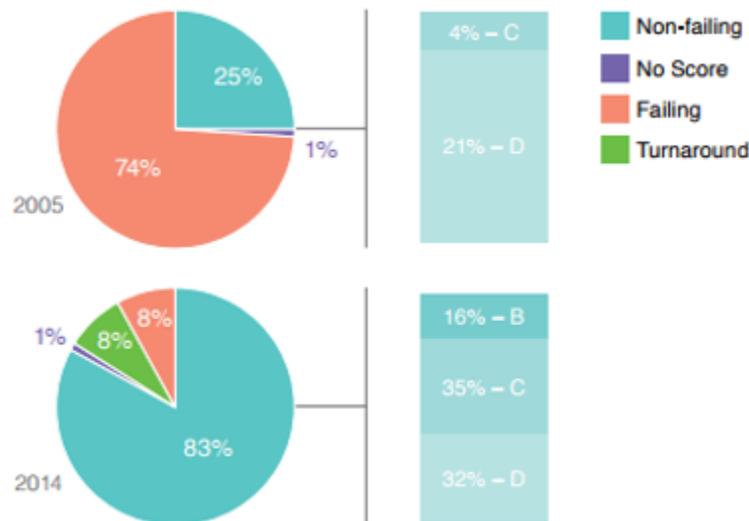
While Hurricane Katrina currently is remembered for the devastation and damage it wrought on the city of New Orleans, history will mark the hurricane as a turning point for education in the city. Before the disaster, New Orleans public schools were among the worst in the nation: New Orleans Parish public schools ranked second to last among Louisiana districts in test scores with only 54% of students graduating high school on time.¹ In 2003, the state of Louisiana established the “Recovery School District” to overhaul the state of education in New Orleans. At the time, the Recovery School District numbered a half-dozen schools. Post-Katrina, however, the state of Louisiana used the state of disaster to consolidate control over many more perennially failing schools in the city.

The Recovery School District grew rapidly to the tune of 80+ schools. By 2014, all schools in the Recovery School District (RSD) had been converted to charter schools, thus making RSD the first all-charter district in the country. As a result, the district became a natural case study for examining the effect of charter school reforms on the outcomes of students. Since RSD schools predominantly neighbor established New Orleans schools, the outcomes of charter and non-charter schools could be compared to assess the effectiveness of the school overhaul.

Since the cataclysm of Katrina occurred recently, the existing body of research on the effects of these charter school reforms is sparse. As seen below in *Figure 1*, the quality of New Orleans schools seems to have improved in the decade since the hurricane, yet it is unclear whether this can be attributed to the charter nature of the schools or other confounding variables. As a result, this paper attempts to determine the effect of the establishment of RSD using an Ordinary Least Squares and a Propensity Score Matching design. A set of school characteristics is determined that are similar among RSD charter schools to the public schools in the Orleans Parish School Board. Upon determination of the significance of any school characteristic variables, each outcome variable is tested to analyze the most important predictors of New Orleans school success. Furthermore, RSD schools are matched with traditional Orleans Parish School Board schools to isolate the effect of the district and its corresponding reforms. In this way, a deeper understanding of the effects of charter school reforms and the unique New Orleans school reform situation will be achieved.

¹ Emma Brown, "Katrina swept away New Orleans' school system, ushering in new era," *The Washington Post*, September 03, 2015, accessed March 30, 2018, https://www.washingtonpost.com/news/education/wp/2015/09/03/katrina-swept-away-new-orleans-school-system-usher-in-new-era/?utm_term=.46d027a31457.

Figure 1: Student Enrollment at Schools Rated by Letter Grade²



II Literature Review

Since the creation of the first charter school in Minnesota in 1991, charter schools have dominated discussions of educational reform and now exist in more than 80% of U.S. states. School choice policies are being implemented nationwide to overhaul chronically low-performing schools, especially those in urban areas. The city of New Orleans serves as a good case study; at the beginning of the 21st century, less than 10% of New Orleans public schools demonstrated passing School Performance Scores. Accordingly, the state of Louisiana passed legislation in 2003 to assume control of poorly-performing New Orleans public schools by establishing the “Recovery School District”, which began to operate alongside the existing “Orleans Parish School Board”. The damage wrought by Hurricane Katrina accelerated the state’s mandate to close underperforming schools and to further decentralize power from the pre-Katrina public School Board to individual charter schools. By 2014, the Recovery School District had become the first school district in the nation to be solely composed of charter schools; consequently, the district has become a natural case study to examine the effect of charter schools and of school-choice policies.

² “10 Years after Hurricane Katrina,” Louisiana Believes - Louisiana Department of Education, accessed March 30, 2018, <https://www.louisianabelieves.com/resources/about-us/10-years-after-hurricane-katrina>.

Much of the research examining charter schools in New Orleans is built on a study investigating urban charter schools in Massachusetts. Angrist et al. (2011) of the National Bureau of Economic Research are among the first to quantify whether urban charter schools perform better than non-urban charters. Using charter school lottery data for sixteen over-subscribed middle schools and eight high schools, the authors of the paper attempt to isolate school-level characteristics that might explain the differences in charter school effectiveness. They show that urban charter attendance boosts achievement well beyond achievement at other urban non-charter schools. In contrast, enrollment at non-urban charter schools tends to reduce student achievement scores overall. The authors also determined that charter schools with established admissions lotteries produce better results than under-subscribed urban charters with poor lottery systems. The authors attribute the positive achievement effect to the “No Excuses” approach to education at certain urban charter schools, a pedagogical discipline that emphasizes student behavior, instruction time, and an emphasis on traditional math and reading skills.

Stewart (2012) builds on existing quantitative analysis of charter school effectiveness by examining whether differences in teacher qualifications, as defined by the *No Child Left Behind Act*, are the cause of the improved performance of students in New Orleans schools before and after Hurricane Katrina. In the aftermath of Hurricane Katrina, charter schools in both the Orleans Parish School Board and the Recovery School District outperformed the traditional public schools in their respective neighborhoods. Although RSD schools had lower overall scores in comparison to OPSB schools, the RSD schools improved at a higher rate between the 2006-07 and 2007-08 academic years. As a result, Stewart studied nine New Orleans public schools (three elementary schools and six senior high schools) in the Recovery School District that existed before Hurricane Katrina (in 2004) and after Hurricane Katrina (in 2008) which maintained identical grade structures during both time periods. Using a paired t-test analysis, Stewart found an improvement in student ELA (English/Language Arts) and math academic performance from pre- to post-Hurricane Katrina. However, the presence of a highly qualified teacher does not have a strong effect on student performance, despite *No Child Left Behind* legislation prioritizing the issue of teacher qualification in its vision for school reform.

