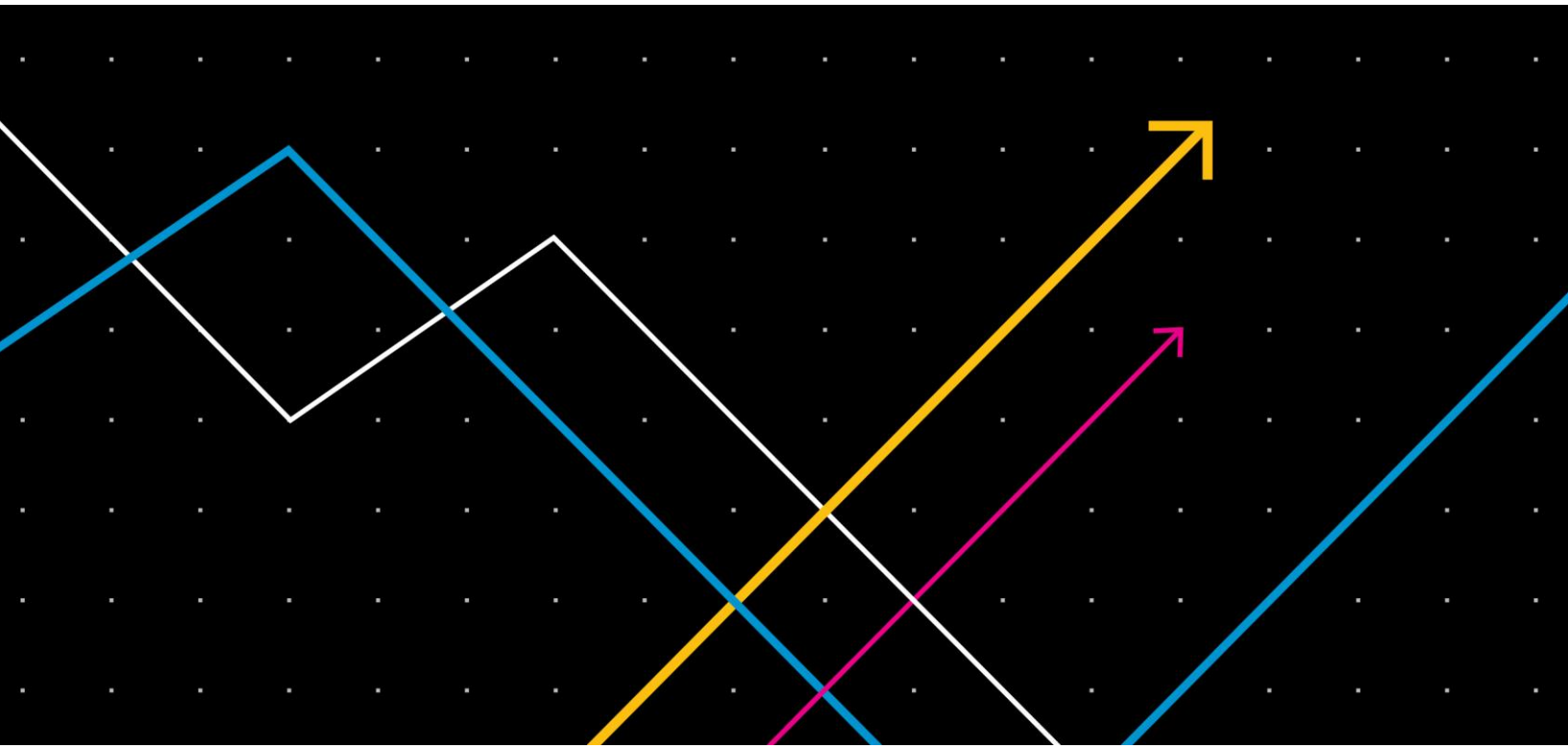

RESEARCH REPORT

Charter School Effects on School Segregation

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Executive Summary

Charter schools have been a polarizing issue in US public education. There is a contentious debate about how greater school choice could affect stratification by race or ethnicity. Charter school advocates argue that decoupling school assignment from intensely segregated residential neighborhoods should have a net positive impact on school integration. Charter school critics, however, are concerned that choice could increase racial and ethnic stratification. In this study, we provide the first nationally comprehensive examination of charter school effects on school segregation using longitudinal data on public school enrollment by grade level and race or ethnicity.

