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CHANGES IN NEW ORLEANS SCHOOL SEGREGATION AFTER HURRICANE KATRINA

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Abstract

Following Hurricane Katrina, the state of Louisiana took over nearly all New Orleans schools and created a district-wide choice system. We examine post-reform changes in segregation for New Orleans students by race, income, English language-learner status, special education status, and achievement. Difference-in-differences models are used to compare changes in segregation in New Orleans to changes in other similar districts in Louisiana and around the country. We find little evidence that the New Orleans school reforms affected segregation for elementary school students. Reforms affected segregation for most groups of high school students, with some groups seeing an increase in segregation and others a decrease. In particular, segregation has increased for low-income students and English Language Learners, but decreased for special education students and by achievement. There were no consistent trends in segregation; some groups became more segregated, others less so.

In many large urban districts, school choice has substantially expanded in the last decade, both because of growth in the charter sector and the diffusion of open enrollment plans. Expansion has been accompanied by substantial debate about the impacts of these policies on school segregation. Because neighborhoods are highly segregated by race and socioeconomic status (Reardon & Bischoff, 2011), school choice policies have the potential to reduce student segregation by race, family income, and achievement by decoupling residence and school assignment. On the other hand, choice policies may increase segregation if advantaged parents are more likely to participate in school choice systems, if parents from different backgrounds prefer different school characteristics, or if schools select, or "cream-skim," students. Ultimately, whether amplified choice increases, decreases, or leaves unchanged the distribution of students across schools depends on how families navigate choice policies and how districts design student allocation systems.

Until recently, districts' default zoned school assignments made it difficult to explore the effects of choice at scale on segregation. Instead, previous research has emphasized segregation between sectors, exploring the extent to which charter and traditional public schools serve different types of students (Booker, Zimmer, & Buddin, 2005; Bifulco & Ladd, 2007; Garcia, 2008; Frankenberg, Siegel-Hawley, & Wang, 2010; Zimmer et al., 2011; Ritter et al, 2012; Butler, et al., 2014). This evidence provides only a rough approximation, however, of what we might expect when essentially all schools are charters that open to students from anywhere in the district.

In this paper, we examine differences in the distribution of students across schools before and after the expansion of school choice in New Orleans, where almost all schools are now charters. After, Hurricane Katrina in August of 2005, the majority of the school buildings were

destroyed or severely damaged, and many families (along with educators) were displaced. The state stepped in, took over nearly all of the district's schools, and eventually turned almost all of them into charter schools. Prior to Hurricane Katrina, charter schools served only a fraction of New Orleans students. However, by 2013-14, 75 of 88 publicly funded New Orleans schools were charters, serving 91% of the district's students. The governing agencies also eliminated almost all attendance zones so that families could, in principle, choose essentially any publicly funded school.[1] We study the effects of this massive shift to charter schools, addressing the following questions:

1. To what extent did the New Orleans reforms lead to changes in school segregation by race/ethnicity, free and reduced-price lunch status, LEP status, special education status, and achievement?
2. Do these patterns vary by level of schooling (elementary vs. secondary)?

Despite the unique nature of New Orleans, both in the source and scale of the reform, we argue that this case presents an opportunity to examine what some advocates of school choice ultimately envision—an entire system of decentralized, mostly open enrollment schools. As a result, our analysis will increase understanding of the potential implications of expanded school choice plans as they continue to grow in urban districts.

[1] Other initiatives facilitated the choice process for families. Beginning in 2007, a non-profit group disseminated school information to families through a guide called the New Orleans Parents' Guide to Public Schools. Though families did have access to this information for making enrollment choices, and any family was free to enroll their child in any charter school in the new school system, the process was not centrally managed. Families had to apply to each school individually. However, the process became centralized and automated for applications for the 2012-13 school year through a system called "OneApp". In the new OneApp system, families rank schools in order by preference, and a computer algorithm implemented by the Recovery School District assigns students to schools to maximize fairness, transparency, and efficiency (EnrollNOLA, 2015). Together, the Parents' Guide, which continues to be available to families, and the OneApp interface provide families information about a host of school characteristics, including services offered, test scores, and demographics.

Literature Review

Two groups of studies are relevant to the questions pursued in this paper. The first group has asked whether charter schools are more racially and socioeconomically concentrated than traditional public schools in specific geographic areas. In national estimates, Epple, Romano, and Zimmer (2015) reported that 40.6% of charters versus 21.8% of traditional public schools are more than 80% non-white. The problem with this approach, especially when looking at high levels of aggregation like states, is that charters are not uniformly distributed, and are more likely to locate in urban areas, and even specific neighborhoods. When looking within districts, racial and economic gaps between charter schools and their traditional counterparts narrow substantially. Kisida et al. (2010) show that as we narrow from national to state and local comparison groups, differences in measured racial isolation between charter schools and traditional public schools diminishes dramatically, reinforcing that isolation is mostly about where charter schools locate than about how they attract or select students.

The more localized geographic comparisons do find higher isolation in charter schools, especially among black students (Kisida et al., 2010; Malkus, 2016; Whitehurst, Reeves, and Rodrigue, 2016), although the share of low-income students seems similar between the two groups of schools. Matching charters to their nearest 5 traditional public schools, Malkus (2016) finds that a similar proportion of charter and traditional public schools have high concentrations (>75%) of free and reduced price lunch students.

Given the problem of comparing charters and traditional public schools in specific geographic regions, a more rigorous approach to understanding the effects of market-based school reform on segregation is to use longitudinal student-level data to examine the actual movement of students from traditional public schools (TPSs) to charter schools (Ritter, Jensen, Kisida, & Bowen, 2012; Zimmer et al., 2011; Garcia, 2008; Bifulco and Ladd, 2007; and

Booker, Zimmer, and Buddin, 2005). These studies consider whether students who exit TPSs to attend charter schools move to schools with a higher or lower concentration of students with similar characteristics.