One of the main drivers of charter school success in New Orleans has been the *Knowledge is Power Program* (KIPP) educational model, which emphasizes high expectations for student achievement and behavior as well as a substantial increase in time in school. Since existing studies examining KIPP schools have been subject to methodological limitations, Gill et al. (2014) measure the achievement of 41 KIPP middle schools across the country by using Propensity

Score Matching to identify students entering public schools who share similar characteristics/achievement histories to those entering KIPP schools. The authors examined education outcome data from 41 KIPP schools in thirteen states and the District of Columbia, resulting in a sample of 19,289 students who enter KIPP schools during the follow-up period, ultimately tailoring the number to 15,916 students who are used in the matched comparison sample for the impact analysis. After matching the students based on student characteristics, the researchers estimate KIPP impacts using a regression model; the researchers find that average increases in student outcomes were 0.15 standard deviations in math and 0.05 standard deviations in reading one year after entering KIPP. Cumulative impacts after two and three years are even larger, with statistically significant impacts of 0.36 standard deviations in math and 0.21 in reading by the third year. The authors conclude that these positive effects can be attributed to three factors: 1) the unique characteristics of the KIPP training model, 2) the socio-economic environment in which the KIPP schools were operating (as socioeconomically-disadvantaged students have more potential to improve), and 3) distinctive student characteristics. That is, the authors argue that students applying to KIPP schools must be more motivated to obtain high-quality education than are students from other neighborhood public schools who choose not to apply. In short, 2 of the 3 factors can be linked to student characteristics.

Abdulkadiroğlu et al. (2015) expand existing understanding of school choice reform efforts by examining the process of charter school system takeovers. The authors conduct an in-depth analysis of the New Orleans Recovery School District as well as 9 schools in Boston that were closed for poor performance at the end of the 2010-11 school year. The researchers specifically seek to examine the population of students who are passively grandfathered into a new charter school after their old school was closed. Existing studies examining charter school effectiveness had shown causal effects only for charter applicants; this tended to be a self-selecting population as students who are more driven to apply to charter schools tend to be more motivated to improve their own academic outcomes. The authors also use student enrollment, demographic, and outcome data provided by the Massachusetts Departments of Education to construct a lottery instrumental variable framework to analyze grandfathered applicants. As a result, the authors match each middle school student grandfathered into the UP Academy Charter School of Boston from Gavin Middle School to similar students who attended the same school in 5th grade. The authors subsequently find that the new charter schools in the New Orleans Recovery School District demonstrate substantial gains from takeover enrollment. The same holds for the Boston schools, where students grandfathered into the charter schools experience achievement gains at least as large as the gains for students assigned seats in the charter school lotteries.

Harris and Larsen (2016) approach their research from a different angle, using the ‘natural experiment’ of Hurricane Katrina to conduct a difference-in-differences analysis by taking the difference in outcomes before and after the education policy revamp. The authors use a 10-year panel dataset provided by the Louisiana Department of Education, truncating their analysis in 2012, the year when most of the major reforms were completed. The researchers analyze student achievement gains from two angles: 1) ‘Returnees only’, in which the researchers limit their analysis to students who returned to New Orleans after Hurricane Katrina, and 2) ‘Different cohorts’, in which the researchers consider the achievement growth of different cohorts of students before and after the school reforms. Approach #1 compares the same students over time. Approach #2 allows for the comparison of the same age group at different points in time: for example, students in 5th grade in 2005 versus students in 5th grade in 2011. The authors discover that the New Orleans school reforms increase the average student’s performance by 0.2 to 0.4 standard deviations and boost rates of high school graduation and college entry. As the authors note, this impact is also large when comparing it to other strategies of school improvement, such as intensive preschool and class-size reduction. The researchers also observe a smaller impact on ‘Returnees’ of at least .2 standard deviations. The authors of the study attribute the smaller effect on this population to the greater impact of trauma/disruption on the returnees, the delay in having to re-establish a school system, and the nature of reforms themselves, which tend to have more of an effect in early elementary grades than in middle school (when the returnees tend to be older in age).

The implementation of school choice policies is said to increase access to higher-quality schools for all New Orleans students. However, as has been well-documented, students who choose to change schools are often higher-achieving, more likely to be white, and less likely to live in poverty. Thus, Duque et al. (2016) seek to understand how this trend manifests itself in New Orleans by examining school mobility patterns through students’ prior achievement and school quality (both origin and destination schools). Specifically, they examine non-structural mobility, defined as mobility not occurring from a natural change of schools such as from middle to high school. Through use of a five-year panel of student-level data from 2006–07 through 2010–11 for all public schools within the portfolios of the RSD, the OPSB, and the BESE (the Louisiana Board of Elementary and Secondary Education), the authors construct a linear probability model for non-structural mobility exiting patterns and a multinomial framework to predict the quality of the destination school for non-structural movers. The authors’ results reveal that high-achieving students, on average, switch to high-quality schools, whereas low-achieving students transfer to low-quality schools. Students who ultimately switch schools are disproportionately minority and low-income students with below-average achievement. The authors note that these

differential mobility patterns could lead to a stratified educational system within New Orleans, in which one educational standard exists for lower-achieving students and another for higher-achieving students.

Building on the premise that greater school competition/differentiation (i.e. heterogeneity) leads to better school outcomes, Arce-Trigatti et al. (2016) examine the extent of school differentiation in New Orleans to determine whether the district charter schools are homogeneous or heterogeneous. Using data from the Spring 2014 edition of the New Orleans Parents' Guide to Public Schools in which parents fill out a written survey about the school characteristics they consider when choosing a school, the authors employ cluster analysis to better understand the unique differences across schools. Using a 'bottom-up' approach to study school-level differences, the authors determine that there is considerable variance across New Orleans schools throughout most dimensions of school characteristics. RSD charter schools, which often are in charter school networks, tended to be similar, whereas individual charter schools, common in the OPSB, could vary significantly in terms of instructional hours, extracurricular activities, etc. Moreover, by using the same variables that measured school variation in New Orleans, the researchers discover that New Orleans schools are more heterogeneous than schools in a traditional public-school system.

Since student mobility between schools in a school choice environment indirectly reflects individual preferences of education consumers, Harris et al. (2016) examine the factors contributing to inter-school mobility in New Orleans. The authors conceptualize student mobility as a network of inter-school flows and, thus, decompose the relationship between mobility and performance of a school into its constituent push and pull components. Using data from the Louisiana Department of Education from 2003-05 and 2010-12 to develop a cross-classified, multilevel model of sender and receiver schools, the authors discover that the sender school's School Performance Score (SPS) coefficient is negative and statistically significant (-0.86), demonstrating that the lower the SPS of the school, the more likely that students leave the school. On the other hand, the receiver SPS coefficient was positive (0.27) but not statistically significant from zero. Thus, the authors conclude that low School Performance Scores better predict that students will leave a school (i.e. the "push factor") than high SPS scores indicate that students will enter a new school (i.e. the "pull factor"). The authors also find, as consistent with prior research, that low achieving students are less likely to migrate to higher performing schools through non-structural mobility than are higher achieving students.