We identify the causal charter school effects on segregation exploiting between-grade-level variation in the dynamics of charter school enrollment share within a school district in a given year from 1998 to 2015. We find that charter schools increase the segregation of black, Hispanic, and white students in school districts. The magnitude of the estimated effect is modest, implying that segregation would fall 5 percent if charter schools were eliminated from the average district in our sample.

Average treatment effect estimates mask considerable heterogeneity across states and by district type. The segregative effect of charter schools is greater in urban districts with high shares of black and Hispanic students and in suburban districts with low black and Hispanic representation. Our estimates are robust to several measurement choices, model specifications, and levels of aggregation. We also present evidence suggesting that charter schools decrease segregation between districts in the same metropolitan area, especially in cities with high levels of school district fragmentation.

Charter School Effects on School Segregation

Charter schools have been a polarizing issue in US public education. Proponents claim that through greater school autonomy and parental choice, charter schools can generate innovation and competition in education. A necessary component of the charter school model requires decoupling school assignments from neighborhood school attendance boundaries. From a competitive perspective, parental choice might introduce market forces, as parents choose higher-performing schools and pressure low-performing schools to improve or risk losing students (Betts 2005; Chubb and Moe 1990). From a sorting perspective, parents looking for particular schooling attributes can select schools that fit their child's particular needs (Coons and Sugarman 1978).

A contentious debate surrounding charter schools is how greater parental choice could affect stratification by race or ethnicity, socioeconomic status, and student ability. Claims surrounding this issue differ among different political constituencies, and the current empirical evidence does not provide a definitive answer. Charter school advocates argue that decoupling school assignment from intensely segregated residential neighborhoods should have a net positive impact on school system integration. Charter school critics, however, are concerned that the ability to exercise parental choice depends heavily on parental resources and ability. If socioeconomically advantaged families take advantage of school choice opportunities and leave the most disadvantaged students behind in the worst schools, school choice could lead to increased stratification that exacerbates segregation in school systems.

The question of whether or how charter schools affect segregation has been insufficiently explored by studies using different terminologies, methodologies, and geographies. Establishing whether charter schools increase or decrease segregation is difficult because charter schools are not randomly assigned to school systems. Places where charter schools locate likely have other characteristics that contribute to segregation. In this study, we provide the first nationally comprehensive examination of the effect of charter schools on school system segregation. We use nationally comprehensive annual records on school enrollment by race or ethnicity from 1998 to 2015. We combine these data with a credible research design to uncover the causal effect of the charter school enrollment share – the percentage of students attending a charter school - on school district segregation.

Our research design is based on a generalized difference-in-differences framework estimated at the district-grade-year level. We identify the average causal effect of charter school enrollment share by comparing the dynamics of segregation between grade levels that have experienced differing intensity in charter school penetration. We restrict comparisons within districts in a given year (district-year effects) to eliminate the influence of districtwide time-varying confounding factors correlated with charter school enrollment. Furthermore, we flexibly control for fixed differences in segregation across the grade levels of each district in our sample (district-grade effects). We demonstrate that these flexible controls help eliminate spurious correlations between charter school penetration and district characteristics such as total enrollment and overall racial or ethnic composition.

We find that, on average, an increase in the share of enrollment attending charter schools increases the segregation of black, Hispanic, and white students. Nonetheless, the magnitude of this average effect is small. Our preferred estimates suggest that a 1 percentage point increase in the share of enrollment attending charter schools causes a 0.11 percentage-point increase in the segregation of black or Hispanic students, as measured by the variance ratio index of segregation. For the average district in our sample, this implies that eliminating charter schools would lead to a 5 percent decrease in the segregation of black or Hispanic students. Moreover, we uncover extensive heterogeneity in this effect between district types and across states.