Most of the longitudinal studies have shown that black students transfer to charter schools with higher concentration of black students, but in many locations, the differences between the TPS the students exit and charter school they enter have not been substantial — often less than 10 percentage points (Ritter, Jensen, Kisida, & Bowen, 2012; Zimmer et al., 2011; Zimmer et al., 2009; Bifulco & Ladd, 2007; Booker, Zimmer, & Buddin, 2005).[2] One notable exception is Bifulco & Ladd's (2007) study, which showed that when black students transfer from TPSs to charter schools in North Carolina, they transfer from TPSs that, on average, have 53 percent black students to charter schools that, on average, have 72 percent black students. In addition, the authors found that white students transfer from TPSs with an of average 28 percent black students to charter schools with an average of 18 percent black students.

These longitudinal studies, however, suffer from a different problem: they (usually implicitly) define segregation in only one way. We return to this issue later after describing the two standard segregation measures we use. The implication, however, is that the preponderance of studies using the geography-based approach, combined with the narrow definition of segregation in the longitudinal studies, means that our knowledge of this phenomenon is still somewhat limited. One prior study that we are aware of has used multiple measures of

[2] In summarizing this research, Bifulco and Bulkley (2015) noted that there are some districts (i.e., Chicago, Little Rock, Milwaukee) in which black students do not transfer to charter schools with a higher proportion of black students. However, they also noted that in these districts, these black students were already attending TPSs serving a high proportion of black students (ranging from 73 to 90 percent). They conclude that in locations in which black students are already highly isolated, charter schools can actually increase exposure to other racial/ethnic groups. However, the authors also suggest that in places in which black students typically have ample exposure to other racial/ethnic groups, charter schools may reduce exposure.

segregation and combined the longitudinal and geographic-based approaches by examining the correlation between the increasing presence of charter schools in a county and county-level racial and income segregation in public schools across the U.S. (Chingos, 2013). Using this approach, Chingos finds little association between school choice and racial segregation. However, this study is limited by its non-causal regression design.

Our study is concerned not only with segregation by demographics, but also segregation by achievement and educational needs. Scholars comparing students exiting TPS for charter schools with those exiting for other TPS have found they have similar achievement levels (Zimmer et al., 2011; Zimmer et al., 2009; Garcia, 2008; Garcia, McIlroy, & Barber 2008; and Booker, Zimmer, & Buddin, 2005).

Older research has looked at special education status and suggested that charter schools serve lower proportions of these students (Zimmer et al., 2003). More recent research has complicated this picture. In New York, Winters (2014) found that charter schools are serving fewer special education students but attributes this difference to (1) the fact that fewer special needs students apply to charter schools and (2) that charter schools have lower rates of identifying students who would have individualized education plans (IEPs) in TPSs. In his Denver study, Winters (2013) again found that charter schools did serve fewer special education students. The gap is 1.7 percentage points when students enter in kindergarten and grows to 7.2 percentage points by 5th grade.

To the degree that choice policies do lead to segregation, one likely cause is parents' own preferences. Several studies suggest that despite parents' stated preferences for schools with high test scores, they picked schools with lower test scores than their current school but with a higher fraction of students from their own racial group (Schneider & Buckley, 2002; Weiher & Tedin,

2002; Hamilton & Guin, 2005). Other evidence suggests that socioeconomic status, rather than school racial composition, plays a more central role in families' choices. For example, Butler et al. (2014), using the Early Childhood Longitudinal Study data to examine educational enrollment choices, found that once a larger set of family observable characteristics were included, schools' socioeconomic rather than racial characteristics were more strongly associated with their families' decisions to attend charter schools.

Other evidence suggests that family preferences affect school choices and that they vary by family background. In particular, Harris & Larsen (2015) find that low-income families of elementary school children in New Orleans place greater weight than middle-income families on the practical considerations of choice, such as distance to school, whether schools offer after-school care, and whether other siblings are at the same school. Among high schoolers, low-income families seem to place greater weight on sports and extracurricular activities. The implication is that, if low-income families have different schooling preferences, then more open school choice may lead, indirectly, to more segregation on family background.

A third possibility is that charters may not have the resources to accommodate these students or may try to limit their enrollment to their preferred students in indirect ways or counsel out some students after they enroll. Some New Orleans school leaders have reported using these practices (Jabbar, 2015). In a qualitative study of 30 New Orleans schools, Jabbar found that eight open-enrollment schools reported informally selecting students, through such methods as invitation-only open houses, targeted marketing and recruitment, and strategically failing to advertise open seats.

Additionally, early in the New Orleans post-reform period, there were regular reports of inadequate services being provided to special education students, which may have had the effect

of inducing these students to leave and keeping others from applying. For some of these same reasons, the Southern Poverty Law Center initiated a lawsuit against the state for the treatment of special education students, and one school was closed partly because of a scandal over the handling of special reporting and programs (Perry, Harris, Buerger, & Mack, 2015).

While these studies tend to suggest that choice will increase segregation—through their preferences for same-race students, differences in preferences for school programs and characteristics, or the actions of schools—these factors may be counteracted by other forces from school choice. In particular, decoupling of housing and schooling choices may, as choice advocates suggest, allow more disadvantaged students to escape failing neighborhood schools and enroll in schools in more advantaged areas with students from different backgrounds.

All of these studies have added something important to our understanding of choice and segregation. Our study adds to this research by examining a district with nearly complete open choice options, using multiple definitions of segregation, and applying these definitions to a wide variety of student groups, including going beyond race and income.

Measures of Segregation

There are two major classes of measures used in segregation research: measures of unevenness and measures of exposure or isolation. These are not measures of the same phenomenon; they capture distinct elements of segregation and can lead to different conclusions about trends in segregation over time and the overall magnitude of segregation. Whether one set of measures is preferred over the others depends on the mechanisms through which one believes segregation affects student outcomes and experiences. As Reardon and Owens (2014) explain:

> There is no one correct measure of segregation. To the extent we think that segregation affects students through peer or compositional effects or mechanisms correlated with school composition, then exposure measures are an appropriate measure. To the extent we think that segregation operates by exposing students to different school environments,

> however, unevenness is the appropriate measure because if there is no unevenness, all students experience the same average school environments. (p. 202)

We summarize each set of measures below. A key difference between the two sets of measures is that though measures of unevenness mechanically are not sensitive to the composition of a given school district, measures of exposure and isolation are directly affected by district composition in that the lowest possible value that the isolation index can take (or conversely, the highest value that the exposure index can take) is the fraction of students in the given group. So if a district is 80% black, the lowest possible isolation value for the district is 0.80.