Cowen et al. (2016) expand on this research to develop a deeper understanding of parents' preferences for public and private schools through Louisiana's state-funded school voucher system. They seek to understand the competitive pressures among New Orleans public and private schools to retain

students and prevent students from switching schools. As a result, the authors use data from OneApp, a New Orleans-specific centralized school lottery and enrollment process for the 2013-14 school year. Of the 37,000 complete applications in the dataset for students entering grades kindergarten to twelve, 8,449 of these applications rank at least one school higher than the student's currently attended school. The authors examine a subset of 892 students who use the 'mixed strategy' of using OneApp to rank both public and private schools. Through creation of a model to analyze the characteristics of individual voucher and public schools, the authors find that private schools unambiguously are preferred overall. However, the researchers discover that applicants would still choose to attend a public school over a private school based on specific criteria: if the School Performance Score assigned to the school were high, the school were closer to home, and/or certain extracurricular programs were offered. Conversely, if the school has a high percentage of impoverished students, then the school would receive fewer applications overall.

The Portfolio Management Model of New Orleans schools, in which the state government infuses choice and experimentation into the school system through the allocation/revocation of charters for schools, is a constant area of interest for researchers. Brewer et al. (2016) seek to quantify the PMM's effectiveness by 1) analyzing whether certain sectors or school types produced larger gains in student achievement than others and 2) examining the variation in student achievement growth within and between sectors in the context of the New Orleans Portfolio. The authors analyze a five-year panel of student- and school-level data from the 2006–2007 to 2010–2011 school year that contains students' annual math and ELA test scores for Grades 3 through 8. They find that nearly half of the RSD charter schools outperform the district average in math/ELA achievement and non-test outcomes and that the networked charter schools in both the RSD and OPSB outperform the independent RSD charter schools. Specifically, they find that the six OPSB independent charter schools mostly have positive effects across outcomes, whereas the RSD independent charter schools mostly have negative effects. These observations lead the researchers to conclude that school quality within the PMM varies not only by school type but also across and within sectors.

In conclusion, much of the existing body of research details the rise and impact of Recovery School District charter schools in the years immediately after Hurricane Katrina. However, the literature is sparse on the longer-term effects of this educational overhaul. Furthermore, the existing research focuses on specific characteristics of New Orleans schools, such as the 'grandfathering effect', the heterogeneity resulting from school choice policies, etc. This analysis will conduct a comparison between two New Orleans school districts to determine whether the establishment of the RSD itself has generated positive outcomes, and

to determine which school characteristic variables explain this effect. The paper will be original in this regard: no paper in the literature has constructed a model based on school characteristics that compares the RSD to a similar school district in order to isolate the effect that the predictors may have on critical outcome variables.

III Data

Sources

The data used were almost exclusively extracted from ‘Louisiana Believes’, (<https://www.louisianabelieves.com/resources/library/data-center/>), i.e. the Louisiana Department of Education website. The LDOE has publicly available data for most schools in Louisiana from the year 2004 to the present. Additional data were from www.schooldigger.com/, a website advertised as providing ‘useful metrics and information for over 120,000 elementary, middle, and high schools in the United States’. Data from the 2014-15 school year were used; 2014 was the most recent year for which data for the independent variables were available. The only exception was the Student-Teacher Ratio variable, for which the earliest year data were available was 2016.

From the LDOE website, the “Enrollment Counts” section provided a downloadable file from which data were extracted for 1) Free/Reduced Lunch, 2) Percentage of Students with Disabilities, 3) Absolute Number of Students in the School, 4) Percentage of Students who are Minority, and 5) Percentage of Students who are Female. The Recovery School District binary variable was generated by assigning 0 if the school in question was in the Orleans Parish School Board district, and 1 if the school was in the Recovery School District.

The data for number of teachers with bachelor’s degrees and the number of teachers with master’s degrees were extracted from school financial data from the LDOE website (<https://www.louisianabelieves.com/data/310/>). While these data were not in downloadable form, data were gathered by searching for each individual school and manually recording the data values. Likewise, Student-Teacher Ratio data were similarly gathered by searching for each individual school on schooldigger.com.

With respect to the outcome variables, School Performance Score data were extracted from the “School, Center, & School System Performance Scores” section of the LDOE website. School Performance Score is measured on a scale from 1-150. Attendance Rate data were extracted from the “Safe and Healthy Schools Data Reports” section of the LDOE website. School Stability Rate data (i.e. the percentage of students who remain at a school from year to year) were extracted from the “Student Discipline” subsection of the LDOE website

<http://www.louisianabelieves.com/resources/about-us/10-years-after-hurricane-katrina>).

Alterations

Since the data were extracted from disparate sources, much of the data was inconsistently recorded. As a result, various alterations to the data were implemented to achieve functionality for the desired regressions.

The Louisiana Department of Education files generally recorded data to 2 decimal points. However, for continuous variables on a scale of 1-100, if a variable was greater than 95 or less than 5, ">95%" and "<5%" were used respectively. Accordingly, these data values were altered to ".975" and ".025". Similarly, "≥99%" was replaced with "100%". However, one school recorded "<5%" for 'Percentage of Females' variable; in this case, the value "0" was imputed, as the school was an all-boys school. For the 'Percentage of Students who are Minority' variable, the number of minority students is recorded in increments of 10 as the minimum of a range (e.g. "≥410"). In this case, the "≥" sign was replaced with "=" sign, and then the percentage was calculated by dividing by the total number of students in the school.

Furthermore, individual schools occasionally lacked certain data points for some categories. In this case, a mean imputation was performed for the missing data points for the variable in question. Lastly, two schools were removed from the original list of OPSB/RSD schools. The "RSD-ReNEW-Reinventing Education, Inc. Central Ofc." school (school #369700) and the "Youth Study Center" (school #36132) had 13 and 28 students respectively, and so were classified as outliers.

Table 1: OPSB Summary Statistics

Variable	Minimum	Mean	Median	Maximum	Standard Deviation
<i>Free/Reduced Lunch</i>	0.2099	0.71396	0.7961	0.9422	0.2256
<i>Percentage of Disabilities</i>	0.025	0.0714	0.0699	0.1535	0.0369
<i>Number of Students</i>	150	665.35	717	1691	383.6227
<i>Ratio of Bachelor's Degrees to Master's Degrees</i>	0.1940	1.7112	1.3921	4.9989	1.1492
<i>Student/Teacher Ratio</i>	9.1	14.96	14.65	20.9	2.6086
<i>Percentage of Minorities</i>	0.4613	0.8469	0.9750	0.9965	0.2022
<i>Percentage of Females</i>	0.433	0.5089	0.5	0.617	0.0434
<i>RSD School Status</i>	0	0	0	0	0
<i>School Performance Score</i>	49.1	93.5813	93.2	138.9	24.3682
<i>Attendance Rate</i>	86.9774	95.44286	97.5	97.5	2.8369
<i>School Stability Rate</i>	32.9	84.62	87.15	97.5	14.3135