Charter schools have a stronger segregative effect on urban districts with high shares of low-income students and high shares of black or Hispanic students. But in suburban districts, charter schools increase segregation when the district has a lower share of black or Hispanic students or a lower share of low-income students. In particular, white students in low-minority suburban districts are more segregated following charter school penetration than white students in urban districts. On the other hand, black students face larger increases in segregation in high-minority urban districts than in high-minority suburban districts. The complexity of these treatment effect heterogeneity patterns should be a cautionary tale for extrapolating our estimates to different contexts.

In addition, we demonstrate that the effect of charter schools on school segregation varies considerably across states—the government entities responsible for enacting charter school policy. Consistent with our main estimates, we find that charter schools cause higher segregation in most states. But in several states, the effect is statistically indistinguishable from zero. Moreover, our point estimates are near zero in some states and negative for others. Once again, the extent of this heterogeneity should be kept in mind when interpreting our average national estimates.

To assess the robustness of our findings, we conduct a range of checks on the stability of our estimates. We show that our estimates are not driven by our choice of segregation index, the way we group students from different racial or ethnic groups, or the way we parametrize the treatment variable. We estimate distributed lag models to test for pre-trends in segregation that might be spuriously correlated with charter school penetration but find no evidence of such a relationship. Additionally, we conduct a placebo test in which we test for the effects of charter penetration in elementary schools on the contemporaneous segregation of middle and high schools, and every other combination of such 'mismatched' charter school effects across grade levels. Finding an effect in these placebo models would suggest unobserved confounders in our data, but we find very limited evidence that this is the case.

Finally, we explore the sensitivity of our results to the level of aggregation at which segregation is computed—that is, how we define a "school system." To do so, we aggregate schools into geographic school districts (our main estimates), cities and towns, counties, and metropolitan areas. We find that charter schools have a statistically significant segregative effect at every level of aggregation with the exception of metropolitan areas. When segregation is measured at the metropolitan area level, our effect estimates are attenuated and only marginally significant for black segregation but not significant for white or Hispanic segregation. To further explore this puzzling finding, we decompose metropolitan area segregation into a component caused by within-district segregation and a component caused by between-district segregation. We find that charter school entry is associated with decreases in the between-district component of Hispanic and white students' segregation but with simultaneous increases in the within-district component. We interpret this finding as evidence that charter schools have led to diminishing compositional imbalances across districts in the same metropolitan area but that this has not translated into greater school integration. We provide evidence that the decrease in between-district segregation caused by charter schools is concentrated in metropolitan areas with high school district fragmentation.

Our analysis constitutes a compelling case for the notion that charter schools lead to slightly higher levels of racial and ethnic segregation, on average. But we do not take a normative stance on this result. On the one hand, there is enormous evidence of the beneficial impacts of school integration on the educational and socioeconomic outcomes of racial and ethnic minorities. The fact that charters lead to higher segregation is thus very worrisome. On the other hand, many charter schools were founded and tailored to serve students from vulnerable backgrounds, and many have improved student outcomes. By enrolling largely homogenous student bodies, such schools are likely to cause increases in segregation. Segregation that takes place under such a school choice environment is fundamentally

different from the pre–*Brown v. Board of Education* era of de jure segregation. Segregation caused by school choice and segregation forced by government statute should not be interpreted with the same lens. More research is needed to understand the effect of choice-driven segregation on student outcomes.

The rest of the report proceeds as follows. Section 2 provides additional background on the history of school segregation and the literature on charter schools. Section 3 describes our data and estimation sample and presents descriptive statistics. Section 4 develops our empirical framework to estimate the causal charter school effects on segregation. Section 5 presents the main results. Section 6 conducts robustness checks and provides our analysis of the components of metropolitan area segregation. Section 7 concludes.

Background and Literature Review

The History of School Segregation

The issue of segregation and school choice has particular significance in the United States, as historically it was used as a tool to maintain segregated schools in the South following the *Brown v. Board* decision (Reardon and Owens 2014). In 1968, 14 years after *Brown*, US public schools were still intensely segregated, with an average within-district index of dissimilarity between black and white students of roughly 0.80 (Logan and Oakley 2004) and an average within-district variance ratio index of 0.63 (Coleman, Kelly, and Moore 1975; Reardon and Owens 2014).