Unevenness. Measures of unevenness capture the extent to which students are uniformly distributed across schools. The most commonly used measure of unevenness is dissimilarity (D), which ranges from 0 to 1, where 0 represents an even distribution of a given group across schools, and 1 represents complete segregation. Consider, for example, black-white segregation. A dissimilarity index equal to 1 represents the extreme case in which some schools are entirely made up of white students, and the remaining schools are entirely comprised of black students. The calculation of dissimilarity for group *X* is given in Equation 1, where (for the segregation of students across schools) t_i is the total population of school i, p_i is school i's proportion of group *X*, *T* is the total population of the school district, and *P* is the district proportion of group *X*.

$$\text{Equation 1: } D = \sum_{i=1}^{n} \frac{t_i|p_i - P|}{2TP(1-P)}$$

The value of D can be interpreted as the fraction of students in a given group (i.e., black students) who would have to change schools in order for them to be evenly distributed across all schools. Thus, a value of 0 indicates that students are already evenly distributed; a value of .5 indicates that one-half of all students in the group would have to switch schools to create an even distribution; and a value of 1 would imply that all students in the group would have to switch

schools to create a distribution in which the same proportion of students from that group was present in all schools.

Exposure and Isolation. Measures of exposure capture the extent to which students of a given group are enrolled in schools with a high or low concentration of a *different group*. A measure of isolation, in contrast, captures the extent to which a given group of students are enrolled in schools with high concentrations of the *same group* of students. Isolation is a weighted average of the concentration of a given group by unit (here, schools). The equation for isolation is given in Equation 2, where X represents the total number of students of group X in a given area (here, New Orleans publicly-funded schools), x_i represents the number of students of group X in school i, and t_i is the total number of students in school i.

$$\text{Equation 2: } I = \sum_{i=1}^{n} \left[\frac{x_i}{X}\right]\left[\frac{x_i}{t_i}\right]$$

With a two-group comparison, isolation for a given group is equal to one minus exposure. For example, a measure of Hispanic-white exposure summarizes the mean proportion of white students attending Hispanic students' schools. In contrast, a measure of Hispanic isolation would summarize the mean proportion of Hispanic students in Hispanic students' schools. In this paper, all comparisons are between two groups (an identified group of students compared to all other students; i.e., white students vs. all non-white students), so isolation and exposure provide redundant information when we are considering these measures for the same group (i.e. Hispanic-white isolation is equal to one minus Hispanic-white exposure). Here we present results from the isolation index, so that the interpretation of results mirrors the interpretation of D (closer to 1 represents more segregation).

The prior longitudinal studies have relied on a measure that is similar to isolation, though not exactly the same, as the isolation index measures the average experience of all students of a

given group in an area (or district). For example, in the above North Carolina study, black students moved from schools that were 53 percent black to ones that were 72 percent black. In this sense, black students in the sample were more isolated. However, as noted, the isolation index is not necessarily informative about how evenly spread students are. Additionally, this study only measured the impact on those students who moved, not the change in segregation for the district as a whole.

Data and Methods

Our data come from the Louisiana Department of Education and include enrollment and testing data for the 2000-01 through 2013-14 school years, excluding the 2005-06 school year, the year of the hurricane. For this analysis, we use school years 2001-02 through 2004-05 to assess segregation in the pre-Katrina period and 2011-12 through 2013-14 for the post-Katrina period. In the interim years, the system was in a state of transition, as the RSD closed its direct-run schools or turned them over to CMOs. We use the most recent three years of data to most closely represent the system that exists now. The enrollment data include information on students' race/ethnicity, free/reduced-price lunch (FRPL) status, and school attended. The test data include information on students' performance in math and English language arts (ELA), as well as their IEP status. Because we are interested in relative performance, we standardize the test scores within New Orleans for each year.

We use the most common entering grade at each level where possible (kindergarten for elementary and ninth for high school). This likely reduces the role of cream-skimming since there are fewer opportunities to counsel out or expel students in earlier grades versus later ones. Also, in cases like achievement, we want to isolate the effectiveness of the school in raising scores from student sorting, to the extent possible. Additionally, in a rapidly changing landscape

in which schools open and close every year, using the entering grades allows us to capture the trends in a given year, rather than including many students who enrolled in their schools years earlier.

For elementary schools, we use students' demographic information (race/ethnicity, FRPL status, and LEP status) reported to the state in October of the kindergarten year. Because the first year of testing is third grade, we use third-grade scores to examine the distribution of students by achievement in elementary schools. Additionally, because our IEP data come from the testing file, we also use third-grade information to examine the distribution of students with IEPs. For ninth-graders, we use demographic information reported in October of the eighth-grade year, because high school students are less likely to participate in the FRPL program, even if their family income would qualify them (Harwell and LeBeau 2010). In addition, we use IEP status and state achievement test scores from the 8th-grade year, so that we can see how high school students sort into schools before the school itself can impact the student's IEP status or achievement. To examine distributions by achievement, we divide New Orleans students into quintiles in each year and examine how the top and bottom quintiles of students are distributed across elementary schools and sort into high schools.

Using these demographic and achievement indicators, we first describe changes in the public-school population between the pre- and post-Katrina period and then use a difference-in-differences regression model with clustered standard errors, comparing New Orleans to five other large districts in Louisiana, to calculate changes in the dissimilarity (D) and isolation (I) of students by race, income, ELL and IEP status, and achievement after the reform (see Equation 3 for the equation estimating the post-reform change in dissimilarity for group *g*). The vector X_{gj} includes the average number of students per school and the district-wide percentage of the

analyzed group (i.e., the percent FRPL when assessing changes in income segregation; see Reardon & Bischoff, 2011). These controls prevent changes in school size and changes in the district population from influencing the results.