Table 2: RSD Summary Statistics

Variable	Minimum	Mean	Median	Maximum	Standard Deviation
<i>Free/Reduced Lunch</i>	0.6034	0.9214	0.9302	0.975	0.0601
<i>Percentage of Disabilities</i>	0.025	0.1267	0.1179	0.2319	0.0425
<i>Number of Students</i>	94	533.1404	487	1316	230.3701
<i>Ratio of Bachelor's Degrees to Master's Degrees</i>	0.2753	4.6361	4	16.3722	3.2719
<i>Student/Teacher Ratio</i>	6.4	15.0066	14	36.1	5.8399
<i>Percentage of Minorities</i>	0.6322	0.9710	0.9836	1	0.05697
<i>Percentage of Females</i>	0	0.4730	0.48	0.543	0.0734
<i>RSD School Status</i>	1	1	1	1	0
<i>School Performance Score</i>	18.9	64.4618	67	96.8	18.8469
<i>Attendance Rate</i>	41.0242	90.5955	93.1281	97.5	11.21020
<i>School Stability Rate</i>	47.5	73.7504	74	91.8	9.9837

When comparing the summary statistics from the RSD and OPSB schools separately, some noteworthy conclusions are as follows:

- Students attending RSD schools are on average 20% more socioeconomically-disadvantaged than students attending OPSB schools. The median percentage of RSD students who receive Free/Reduced School Lunches is 92%.

- Students attending RSD schools are 5% more likely to have a disability. This is notable as schools with a greater number of students with disabilities receive a larger share of state funding.
- RSD schools are smaller on average than OPSB schools, and less dispersion exists with respect to the size of each school.
- Teachers at RSD schools are much less-educated on-average; OPSB teachers are 3 times more likely to have a Master's Degree.
- The average Student-Teacher Ratio is 15.0 and is almost identical at OPSB and RSD schools.
- The schools are almost exclusively populated by minority students (the median number in both samples is about 98%).
- The schools have an almost-even gender breakdown: 48% of students are female at RSD schools and 50% at OPSB schools.
- There are 3 times as many RSD schools in this sample as there are OPSB schools.
- These schools are, on average, classified as "failing". The median School Performance Score at an RSD school is 25 points lower than that at an OPSB school.
- Attendance Rates are generally high -- above 90% on average -- but lower by 5% at RSD schools than at OPSB schools.
- In a given year, only about 74% of students remain enrolled at an RSD school, compared with 85% at an OPSB school.

IV Economic Model

In order to build a model to explain student outcomes in New Orleans schools, 8 key school characteristic variables were chosen. These variables were hypothesized to be the most likely predictors of school quality across both the Recovery School District and the Orleans Parish School Board. Furthermore, variables X_1 to X_7 were all chosen so as to be independent of any effect of district status. The eight school characteristic variables are as follows:

X_1 = Free/Reduced Lunch Percentage of the Student Body

X_2 = Percentage of Students with Disabilities

X_3 = Absolute Number of Students in the School

X_4 = Ratio of Instructional Teachers with Bachelor's Degrees to Instructional Teachers with Master's Degrees

X_5 = Student-Teacher Ratio

X_6 = Percentage of Students who are Minority

X_7 = Percentage of Students who are Female

X_8 = Recovery School District Status (=1 if school is in RSD, =0 if school is not in RSD)

Furthermore, three variables were chosen as measures of student outcomes, as follows:

Y_1 = School Performance Score

Y_2 = Attendance Rate

Y_3 = School Stability Rate³

Three classes of models were employed in this paper to analyze the effect of various school characteristics on outcome variables. The first class of models employed a multivariate model for each of the three outcomes. Only independent variables significant at the $p = .05$ level were used (as determined by individually regressing each predictor on the dependent variable in question). That is, School Performance Score, Attendance Rate, and School Stability Rate were each regressed on the sum of significant X_i 's, with each X_i defined above. (See *Appendix 1* for the results of these significance tests). This set of models can be classified by the equation:

$$Y_j = \sum_{i=1}^8 \beta_i X_i | (P(X_i) > .95), j \in \{1, 2, 3\}$$

The second class of models involved creating a multivariable model for all eight independent variables listed above, plus an interaction term for X_1 to X_7 with X_8 (RSD School Status). This can be classified as follows:

$$Y_j = \sum_{i=1}^8 \beta_i X_i + \sum_{k=1}^7 b_k X_k * X_8, j \in \{1, 2, 3\}$$

Lastly, the third class of models involved implementing a Propensity Score Matching design in order to isolate the effect of the Recovery School District on the remaining predictor and outcome variables. The propensity scores were computed using a probit model taking a value of 1 for RSD school and 0 for OPSB school. The propensity score is the likelihood of any New Orleans school being an RSD school given the seven school predictor variables.

$$p(x) := Pr(T=1 | X = x)$$

³ A measure of the percentage of students remaining at a given school in a year.

Once the propensity scores were computed for all schools, each of the 20 OPSB schools was matched to the 57 RSD schools using the “nearest neighbor” method by minimizing the difference between the two propensity scores, thus finding the closest match based on the given characteristics.

N.B. Distributions of the RSD and OPSB propensity scores are included in *Appendix 2*.

V Results (OLS)

1st Set of Regressions:

School Performance Score

When regressing School Performance score on each of the individual school characteristic variables listed above, only Student-Teacher Ratio is not significant at the $p = .05$ significance level. Thus, the initial regression equation becomes:

$$(1) \quad \text{SchoolPerformanceScore} = \beta_0 + \beta_1 * (\text{FreeReducedLunch}) + \beta_2 * (\text{PercentDisabilities}) + \beta_3 * (\text{NumberofStudents}) + \beta_4 * (\text{BachelorstoMasters}) + \beta_6 * (\text{PercentMinority}) + \beta_7 * (\text{PercentFemale}) + \beta_8 * (\text{RSDstatus}) + \varepsilon$$

By performing this Multiple OLS regression, it is found that X_2 , X_4 , and X_6 are not significant. Thus, by removing these variables, the final OLS equation becomes:

$$(2) \quad \text{SchoolPerformanceScore} = \beta_0 + \beta_1 * (\text{FreeReducedLunch}) + \beta_3 * (\text{NumberofStudents}) + \beta_7 * (\text{PercentFemale}) + \beta_8 * (\text{RSDstatus}) + \varepsilon$$

These variables are all significant at the $p = .05$ level. Therefore, the quality of a New Orleans school (i.e. the School Performance Score) increases jointly with the size of the school and with a greater female enrollment; the quality of a school declines with a poorer student population and if the school is in the Recovery School District. By far the biggest impact on the quality of a school is its female enrollment; if the percentage of females increases by one standard deviation (7%), then the School Performance Score increases by 4.55 points. The magnitude of this change is 1.3x larger than the magnitude of a

change in the Free/Reduced Lunch Percentage, and 5x larger than a change in RSD Status.