Because of court-ordered desegregation plans in the 1970s, these rates fell substantially, with the largest declines in the South (Coleman, Kelly, and Moore 1975; Reber 2005). As within-district segregation decreased, however, between-district segregation increased, particularly in areas where school districts tended to be smaller and more numerous (Coleman, Kelly, and Moore 1975). This form of de facto segregation, facilitated through white flight and racist housing market practices, was more difficult to address after the Supreme Court's 1974 *Milliken v. Bradley* decision ruled against court-ordered interdistrict desegregation plans. Nevertheless, within-district segregation decreased substantially throughout the 1970s and continued to fall during the 1980s, albeit more modestly (Reardon and Owens 2014). Additional examinations during the 1990s and 2000s find that trends in segregation have been near flat or have modestly decreased over the past 20 years (Logan 2004; Stroub and Richards 2013). Between-district segregation is now higher than within-district segregation (Reardon and Owens 2014). Moreover, where districts tend to be larger, such as in the South and West, between-district segregation tends to be lower (Clotfelter 1999).

The Effects of School Segregation

From a political perspective that values equality and diversity, integrated schools are inherently good. Moreover, the literature supports the notion that diversity has positive political and sociological benefits for a pluralistic society. In terms of measurable educational outcomes, a growing body of research has documented the consequences of school integration, yet the precise mechanisms that produce student benefits are less clear (Reardon and Owens 2014). Analyses of the desegregation plans that followed the *Brown* ruling found reduced high school dropout rates for black students (Guryan

2004; Reber 2010), as well as reductions in the probability of incarceration and increases in wages, employment, and health status (Johnson 2015). The eventual termination of desegregation orders subsequently led to short-term resegregation that resulted in higher dropout rates for black and Hispanic students (Liebowitz 2018; Lutz 2011). Similarly, an examination of the consequences of ending race-based busing in Charlotte-Mecklenburg found that it increased racial inequality and led to negative effects on high school exams for white and minority students, lower graduation rates and college attendance for white students, and increases in crime for minority males (Billings, Deming, and Rockoff 2013; Vigdor 2011). Experimental lottery data show that a desegregation plan allowing minority students to transfer to higher-income schools with higher shares of white students increases college enrollment for minority students (Bergman 2018). Other research has documented the effects of both neighborhood and school segregation on the black-white test score gap, which is larger in more segregated cities (Card and Rothstein 2007).

Reardon and Owens (2014) describe two primary mechanisms by which integration might improve student outcomes: by ensuring educational resources (e.g., school, teacher, peer, and parent resources) are more equitably available to all students, and by increasing the total pool of available resources because, for example, the political capital of parents in an integrated system may be more directed toward acquiring higher total resources for the school system rather than for specific schools. Thus far, studies have focused on the distribution of available resources, which varies as a function of segregation and seems to be a driving mechanism of the benefits of integration (Bergman 2018; Johnson 2015; Reardon, Kalogrides, and Shores 2019; Reber 2010).

Prior Research Findings on Charter Schools and Integration

A summary of research on charter schools and segregation described it as "regrettably weak" and noted that we know little about how charter schools affect the distribution of students in school systems (Gill et al. 2007, 196). This gap in the research has become more glaring and particularly polarizing since Secretary of Education Betsy Devos has made expanding charter schools a centerpiece of her tenure. In 2017, for example, an Associated Press analysis compared charter schools with public schools and found that charter schools were more likely to demonstrate high levels of racial isolation, which was quickly interpreted as more segregation.[1] The reaction to the story exemplified the importance of measurement and the issue's divisiveness. The president of the American Federation of Teachers, Randi Weingarten, called the data from the Associated Press "damning" and argued that "America's children

deserve better."[2] The National Education Association later featured this headline: "Racial Isolation of Charter School Students Exacerbating Resegregation."[3] Charter school proponents pushed back, calling the Associated Press analysis "irresponsible" and arguing that charter schools merely reflected the neighborhoods in which they locate and the students they predominantly serve, which, in both cases, tend to be students of color.[4] Charter schools, they argued, were being unfairly criticized for doing exactly what they had set out to do—serve students most in need of better education.