Equation 3: $$D_{gj} = \beta_0 + \beta_1\left(New\ Orleans_j\right) + \beta_2(post\_reform_t) + \beta_3\left(New\ Orleans_j * post\_reform_t\right) + \beta_4 X_{gj} + e_{gjt}$$

We used two comparison groups. First, we used 2005 data to identify districts in Louisiana with enrollments of at least 20,000 students and an average number of students per school within one standard deviation (based on the nationwide distribution from the Common Core of Data) of New Orleans's average students per school. These decision rules identified five comparison districts – Caddo Parish, Calcasieu Parish, East Baton Rouge Parish, Lafayette Parish, and Jefferson Parish. These districts ranged in size from 30,000 to 51,000 students (compared to 64,000 in New Orleans), and more than half of students in all districts were eligible for free or reduced-price lunch. Comparison districts were primarily mid-sized cities (>100,000 residents and < 250,000) and urban fringe. We tested each model for parallel trends in the pre-reform period, comparing the time trend in New Orleans to the time trend in the comparison districts.

The second comparison group is national sample of urban districts from the federal Common Core of Data (CCD). Using 2005 data, districts were eliminated if they did not enroll at least 20,000 students, did not have at least 90% of their schools located in urban areas, or if they enrolled more than ten percent of their students in charter schools.[3] Districts were also eliminated if they fell one standard deviation outside of the 2005 New Orleans value for the percent of black

[3] Since many urban school districts are confined to the city limits, and OPSB includes the entire parish, we use a lower enrollment count to establish inclusion in the sample, but add the additional requirement of urbanicity, since all schools in OPSB are located in an urban area. We also include districts that have a small number of charter schools, since New Orleans had several charter schools prior to the RSD takeover in 2006.

students enrolled, the percent of enrolled students qualifying for free or reduced price lunch, or the average number of students per school. Finally, we excluded any district that exceeded 20 percent enrollment in charter schools in 2014. These selection rules identified Atlanta Public Schools, Baltimore City Public Schools, Birmingham City, and St. Louis City as demographically similar districts. Additionally, we included East Baton Rouge, which met all criteria except urbanicity, because of the potential for state-specific factors to affect segregation. With this national sample, we can only examine segregation by race and income since achievement and other measures are not included in the CCD.

Racial segregation in comparison districts was calculated using kindergartners and ninth-graders, to parallel the New Orleans-specific models. However, the CCD does not provide grade-level counts of students receiving FRPL, so income segregation was calculated using all students in schools with kindergarten and in schools with ninth grade. For both race and income, we used CCD data to calculate segregation in New Orleans to prevent differences from arising simply from the data sources.

Results

Table 1 reports the demographic composition and program eligibility of students in New Orleans and our in-state and national comparison districts at baseline (the average of four years pre-Katrina in the Louisiana data and the average of six years in the CCD) and in the post-reform years in this study (the average of 2011-12 through 2013-14). Note that we provide the descriptives for New Orleans from both the state and national data, but focus our discussion on the state data, which are available for all measures at the grade level. There are three changes in New Orleans' student composition over time that are worth noting. First, the fraction of students that is white has increased over time. While white students comprised approximately 4 to 6

percent of public school students at baseline, they make up about 8 percent of both kindergarten and 9th grade students in the post-reform period.

Second, the percentage of Hispanic students has increased as well, such that by 2013, Hispanic students made up 5.6 percent of kindergarten students and 3.8 percent of 9th grade students. The increase in these student populations is mainly attributable to the changing racial demographics of the city: in 2013, the city was 5.5% Hispanic, as compared to 3.1% in 2000 (The Data Center, 2014). The city's white population also increased from 26.6% to 31%, similar to the increase in the public school population.

Third, the percentage of ninth grade students qualifying for free and reduced price lunch has also changed substantially over time, increasing from 68 to 79 percent of ninth graders qualifying in the post-reform period. However, the child poverty rate in New Orleans did not change significantly over this period (The Data Center, 2014), and the average household income of public school students in New Orleans changed only by a few hundred dollars between 1999 and 2013 (Harris & Larsen, 2016), so this increase may be the result of changes in reporting practices rather than a reflection of an actual change in the population.

Tables 2 and 3 provide summaries of the baseline and post-reform values of the two segregation indices for New Orleans and the comparison groups, and tables 4 and 5 present the results from the difference-in-differences analyses. Tables 2 and 4 contain results for race and income, which were compared to both the in-state and national groups. Tables 3 and 5 contain results for all other outcomes, which we were only able to compare to the in-state districts. Before Hurricane Katrina, New Orleans was highly segregated by race and income, and more so than other large districts in Louisiana (though not similar urban districts). New Orleans high

school students were also substantially more segregated by achievement relative to other Louisiana districts.

There are no established benchmarks for what magnitude of change in the dissimilarity index counts as "large," nor are there consistent ways of reporting these changes in the literature. The most common approach is to report a percent change. However, there is no standard for what constitutes an educationally relevant percent change in the population; that is, a change large enough to impact the educational experiences of students. We instead offer a benchmark of changes in racial segregation nationally in the last 20 years. Black-white dissimilarity indices nationally declined from .69 to .67 between 1991 and 2009, while white-Hispanic indices declined from .75 to .69 (Orfield et al. 2012).

The results presented in Tables 4 and 5 suggest that there is no consistent effect of the reforms on segregation across levels of schooling or student characteristics. Note that we do find some violations of the parallel trends assumption, but these coefficients are generally not of the same magnitude and direction as our effects, and results are generally consistent across models, so we do not believe these violations indicate substantial bias in our results (we note one exception below).

For race and income, results are generally consistent between the in-state and national analyses. Across both of these models, we find evidence that the New Orleans reforms increased segregation by at least one measure for Hispanic and low-income students and decreased segregation for Asian elementary students. However, results are not consistent across models for black and white students, particularly in high school. Relative to similar urban districts, black and white high school students in New Orleans are less evenly distributed than they were prior to Katrina; however, relative to other large districts in Louisiana, white students are less isolated,

and black students show no change in either measure. This discrepancy is likely due to the difference in these comparison groups – the national group is comprised of demographically similar large urban districts, whereas the state districts are either mid-sized cities or suburban districts with much lower percentages of black students (with the exception of East Baton Rouge) than New Orleans.