Attendance Rate

When regressing Attendance Rate on each of the outcome variables listed, X_1 , X_4 , X_5 , X_6 , X_7 , and X_8 are not significant at the $p = .05$ significance level. Immediately, it is seen that RSD Status does not have a significant impact on Attendance Rate. For the purposes of the research hypothesis, X_8 is kept in the linear equation. The regression equation subsequently becomes:

(3)

$$\text{AttendanceRate} = \beta_0 + \beta_2 * (\text{PercentDisabilities}) + \beta_3 * (\text{NumberofStudents}) + \beta_8 * (\text{RSDstatus}) + \varepsilon$$

By performing this Multiple OLS regression, it is found that X_2 and X_3 remain significant at the $p = .05$ significance level. As a result, by far the biggest predictor of a decline in the Attendance Rate is the percentage of the student body with disabilities. An increase of 1 standard deviation (5%) in the percentage of students with disabilities reduces the Attendance Rate by 4 points. However, this result should be taken with a grain of salt; as the summary statistics show, the median disability rate of an OPSB and RSD school is 7% and 12% respectively. Consequently, Attendance Rate may be impacted by factors other than by the disability status of a small percentage of the student body.

School Stability Rate

When regressing School Stability Rate on each of the outcome variables listed, X_2 , X_4 , and X_5 are not significant at the $p = .05$ significance level. Thus, the regression becomes:

(4)

$$\text{SchoolStabilityRate} = \beta_0 + \beta_1 * (\text{FreeReducedLunch}) + \beta_3 * (\text{NumberofStudents}) + \beta_6 * (\text{PercentMinority}) + \beta_7 * (\text{PercentFemale}) + \beta_8 * (\text{RSDstatus}) + \varepsilon$$

By performing this Multiple OLS regression, it is found that only X_3 , the Absolute Number of Students in a School, is significant at the $p = .05$ significance level. An increase in 1 standard deviation of the number of students (280 students) increases the School Stability Rate by 5 percentage points. Thus, the School Stability Rate moderately increases as school size increases.

Table 3: Recovery School District OLS (Class 1) Models

	OLS Regression Models		
	<i>Dependent variable:</i>		
	School Performance Score (1)	Attendance Rate (2)	School Stability Rate (3)
Free/Reduced Lunch	-49.092*** (15.412)		-5.341 (16.806)
Percentage of Disabilities		-75.794*** (25.562)	
Number of Students	0.030*** (0.007)	0.009** (0.004)	0.019*** (0.004)
Percentage of Minorities			-12.078 (18.034)
Percentage of Females	64.915** (28.346)		19.826 (16.851)
RSD School Status	-12.679** (5.299)	0.470 (2.714)	-5.014 (3.192)
Constant	75.825*** (19.093)	95.192*** (3.935)	75.804*** (12.204)
Observations	77	77	77
R ²	0.569	0.227	0.414
Adjusted R ²	0.545	0.195	0.373
Residual Std. Error	16.188 (df = 72)	8.935 (df = 73)	9.621 (df = 71)
F Statistic	23.718*** (df = 4; 72)	7.139*** (df = 3; 73)	10.049*** (df = 5; 71)
<i>Note:</i>	*p<0.1; **p<0.05; ***p<0.01		

2nd Set of Regressions:

In order to isolate the effect of RSD School Status on the outcome variable in question, RSD School Status is first regressed on the other seven predictor variables to ensure that RSD School Status is independent of the other variables. The results of this regression are below:

Table 4: Testing the Independence of RSD School Status
Effect of RSD School Status on Other Predictor Variables

	<i>Dependent variable:</i>
	RSD School Status
Free/Reduced Lunch	1.915 ^{***} (0.510)
Percentage of Disabilities	3.431 ^{***} (0.902)
Number of Students	0.0001 (0.0002)
Ratio of Bachelor's Degrees to Master's Degrees	0.028 ^{**} (0.012)
Student/Teacher Ratio	0.012 (0.008)
Percentage of Minorities	-1.143 [*] (0.594)
Percentage of Females	-0.483 (0.554)
Constant	-0.333 (0.411)
Observations	77
R ²	0.532
Adjusted R ²	0.485
Residual Std. Error	0.317 (df = 69)
F Statistic	11.210 ^{***} (df = 7; 69)

Note: * p<0.1; ** p<0.05; *** p<0.01

As can be seen, only Free/Reduced Lunch, Percentage of Disabilities, and Ratio of Bachelor's to Master's Degrees are significant at the p = .05 significance

level. Since the Free/Reduced Lunch and Percentage of Disabilities variables are determined *a priori*, it is assumed that these two variables are not affected by RSD School Status. With respect to the Ratio of Bachelor's to Master's Degrees, since the Recovery School District is apportioned a similar level of funding as traditional school districts, the district is limited in its ability to hire more-educated teachers than is typical for other New Orleans schools. Thus, by assumption, RSD School Status has no effect on these three variables, and no significant effects are found for the remaining variables. Consequently, the effect of any interaction of RSD School Status with the other predictors is tested in the following equations. Figures 2 through 4 below use the models to plot predicted outcomes against the measured values.

(5)

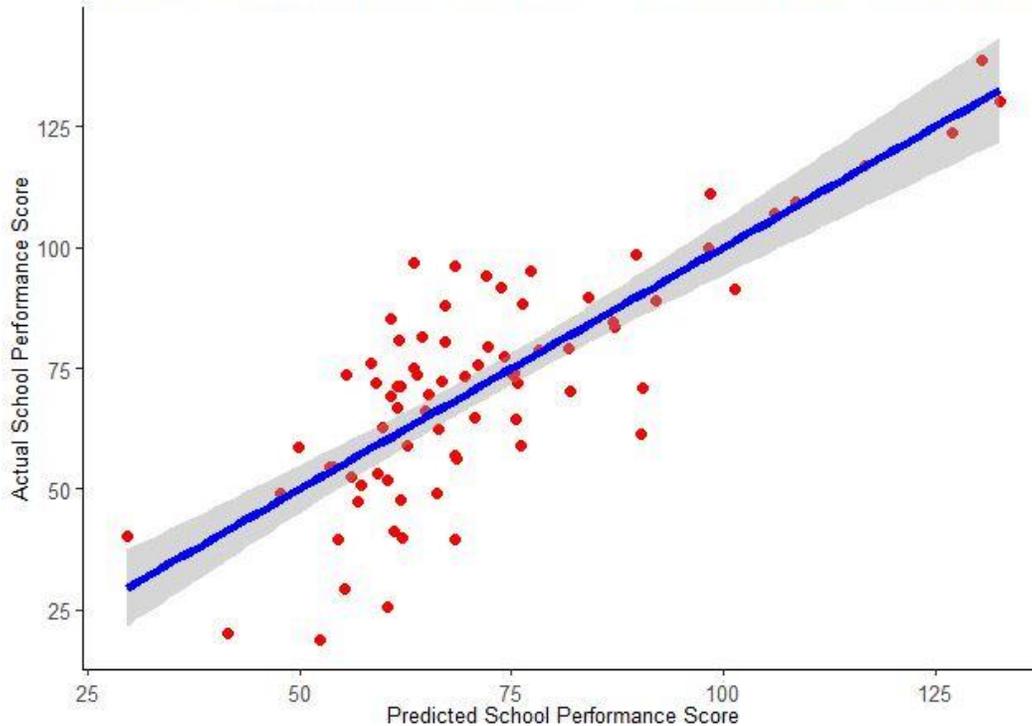
$$\begin{aligned} \text{SchoolPerformanceScore} = & \beta_0 + \beta_1 * (\text{FreeReduced Lunch}) + \\ & \beta_2 * (\text{PercentDisabilities}) + \beta_3 * (\text{NumberofStudents}) + \\ & \beta_4 * (\text{BachelorstoMasters}) + \beta_6 * (\text{PercentMinority}) + \beta_7 * (\text{PercentFemale}) + \\ & \beta_8 * (\text{RSDstatus}) + b_1 * (\text{Free/Reduced Lunch} \times \text{RSD School Status}) + \\ & b_2 * (\text{Percentage of Disabilities} \times \text{RSD School Status}) + b_3 * (\text{Number of} \\ & \text{Students} \times \text{RSD School Status}) + b_4 * (\text{Ratio of Bachelor's Degrees to} \\ & \text{Master's Degrees} \times \text{RSD School Status}) + b_5 * (\text{Student/Teacher Ratio} \times \\ & \text{RSD School Status}) + b_6 * (\text{Percentage of Minorities} \times \text{RSD School Status}) \\ & + b_7 * (\text{Percentage of Females} \times \text{RSD School Status}) + \varepsilon \end{aligned}$$