Similar disagreements surfaced when the Civil Rights Project at the University of California, Los Angeles, issued a study that relied on absolute measures of isolation (Frankenberg, Siegel-Hawley, and Wang 2010). In this case, a reanalysis using similar methods but limited to geographic areas where charter schools tended to locate—urban areas with high residential concentrations—found that charter schools and traditional public schools were similarly isolated (Ritter et al. 2014). Of course, demonstrating that charter schools enroll more black and Hispanic students is unsurprising, given that charter schools tend to locate in areas with high proportions of minority students. Importantly, such relationships do not tell us the causal charter school effects on school system segregation, as they do not account for the effects charter school penetration has on the distribution of school system enrollment patterns.

More informative studies follow students over time in choice environments and judge if individual student transfers harm or improve integration. Using student-level information that compared students' neighborhood-based school assignments to the actual schools students attended because of a public school choice program in Durham, North Carolina, Bifulco, Ladd, and Ross (2009) found that white parents tended to make moves that exacerbate isolation while black parents make integrative moves, with the combined effect of a net increase in racial isolation. Bifulco and Ladd (2007), also using North Carolina data, obtained similar results when examining student transfers to charter schools. Similarly, Garcia (2008) used statewide Arizona data across a four-year period and a measure of exposure to track second-through-ninth-grade students who exited a traditional public school to attend a charter school and found similar results, though not for high school students. In contrast, Ritter and coauthors (2016) tracked student transfers to charter schools in Little Rock, Arkansas, and found that student transfers to charter schools, on average, improved the school system's overall racial balance. Zimmer and coauthors (2009) examined charter schools in eight states and concluded that, on average, students tended to transfer between traditional public and charter schools with similar racial compositions, though there was considerable variation by region. Though informative, these studies are limited in scope, rely on measures of exposure or isolation, and are specific to local geographic conditions.

What has been lacking is a large-scale study of charter school effects in the United States using a causal research design. We provide that here, with a longitudinal analysis of the universe of public school systems containing charter schools from 1998 to 2015.

Data

We use data from several sources in our analysis. First, we use data from the National Center of Education Statistics' (NCES) Common Core of Data, which includes school enrollment counts by grade level and race or ethnicity, school type, and the latitude and longitude of schools' locations. We use a geographic information system procedure to match school locations to different geographical units: school districts, counties, and metropolitan areas. We treat each of these as distinct definitions of school systems when computing school segregation. This allows us to geolocate charter schools in the school systems they affect. For school districts, we use the 2015 definition of school district boundary maps from NCES Education and Geographic Estimates. For metropolitan areas, we use US Census Bureau TIGER/Line 2010 definitions of core-based statistical areas, focusing only on metropolitan statistical areas. We also geolocate schools to maps of census-designated places, the Census Bureau's formal definition of all incorporated cities, towns, and unincorporated concentrations of population. We also merge school location data with 2010 US Census Bureau tracts and blocks. From these data, we acquire residential population counts by age, race or ethnicity, adult educational attainment, and median household income.

We structure the data as a stacked panel of school districts over years and grade levels. For each year from 1998 to 2015, we observe racial composition for each school grade level across grades K–12 (1998 is the first year the charter flag is available). In terms of school-level sample restrictions, we drop closed or inactive schools, schools devoted to special programs, schools serving only kindergarten or lower, schools providing only adult education, and schools not located in US mainland states. We also drop schools with missing enrollment counts by race or ethnicity, a prevalent issue in the early years of the panel. With regard to district-level sample restrictions, we drop district grades that have only one school at any point during the sample period because segregation is not well defined in these cases. In addition, we drop districts that are observed for only a single grade or year after these earlier sample restrictions.