For black and white New Orleans high-school students, the increased unevenness is partly the result of an increasing number of racially diverse schools (<75% black) whose student bodies are dissimilar from the district composition. Figure 1 shows the percentage of black New Orleans ninth-graders in 2005 (blue) and 2014 (red), by the concentration of black students in their schools. Pre-Katrina, there was only one high school with less than 75% black students, with 1.8 % of the city's black ninth-graders attending that school. In 2014, there were six high schools under 75% black, with 14.2% of the population of black ninth-graders attending.[4]

In Table 5, we turn to changes in segregation by achievement and special education status. Here we have no national data for comparison, so we rely solely on in-state comparison districts to identify the effects of the New Orleans reforms. We find evidence of increased segregation of high school English Language Learners and of small decreases in segregation of high school students with IEPs. We see limited effects of the reforms on achievement for elementary students. Students in the top 20% in ELA achievement in third grade are somewhat less evenly distributed now than they were before the storm (an additional 4% of students would have to switch schools to create an even distribution). There is also some evidence of small increases in unevenness for low-achieving elementary students, but both the math and ELA

[4] This may be partly related to a shift in the high school population, from 92% African-American before the storm to 85% after. This affects measured segregation because dissimilarity index is based on deviations from the district average.

models violate the parallel trends assumption with coefficients of similar size to the impact estimates, giving us little confidence in those findings. Furthermore, because we are not able to observe test scores until third grade, these findings could be the result of differences in the relative effects of schools on test scores, rather than the result of differential sorting into schools.

For high school students, we use eighth-grade test scores to examine the distribution of ninth-graders across high schools, and as the majority of New Orleans high schools start with ninth grade, these findings are primarily the result of sorting, not school effects. In contrast to the findings for increased segregation of high school students by race and free and reduced price lunch, we find evidence that higher and lower achieving students are more evenly distributed and less isolated in the post-reform period. The declines in dissimilarity and isolation are larger for high-achieving students (students in the top quintile of test performance in the 8th-grade New Orleans distribution of either subject). An important component of the New Orleans reforms that likely relates to the larger impacts on high-achieving students is the requirement that RSD schools not have academic entrance requirements. Additionally, when re-opening schools in the months following the storm, OPSB ended admissions requirements for two of its large high schools.

Discussion

The impacts of increased school choice on the distribution of students across schools are only beginning to be understood. Our results suggest there is no consistent effect on segregation that holds across all student groups or levels of schooling. While the results are mixed, they do not provide evidence that citywide choice has led to large and consistent increases or decreases in segregation. Though racial and economic unevenness has increased for ninth-grade students over the transition to a choice system, it is largely unchanged for kindergarteners. Furthermore,

for black and white high-school students, the increased unevenness is partly the result of an increasing number of racially diverse schools whose student bodies are dissimilar from the district composition. Additionally, high-school students with IEPs are slightly more evenly distributed and less isolated, while both low-achieving and high-achieving ninth grade students are more evenly distributed and less isolated.

Though we cannot empirically test for mechanisms that may explain differences in kindergarten and high school racial and economic patterns, we discuss possibilities here. Enrollment patterns are driven both by school and district actions as well as parents' choices, and it may be the case that schools at the high school level specialize more than those at the kindergarten. By offering distinctive programs or extra-curricular activities (Arce-Trigatti, Harris, Jabbar, & Lincove, 2015), schools may be differentially attractive to families from different backgrounds. In addition, many charter schools have opened with the specific goal of serving disadvantaged students, which may contribute to the increased economic isolation that we observe.

Changes in high school policies almost certainly played a role in more evenly distributing high achieving students. A decreasing number of high schools in New Orleans admit students based on academic achievement. Three of the four selective high schools that operated in the city pre-Katrina became open-enrollment shortly after the storm – the result of a local school board decision. As of 2014, two high schools operating under OPSB admitted students based on academic performance. Our results suggest that the decision to decrease the number of selective high schools may have played a role in the more uniform distribution of high-achieving students in the post-storm period.

Beyond differences in school offerings, goals, and policies, the relative importance of racial and socioeconomic composition to families or students may vary by grade level. Previous research (Bifulco and Ladd 2007; Weiher and Tedin 2002) indicates that families, in some contexts, opt for schools whose demographics reflect their own characteristics, but the weight families put on composition may change as students age. An alternative explanation for the difference by age group is that composition matters more to students, who tend to have more input in high-school decisions, whereas parents make decisions for their children enrolling in kindergarten. It may be that when students influence school decisions, they are more likely to enroll at a school with a higher concentration of similar students.

"Invisible" barriers, such as travel time, transportation, and complex application mechanisms might influence segregation, though some of these barriers would appear to apply equally to kindergarten and ninth grade students. In New Orleans, OPSB charters (16 schools in 2014, including all of the academically selective schools) are not required to provide transportation, which may limit low-income families' ability to enroll in these schools. These are only a subset of the possibilities, and identifying the mechanisms producing different levels of segregation at the elementary and high school levels is an important issue for further research.

A final potential explanation for our observed segregation trends is that we are picking up the effects of housing segregation rather than choice policies. Address data would allow us to precisely estimate their potential impact on our results, but such data are unavailable. Instead, in Table 6, we present tract-level dissimilarity and isolation indices calculated from Census data for race, and zip code level indices calculated from the 1-year ACS data for poverty status. We observe minimal changes in these indices from the pre-reform (2000) period to the post-reform period, suggesting that residential changes alone are unlikely to explain our findings.

Overall, this study advances the prior literature in three ways. First, we are able to study the effects of the country's only full-scale choice program. Though we might have expected the effects to be much larger than prior studies of racial and income segregation in districts with more limited choice options, our results similarly suggest small changes with regard to race and income that are inconsistent across grade levels.