School Performance Score

When adding interaction terms to the OLS model to test whether RSD School Status has an additive effect with other predictor variables, it is found that Number of Students x RSD School Status and Percentage of Minorities x RSD School Status are significant at the $p = .05$ level. Consequently, RSD School Status affects the magnitude of the associated coefficients for the two aforementioned variables.

When differentiating *Equation 5* with respect to RSD School Status in order to calculate the total effect of RSD School Status (X_8) on School Performance Score, it is found that the total effect is equal to 1.95457. As a result, a school in the Recovery School District has, on average, a 2-point increase in its School Performance Score (amounting to a 1.33% increase overall). It is self-evident that this impact is minimal. This result also calls into question existing research that has lauded the RSD's effect on School Performance Scores.

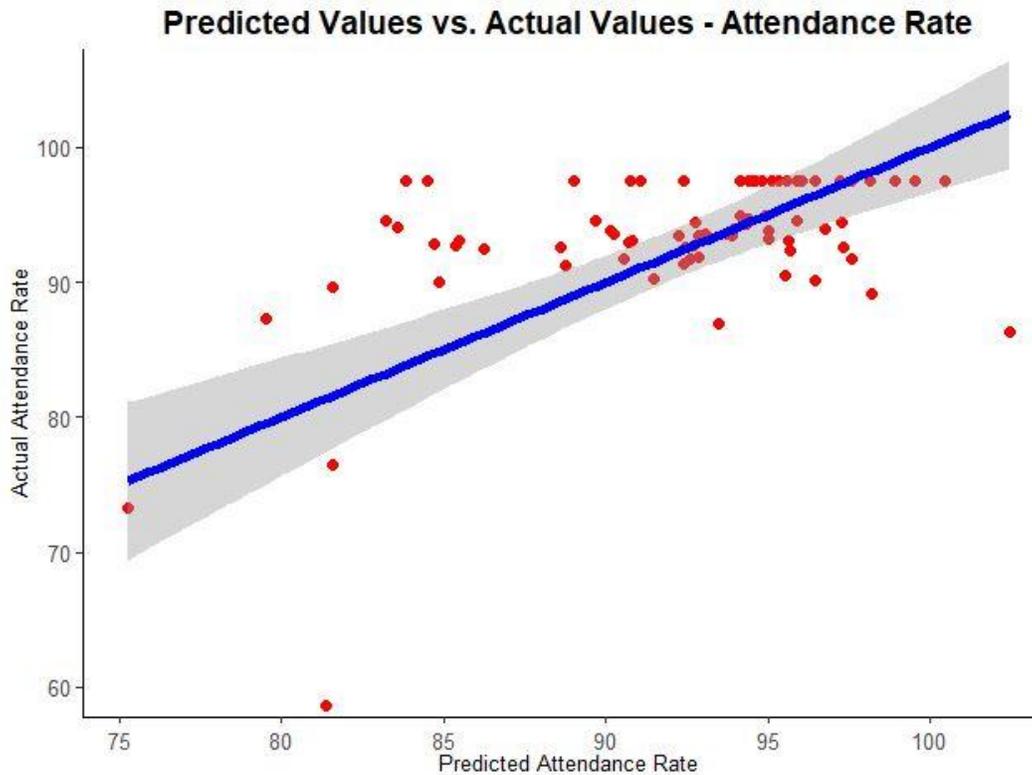
Figure 2: OLS Class 2 Model – School Performance Score
Predicted Values vs. Actual Values - School Performance Score



Attendance Rate

When regressing Attendance Rate on the same OLS Class 2 Model, it is found that the only interaction term significant at $p = .05$ is Number of Students \times RSD School Status. While the first set of OLS models determined that Number of Students is significant when predicting Attendance Rate, this model shows that part of the impact is attributed to RSD School Status. More importantly, the total effect of RSD School Status on Attendance Rate is calculated to be -94.62285 . That is, enrollment in a Recovery School District school decreases a student's rate of school attendance by 95%. Although one would hypothesize that the charter schools of the Recovery School District would maintain school policies encouraging attendance, clearly, the opposite has occurred.

Figure 3: OLS Class 2 Model – Attendance Rate



School Stability Rate

Finally, it is seen that no predictor variables are significant when including an interaction with RSD School Status at the $p = .05$ significance level. As a result, the district of a school does not affect any of the predictor variables when determining the School Stability Rate. By computing the total effect of the RSD School Status (-162.3271), one can see that students in the Recovery School District are much less likely to remain at a school in a given year. This may be partly attributable to the fact that charter schools, by nature, are much more likely to open/close in a given year. However, this reaffirms that RSD schools perform worse in another key outcome variable.