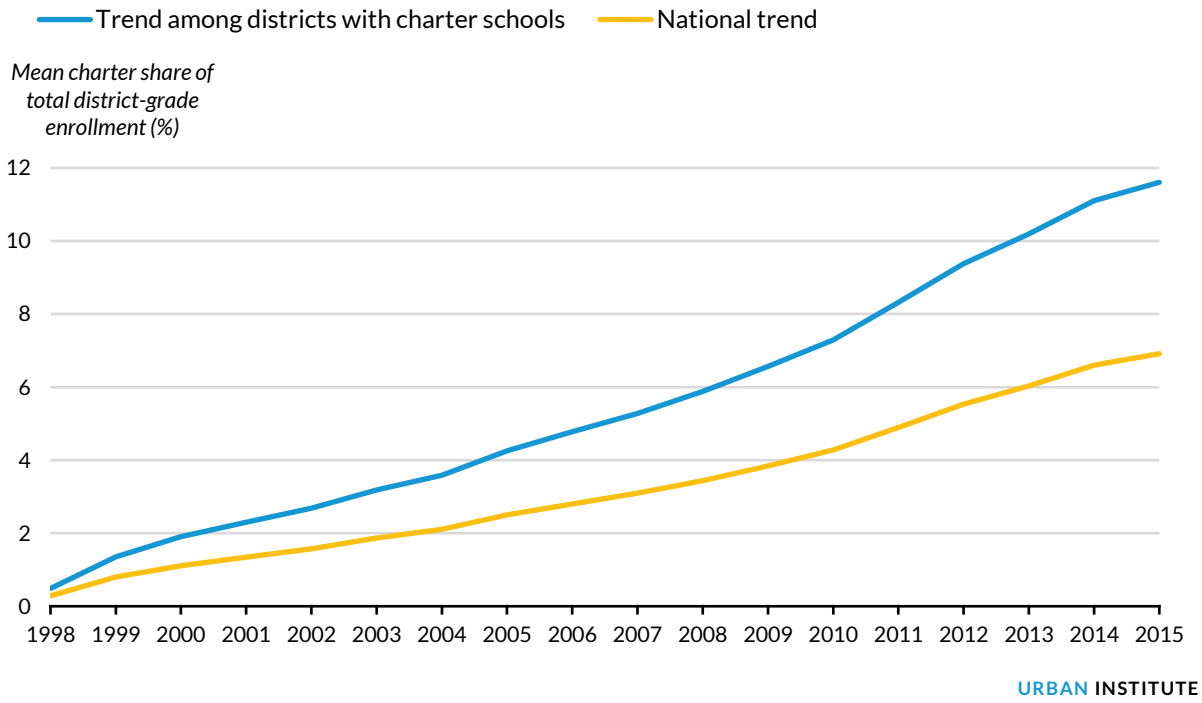
Our final analytic sample includes 4,574 school districts, observed for grades K–12 from 1998 to 2015, for a total number of observations that exceeds 500,000. The quality of the charter indicator and the variables capturing racial or disaggregation of enrollment by grade were sometimes missing during the early years of our estimation sample (about 1998 to 2003). Our main results are insensitive to the removal of these early years of data.

Descriptive Statistics

Nationally, charter schools have increased their share of total enrollment. Figure 1 shows that between 1998 and 2015, the average K–12 student attended a district grade in which the charter school enrollment share increased from 0.3 percent to 6.9 percent. This overall trend includes many districts that never have charter school entry, so it understates the increase among districts that have seen charter school entry, which rose from 0.5 percent to 11.6 percent over the same period. These national trends mask considerable variation in charter school growth between districts and across grade levels within districts.

FIGURE 1

Trends in Average Charter School Share of Total Public School District Enrollment, 1998–2015



Source: Authors' calculations using the National Center for Education Statistics' Common Core of Data.
Notes: Observations are weighted by enrollment. Districts with charter schools have nonzero enrollment in a charter school during the entire sample period.

Charter schools tend to serve a specific population of students. Compared with traditional public schools, charter schools enroll higher proportions of black students than white students in elementary and middle schools (table 1). Charter schools also tend to enroll higher proportions of Hispanic students in middle and high school. These enrollment characteristics largely reflect charter school locations. Charter elementary and middle schools are more likely to locate in census tracts with higher

proportions of black residents, while charter middle and high schools are in areas with higher proportions of Hispanic residents compared with white residents. This is consistent with research demonstrating that schools tend to closely reflect neighborhood compositions (Monarrez 2018; Whitehurst et al. 2017).[5] Charter schools also tend to be located in tracts with lower median income and adult educational attainment.