Second, we expand the range of student characteristics studied to include English Language Learner and special education designations, as well as achievement. Achievement is especially important given evidence that students' scores improve with exposure to higher-achieving peers (Hoxby, 2000). We find that segregation on this dimension declined, though this is probably owed less to school choice reform and more to the decline in selective admissions high schools. We find significant changes in segregation of ELL, special education, and low- and high achievement students in high school, but limited changes in elementary grades.

Our analysis is most similar to prior longitudinal studies that track students as they move from traditional public schools to charter schools. In effect, that is what we did here except that the shift to charters was very sudden—everyone moved all at once—allowing us to use a difference-in-differences methodology. In addition to using a broader range of student groups, however, we differ from prior studies in using multiple segregation metrics. Prior longitudinal studies have focused narrowly on isolation. Finally, the figures we propose help to visualize the underlying factors that contribute to changes in measured segregation. More generally, this analysis suggests that we can improve on future research by broadening the student groups included and the segregation metrics we use to study them, and by changing the ways in which these data are presented.

From the standpoint of educational policy, these results suggest that intense market-based school reforms have mixed effects on segregation, at least not in places like New Orleans that are already heavily segregated between the public and private sectors and across schools within the public sector. The results in New Orleans also likely depend on exactly how the market-based policies were designed, e.g., the continuing roles for school districts, the goals and incentives faced by charter authorizers, the degree to which charter management organizations are locally developed, charter access to school buildings and neighborhoods, and the degree to which transportation, enrollment, and discipline policies allow real choice. Given the distinctive context, especially the very high level of initial segregation, and the distinctive choice policies, whether similar patterns will be observed in other cities adopted choice is an open question.

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Table 1. Demographics of New Orleans and In-State and National Comparison Groups, Before and After the Reform

		Elementary					High School				
			In-State		National (CCD)			In-State		National (CCD)	
Group	Storm	N (NOLA)	NOLA	Comp. Group	NOLA	Comp. Group	N (NOLA)	NOLA	Comp. Group	NOLA	Comp. Group
Black	Pre	4272	90.6%	52.7%	92.6%	84.7%	4044	91.8%	46.4%	92.4%	84.8%
	Post	3345	83.8%	52.3%	82.9%	80.3%	2722	84.8%	51.7%	84.6%	87.1%
White	Pre	277	5.9%	41.8%	4.4%	11.8%	182	4.1%	48.3%	3.9%	12.8%
	Post	322	8.1%	34.6%	8.8%	10.6%	268	8.3%	38.6%	8.3%	7.1%
Hispanic	Pre	78	1.6%	3.2%	1.3%	2.3%	48	1.1%	2.8%	1.1%	1.2%
	Post	224	5.6%	8.7%	5.6%	6.6%	121	3.8%	6.5%	3.1%	3.7%
Asian	Pre	84	1.8%	2.0%	1.7%	1.0%	127	2.9%	2.2%	2.6%	1.1%
	Post	57	1.4%	2.2%	1.4%	1.4%	89	2.8%	2.7%	2.8%	1.6%
FRPL	Pre	3762	79.9%	63.7%	85.4%	77.8%	2975	67.5%	49.2%	57.7%	52.9%
	Post	3332	83.5%	72.2%	82.5%	82.0%	2528	78.8%	64.4%	72.0%	77.7%
ELL	Pre	49	1.0%	2.7%			87	2.0%	2.2%		
	Post	156	3.9%	7.2%			68	2.1%	4.4%		
IEP	Pre	392	8.2%	12.3%			498	11.3%	9.6%		
	Post	374	9.4%	10.3%			322	10.1%	9.4%		

Table 2. Pre- and Post-Reform Dissimilarity and Isolation Values for New Orleans and Comparison Districts

			Elementary				High School			
			In-State		National (CCD)		In-State		National (CCD)	
Group	Measure	Period	NOLA	Comp. Group	NOLA	Comp. Group	NOLA	Comp. Group	NOLA	Comp. Group
Black	Dis	Pre	0.728	0.527	0.737	0.679	0.611	0.448	0.616	0.556
		Post	0.647	0.510	0.665	0.610	0.642	0.401	0.679	0.467
		Diff	-0.081	-0.017	-0.071	-0.070	0.031	-0.048	0.063	-0.089
	Iso	Pre	0.941	0.697	0.952	0.911	0.946	0.614	0.949	0.882
		Post	0.903	0.684	0.901	0.884	0.899	0.628	0.902	0.896
		Diff	-0.037	-0.013	-0.051	-0.027	-0.048	0.014	-0.048	0.014
White	Dis	Pre	0.800	0.517	0.816	0.705	0.748	0.431	0.750	0.581
		Post	0.776	0.487	0.780	0.649	0.752	0.401	0.764	0.519
		Diff	-0.024	-0.030	-0.036	-0.055	0.005	-0.030	0.014	-0.061
	Iso	Pre	0.391	0.600	0.399	0.443	0.402	0.609	0.410	0.303
		Post	0.450	0.524	0.464	0.362	0.367	0.512	0.359	0.176
		Diff	0.059	-0.076	0.065	-0.081	-0.035	-0.097	-0.050	-0.127
Hispanic	Dis	Pre	0.654	0.516	0.682	0.693	0.529	0.368	0.523	0.576
		Post	0.527	0.407	0.550	0.571	0.466	0.291	0.521	0.421
		Diff	-0.127	-0.109	-0.133	-0.122	-0.062	-0.077	-0.003	-0.154
	Iso	Pre	0.072	0.087	0.074	0.144	0.032	0.053	0.032	0.049
		Post	0.210	0.168	0.223	0.223	0.132	0.092	0.136	0.091
		Diff	0.138	0.081	0.150	0.079	0.100	0.039	0.104	0.042
Asian	Dis	Pre	0.759	0.564	0.777	0.746	0.660	0.448	0.667	0.551
		Post	0.659	0.529	0.707	0.668	0.654	0.411	0.658	0.536
		Diff	-0.100	-0.035	-0.070	-0.079	-0.006	-0.037	-0.009	-0.015
	Iso	Pre	0.189	0.061	0.195	0.059	0.095	0.044	0.092	0.037
		Post	0.101	0.062	0.115	0.057	0.114	0.055	0.113	0.041
		Diff	-0.089	0.001	-0.080	-0.002	0.018	0.011	0.021	0.004
FRPL	Dis	Pre	0.454	0.376	0.492	0.436	0.282	0.314	0.247	0.243
		Post	0.577	0.397	0.595	0.470	0.415	0.316	0.499	0.324
		Diff	0.123	0.021	0.103	0.034	0.133	0.002	0.252	0.081
	Iso	Pre	0.851	0.703	0.893	0.826	0.719	0.561	0.623	0.577
		Post	0.892	0.772	0.887	0.872	0.833	0.690	0.814	0.803
		Diff	0.042	0.070	-0.006	0.045	0.113	0.128	0.191	0.226