Figure 4: OLS Class 2 Model – School Stability Rate

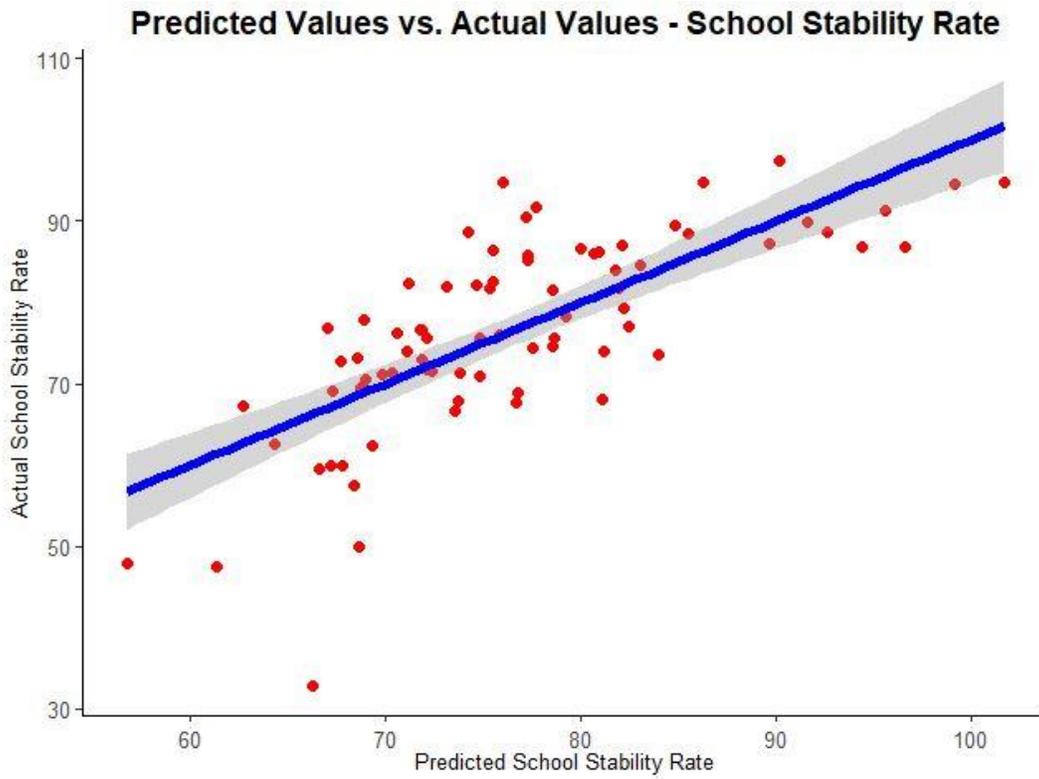


Table 5: Recovery School District OLS (Class 2) Models

OLS Regression Models with Interaction Terms

	Dependent variable:		
	School Performance Score	Attendance Rate	School Stability Rate
	(1)	(2)	(3)
Free/Reduced Lunch	-162.735*** (44.094)	-14.880 (25.337)	-17.689 (25.482)
Percentage of Disabilities	-5.036 (124.145)	-7.616 (71.335)	182.686** (71.743)
Number of Students	0.007 (0.013)	-0.001 (0.008)	0.011 (0.008)
Ratio of Bachelor's Degrees to Master's Degrees	2.791 (3.306)	0.307 (1.900)	0.552 (1.911)
Student/Teacher Ratio	0.396 (1.644)	-0.085 (0.945)	0.866 (0.950)
Percentage of Minorities	124.701*** (46.755)	12.055 (26.866)	-8.713 (27.020)
Percentage of Females	82.421 (107.580)	5.093 (61.816)	108.692* (62.170)
RSD School Status	48.178 (71.277)	7.587 (40.956)	84.188** (41.190)
Free/Reduced Lunch x RSD School Status	116.879* (63.418)	10.928 (36.440)	22.226 (36.649)
Percentage of Disabilities x RSD School Status	20.398 (135.962)	-95.786 (78.125)	-117.019 (78.572)
Number of Students x RSD School Status	0.035** (0.017)	0.020** (0.010)	0.015 (0.010)
Ratio of Bachelor's Degrees to Master's Degrees x RSD School Status	-2.780 (3.374)	-0.344 (1.938)	-0.420 (1.950)
Student/Teacher Ratio x RSD School Status	-1.089 (1.698)	-0.234 (0.976)	-0.628 (0.981)
Percentage of Minorities x RSD School Status	-156.628** (67.804)	-13.742 (38.961)	-55.276 (39.184)
Percentage of Females x RSD School Status	-23.040 (111.549)	-3.051 (64.097)	-95.413 (64.464)
Constant	47.486 (56.707)	95.421*** (32.584)	15.168 (32.771)
Observations	77	77	77
R ²	0.646	0.322	0.539
Adjusted R ²	0.559	0.155	0.426
Residual Std. Error (df = 61)	15.930	9.154	9.206
F Statistic (df = 15; 61)	7.420***	1.931**	4.762***

Note:

* p<0.1; ** p<0.05; *** p<0.01

VI Results (PSM)

When using a probit model to estimate which variables predict Recovery School District Status, it is found that X_1 , X_2 and X_4 remain significant at the $p = .05$ significance level. By far the largest predictor is the Percentage of Students with Disabilities; this finding is in-line with the preliminary summary statistics (*Table 2*), which showed that more students with disabilities attend RSD schools than OPSB schools. The significance of the Free-Reduced Lunch predictor exemplifies that the students of the Recovery School District are poorer than the typical New Orleans student; this fact was part of the state of Louisiana's original justification for intervening in the New Orleans school system.

The use of Propensity Score Matching technique is predicated on the assumption that RSD Status does not affect the three predictor variables. These three variables are the same variables from the OLS Interaction Term Model above, in which it was assumed that RSD School Status had no impact. As a result, the PSM assumption is inferred to be true and is strengthened by evidence from the linear model.

Table 6: Recovery School District Probit Model

Propensity Score Model	
	<i>Dependent variable:</i>
	RSD School Status
Free/Reduced Lunch	5.764** (2.305)
Percentage of Disabilities	17.307** (6.978)
Ratio of Bachelor's to Master's Degrees	0.532** (0.209)
Constant	-7.403*** (2.197)
Observations	77
Log Likelihood	-18.604
Akaike Inf. Crit.	45.208
<i>Note:</i>	* $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$

This model is used to match the OPSB schools to the RSD schools on similar characteristics. The results of the matching procedure on the 3 outcome variables are listed below:

Table 7: PSM Results

<i>Variable</i>	School Performance Score	Attendance Rate	School Stability Rate
<i>Estimate</i>	-24.735	-5.9287	-10.699
<i>AI SE</i>	11.504	6.0891	5.3559
<i>t-statistic</i>	-2.15	-0.97365	-1.9975
<i>p-value</i>	0.031553**	0.33023	0.045766**

Original number of observations..... 77

Original number of treated observations..... 57

Matched number of observations..... 57

Matched number of observations (unweighted)..... 57

As can be seen above, Recovery School District Status is significant when predicting School Performance Score and School Stability Rate. These results are in-line with the OLS results. In both cases, the coefficients are negative, suggesting that Recovery School District schools perform worse on average than similar neighborhood schools. Again, Attendance Rate is not significantly impacted, but the coefficient is still negative.

The coefficients of the PSM model are twice as large in magnitude as those of the OLS model. This is a consequence of the nature of the PSM model design, which eliminates bias by matching the treatment and sample group. The effect of RSD Status is further isolated in the PSM model by the fact that the model is non-linear (i.e. it is based on a probit model) and nonparametric.