Table 3. Pre- and Post-Reform Dissimilarity and Isolation Values for New Orleans and In-State Comparison Districts

			Elementary		High School	
Group	Measure	Storm	NOLA	Comp. Group	NOLA	Comp. Group
ELL	Dis	Pre	0.867	0.793	0.602	0.557
		Post	0.659	0.536	0.584	0.427
		Diff	-0.208	-0.257	-0.017	-0.131
	Iso	Pre	0.173	0.200	0.060	0.078
		Post	0.226	0.205	0.091	0.079
		Diff	0.053	0.005	0.031	0.001
IEP	Dis	Pre	0.259	0.182	0.328	0.200
		Post	0.223	0.189	0.282	0.177
		Diff	-0.036	0.007	-0.047	-0.024
	Iso	Pre	0.115	0.151	0.186	0.127
		Post	0.119	0.126	0.138	0.116
		Diff	0.004	-0.025	-0.048	-0.011
Math Top 20%	Dis	Pre	0.400	0.331	0.642	0.303
		Post	0.424	0.353	0.490	0.367
		Diff	0.024	0.022	-0.152	0.064
	Iso	Pre	0.330	0.274	0.548	0.273
		Post	0.368	0.311	0.459	0.334
		Diff	0.037	0.037	-0.090	0.061
Math Bottom 20%	Dis	Pre	0.311	0.301	0.407	0.237
		Post	0.362	0.315	0.400	0.282
		Diff	0.052	0.014	-0.006	0.046
	Iso	Pre	0.287	0.283	0.326	0.262
		Post	0.310	0.295	0.329	0.275
		Diff	0.023	0.013	0.003	0.013
ELA Top 20%	Dis	Pre	0.377	0.343	0.634	0.300
		Post	0.443	0.363	0.516	0.368
		Diff	0.066	0.020	-0.118	0.068
	Iso	Pre	0.328	0.286	0.533	0.267
		Post	0.371	0.318	0.485	0.322
		Diff	0.043	0.033	-0.048	0.055
ELA Bottom 20%	Dis	Pre	0.316	0.308	0.453	0.235
		Post	0.357	0.318	0.431	0.290
		Diff	0.041	0.009	-0.023	0.055
	Iso	Pre	0.295	0.283	0.350	0.259
		Post	0.304	0.289	0.343	0.277
		Diff	0.009	0.006	-0.007	0.018

Table 4. Difference-in-Differences Results for Race and Income

			Elementary				High School			
			In-State Comparison		National Comparison		In-State Comparison		National Comparison	
			Effect	Par Trends	Effect	Par Trends	Effect	Par Trends	Effect	Par Trends
Black	Dis	coef	-0.080^{+}	0.012*	-0.001	-0.001	0.006	0.000	0.207^{+}	0.005
		se	(0.035)	(0.003)	(0.021)	(0.007)	(0.043)	(0.012)	(0.085)	(0.013)
	Iso	coef	-0.001	0.006	0.005	0.001	-0.033	-0.006	0.013^{+}	0.002
		se	(0.024)	(0.003)	(0.007)	(0.002)	(0.027)	(0.007)	(0.006)	(0.002)
White	Dis	coef	-0.023	0.030**	0.032	0.012	-0.054	-0.017	0.156^{+}	-0.004
		se	(0.019)	(0.004)	(0.039)	(0.009)	(0.043)	(0.013)	(0.071)	(0.012)
	Iso	coef	0.04**	0.012*	0.051	0.016^{+}	-0.090**	0.009	-0.017	0.021
		se	(0.008)	(0.004)	(0.090)	(0.008)	(0.014)	(0.008)	(0.064)	(0.020)
Hisp	Dis	coef	-0.027	0.002	-0.019	0.001	-0.005	-0.019^{+}	0.158^{+}	-0.035
		se	(0.049)	(0.014)	(0.012)	(0.004)	(0.032)	(0.008)	(0.063)	(0.021)
	Iso	coef	0.077**	-0.004	0.066*	-0.002	0.072**	-0.004**	0.078**	-0.007
		se	(0.014)	(0.006)	(0.020)	(0.004)	(0.004)	(0.001)	(0.011)	(0.005)
Asian	Dis	coef	-0.110**	0.001	-0.078**	0.001	-0.036	0.007	-0.010	0.004
		se	(0.026)	(0.012)	(0.016)	(0.011)	(0.045)	(0.014)	(0.055)	(0.010)
	Iso	coef	-0.084**	0.002	-0.060**	-0.003	0.012	0.002	0.023*	0.001
		se	(0.009)	(0.003)	(0.008)	(0.005)	(0.006)	(0.002)	(0.009)	(0.001)
FRPL	Dis	coef	0.111**	-0.068^{+}	0.091	0.017^{+}	0.115**	0.024^{+}	0.193*	-0.011
		se	(0.021)	(0.029)	(0.077)	(0.007)	(0.025)	(0.010)	(0.054)	(0.011)
	Iso	coef	0.012	-0.016	0.004	0.003^{+}	0.010	0.003	0.060**	-0.001
		se	(0.006)	(0.010)	(0.019)	(0.001)	(0.006)	(0.004)	(0.006)	(0.003)

+p<.10; *p<.05; **p<.01

Note. Birmingham reported zero Asian ninth-graders in one year and thus was not included in the national comparison model for Asian high school students.

Table 5. Difference-in-differences results for ELL, IEP, and achievement

			Elementary		High School	
			Effect	Par. Trends	Effect	Par. Trends
ELL	Dis	coef	0.002	0.022	0.086^{+}	0.017
		se	(0.054)	(0.010)	(0.034)	(0.017)
	Iso	coef	0.044	0.021	0.059*	0.001
		se	(0.028)	(0.013)	(0.020)	(0.003)
IEP	Dis	coef	-0.019	-0.016	-0.062*	0.015
		se	(0.013)	(0.010)	(0.019)	(0.007)
	Iso	coef	-0.001	-0.002	-0.035**	-0.004
		se	(0.002)	(0.005)	(0.006)	(0.002)
Math Top 20%	Dis	coef	0.000	-0.001	-0.241**	-0.011
		se	(0.008)	(0.005)	(0.050)	(0.008)
	Iso	coef	-0.002	-0.004	-0.164*	-0.015*
		se	(0.013)	(0.003)	(0.044)	(0.005)
Math Bottom 20%	Dis	coef	0.036^{+}	0.028*	-0.070*	0.012^{+}
		se	(0.016)	(0.007)	(0.024)	(0.006)
	Iso	coef	0.009	0.002	-0.017^{+}	0.001
		se	(0.007)	(0.003)	(0.007)	(0.002)
ELA Top 20%	Dis	coef	0.044**	0.008	-0.203**	-0.018*
		se	(0.004)	(0.008)	(0.034)	(0.007)
	Iso	coef	0.009	0.011^{+}	-0.116*	-0.012^{+}
		se	(0.014)	(0.004)	(0.031)	(0.006)
ELA Bottom 20%	Dis	coef	0.030**	0.018*	-0.093**	-0.005
		se	(0.007)	(0.006)	(0.017)	(0.005)
	Iso	coef	0.002	0.008	-0.031**	-0.003
		se	(0.004)	(0.006)	(0.005)	(0.002)

+p<.10; *p<.05; **p<.01'

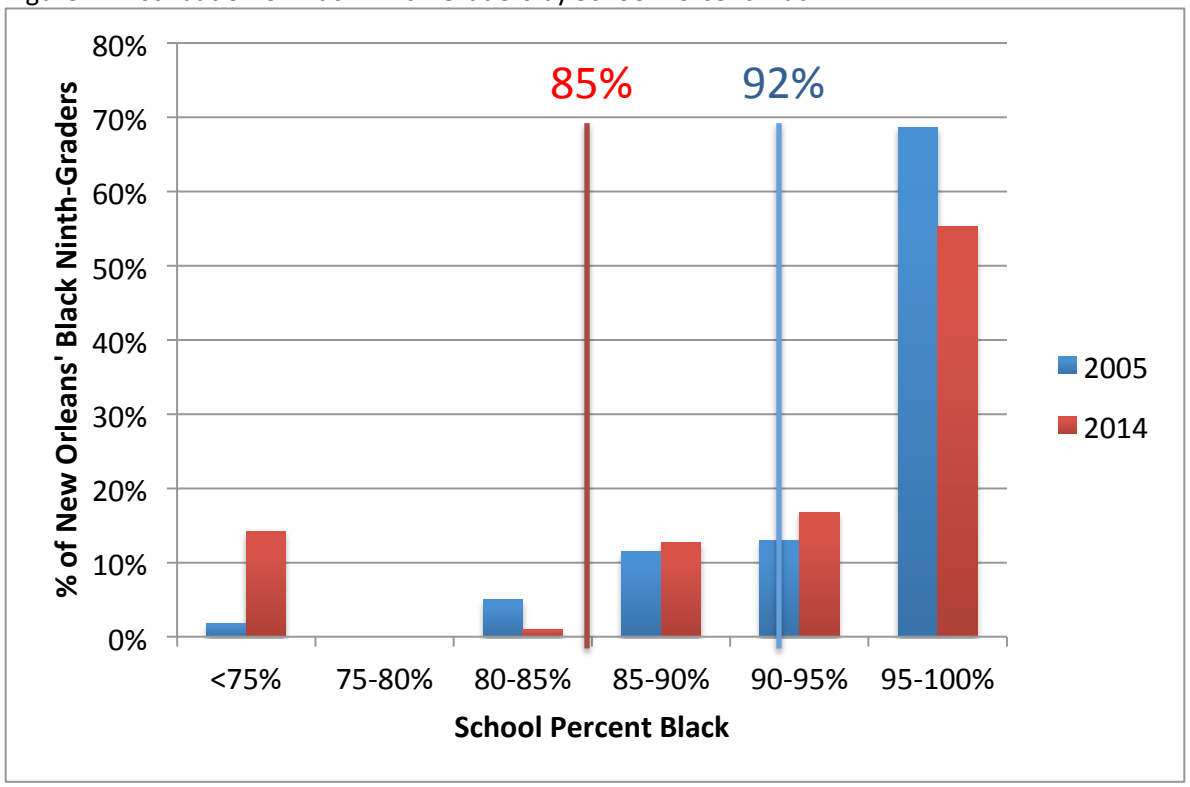
Note.Calcasieu Parish reported zero ELL students in one year and thus was not included in the models for ELL students.

Table 6. Neighborhood Dissimilarity and Isolation Indices, 2000-2014

	Black-White		Black		White		Poverty Status	
Year	Dissimilarity	Isolation	Dissimilarity	Isolation	Dissimilarity	Isolation	Dissimilarity	Isolation
2000	0.648	0.852	0.606	0.820	0.631	0.609	0.234	0.503
2010	0.661	0.825	0.609	0.780	0.637	0.642	0.198	0.465
2014	0.625	0.806	0.584	0.765	0.604	0.619	0.218	0.474

Note: Authors' calculations from decennial Census and ACS X-year estimates at the census-tract level. Indices for poverty are calculated at the zip code level.

Figure 1. Distribution of Black Ninth-Graders by School Percent Black



Note. The vertical lines indicate the district percent of black students in the corresponding year.