VII Conclusion

The Recovery School District has been hailed for its all-charter school model, and previous studies have alluded to the positive impact of the Recovery School District on student outcomes. However, this study presents evidence to the contrary: of the three major student outcomes examined in this paper, the School Performance Score and the School Stability Rate were found to be impacted negatively by the status of the school (i.e. whether it was in the Recovery School District or not), as confirmed by both the OLS Class 1 model and the PSM design. When using only significant predictor variables to determine School Performance Score, RSD School Status accounted for a 13 point (9%) drop in School Performance Score with 95% confidence. Furthermore, when using Interaction Terms in the OLS Models, the total effect of RSD School Status on the Attendance Rate and School Stability Rate was equivalent to a decrease of 95% and 162% respectively.

The existing literature has documented the improvement in RSD School Performance Scores over time but has noted that School Performance Scores are lower at RSD schools than at similar New Orleans schools. This study confirms that this result had not changed in the 2014 school year when the Recovery School District became composed solely of charter schools. As has been stated above, the Recovery School District consists of a biased sample of schools – only the worst-performing New Orleans schools were taken over for new district management. However, one would assume that the charter model of RSD schools would lead to some measurable improvement. Nevertheless, even when considering other school characteristics, this study *did not* observe a direct effect of RSD Status on Attendance Rate in the three model designs, and observed a net *negative* effect on the other two outcome variables.

Needless to say, these results are surprising. Perhaps the existing research has inflated the effect of New Orleans district status on student outcomes, or the research has been measuring the effect of an unseen confounding variable. It is also possible that RSD Status is more relevant to macro-characteristics of the school (e.g. its overall performance) rather than the characteristics of its students (e.g. the percentage of students who attend a school daily in a given year). Further research should be conducted to verify these claims, as well as to test the effect of RSD Status on other outcome variables.

It is encouraging that the OLS and the PSM models produced comparable results. Consequently, this provides additional evidence that Recovery School District schools are not on-par with similar neighborhood schools as determined by key characteristics. In fact, the PSM design, which was predicated on isolating the effect of district status, suggests that the school situation in the Recovery School District is even worse than previously imagined.

With respect to analysis of the final regression models, each presented results in-line with existing research. In no case was Student-Teacher Ratio significant in affecting outcome variables; in contrast, an increase in the Number of Students improved all outcome variables. While these variables are modestly correlated (the correlation between the two is .29), it seems that student outcomes improve to a greater extent when students interact with more students than with more teachers.

Equation 2 demonstrated that the biggest impact on a school's performance score were the socioeconomic and gender characteristics of the student body. Economically-disadvantaged students are likely to face obstacles to attending school regularly, and past research has demonstrated that girls perform better in school settings than boys. The other variables offered illuminating results, albeit without the desired significance. For example, it is seen that the School Stability Rate is largely predicted by the racial and gender characteristics of the student body; that is, minorities are more likely to switch schools, whereas females are more likely to remain in the same school.

The lack of significance for some variables was possibly due to the scarcity of data. The sample size itself was small – 77 schools in total. Moreover, the RSD schools could be compared to only 20 OPSB schools. This number is less than the ideal $n \geq 30$ sample size, which would guarantee a dataset that is approximately normally distributed. Furthermore, few data files could be found to measure both RSD and OPSB schools simultaneously; this problem was apparent for both the school characteristic and the outcome variables. Many of the variables lacked multiple school data points, and several data points required alteration to fit the constraints of the regression analysis. A few outcome variables could not be analyzed due to a severe lack in school data points – for example, the School Suspension Rate and the Teacher Effectiveness Score. In short, due to the small sample size, these data constraints put additional pressure on the efficacy of the analysis.

Given the lack of available data, further research on this topic may be limited. However, researchers could employ other matching techniques to confirm the difference in district outcomes. Furthermore, a panel data analysis to isolate RSD school outcomes would be beneficial as well. However, since charter schools are continually opened and closed, each year would have a slightly different dataset that could, theoretically, yield differential, and thus inconclusive, results.

Overall, this study confirms previous research detailing the impact of socioeconomic circumstances, race, gender, etc., on school outcomes, yet provides contrasting evidence as to the impact of Recovery School District reforms. As a result, additional research is necessary on the efficacy of charter schools to order to determine whether the RSD model has been an effective one in

improving student outcomes. Furthermore, researchers should investigate the consequences of the state of Louisiana returning control of the Recovery School District to supervision of OPSB, and whether the decentralized control of a school district plays a role in improving academic outcomes.

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Appendix 1

Variables used in the OLS Class 1 Model (significant at $p = .05$)

N.B.: Outcome variable is regressed on each predictor variable individually.

School Performance Score

Variable	Estimate	Std. Error	t value	Pr(> t)
<i>Free/Reduced Lunch</i>	-92.44	14.46	-6.394	1.24e-08***
<i>Percentage of Disabilities</i>	-161.815	55.09	-2.937	0.0044 **
<i>Number of Students</i>	0.045686	0.008301	5.504	4.96e-07***
<i>Ratio of Bachelor's Degrees to Master's Degrees</i>	-1.8849	0.8537	-2.208	0.0303 *
<i>Student/Teacher Ratio</i>	0.02102	0.53471	0.039	0.969
<i>Percentage of Minorities</i>	-72.75	20.51	-3.547	0.000676 ***
<i>Percentage of Females</i>	130.323	37.518	3.474	0.000856***
<i>RSD School Status</i>	-29.119	5.299	-5.496	5.12e-07 ***

Attendance Rate

Variable	Estimate	Std. Error	t value	Pr(> t)
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<i>Free/Reduced Lunch</i>	-10.032	7.371	-1.361	0.178
<i>Percentage of Disabilities</i>	-87.129	21.958	-3.968	0.000164 ***
<i>Number of Students</i>	0.011812	0.003849	3.069	0.00299 **
<i>Ratio of Bachelor's to Master's Degrees</i>	-0.2918	0.3642	-0.801	0.426
<i>Student/Teacher Ratio</i>	0.2183	0.2206	0.989	0.326
<i>Percentage of Minorities</i>	-8.728	9.147	-0.954	0.343
<i>Percentage of Females</i>	18.576	16.646	1.116	0.268
<i>RSD School Status</i>	-4.847	2.545	-1.905	0.0606 .

School Stability Rate

Variable	Estimate	Std. Error	t value	Pr(> t)
<i>Free/Reduced Lunch</i>	-34.591	8.182	-4.228	6.58e-05***
<i>Percentage of Disabilities</i>	-35.123	29.191	-1.203	0.233
<i>Number of Students</i>	0.023406	0.004186	5.591	3.48e-07***

<i>Ratio of Bachelor's to Master's Degrees</i>	-0.6991	0.439	-1.593	0.115
<i>Student/Teacher Ratio</i>	0.3946	0.267	1.478	0.144
<i>Percentage of Minorities</i>	-31.57	10.62	-2.973	0.00396 **
<i>Percentage of Females</i>	49.622	19.662	2.524	0.0137*
<i>RSD School Status</i>	-10.87	2.921	-3.721	0.000381 ***

Appendix 2

Distributions of Propensity Scores