TABLE 1

2010 Summary Statistics for Charter Schools and Traditional Public Schools

	Primary School		Middle School		High School	
	Charter school	TPS	Charter school	TPS	Charter school	TPS
School characteristics						
Total enrollment	353.94	552.00	262.16	769.58	312.02	1356.25
Black (%)	0.35	0.23	0.36	0.23	0.26	0.28
Hispanic (%)	0.25	0.32	0.34	0.30	0.31	0.26
White (%)	0.32	0.35	0.24	0.39	0.34	0.37
Census tract characteristics						
Black (%)	0.25	0.19	0.28	0.17	0.18	0.20
Hispanic (%)	0.24	0.24	0.28	0.23	0.27	0.21
White (%)	0.44	0.50	0.36	0.53	0.46	0.51
Adults with college education (%)	0.25	0.27	0.24	0.28	0.25	0.28
Median income ($)	47,558.17	55,602.07	45,053.10	56,633.42	46,319.76	54,053.52
Observations	1,958	19,750	512	5,174	809	4,266

Source: Authors' calculations using the National Center for Education Statistics' Common Core of Data and US Census Bureau data.

Notes: TPS = traditional public school. Standard errors are clustered at the district level in all models.

Measuring Segregation

Determining the effects of charter school growth on school system segregation has proved vexing. A notable takeaway from related literature is that different methods of measuring segregation can lead to different conclusions (Reardon and Owens 2014). The two most common approaches involve absolute measures and relative measures (Clotfelter et al. 2018). Absolute measures, often referred to as *measures of exposure* or *isolation*, measure how much students from one demographic group are exposed to (or isolated from) another demographic group within individual schools. Common exposure measures include the isolation index, which measures the black and Hispanic share of students experienced by the average black or Hispanic student or some similar group comparison. Other approaches more crudely define "segregated" schools as those with high proportions of similar students by comparing schools with an absolute benchmark. For example, some researchers have adopted such terms as "hypersegregated" or "intensely segregated" to describe schools that enroll more than 90 percent of

students with the same demographic characteristic and employed these methods to claim charter schools are more "hypersegregated" (Frankenberg et al., 2019; Frankenberg, Siegel-Hawley, and Wang 2010; Orfield et al. 2016).

Though absolute measures are descriptively useful, one drawback is that they are partly driven by the school system's underlying racial or ethnic composition. Schools in areas with high black and Hispanic representation might be labeled "hypersegregated" simply for reflecting the underlying pool from which they draw students. Additionally, a school or system might appear to become increasingly "segregated" simply because of increases in the local black and Hispanic population. Recent claims that schools have been resegregating tend to rely on absolute measures, which do not account for the fact that white students make up an increasingly smaller share of all US students (Clotfelter et al. 2018; Fiel 2013).[6] As a result, it is impossible to distinguish whether absolute measures across time and place indicate segregation or merely demographic transitions.

Relative measures of imbalance or unevenness adjust for the underlying student composition, making them comparable across different locations and over time. Relative measures are also conceptually different in that they measure how evenly a given population of students is distributed across a school system. This makes intuitive sense, as the term "segregation" implies that some students are segregated from other students—the key here being that the term loses some meaning without accounting for who those other students are. One commonly used index in this group of segregation measures is the variance ratio index, which builds on the isolation index but includes a simple adjustment for systemwide composition that allows for accurate comparisons across time or sectors. It is defined as follows:

$$Variance\ Ratio = \frac{E\left[q_{sj}\middle|URM = 1\right] - Q_j}{1 - Q_j} = E\left[q_{sj}\middle|URM = 1\right] - \left[q_{sj}\middle|URM = 0\right]$$

where q_{sj} is the share of students in school *s* in school system *j* that are black or Hispanic. The isolation index, which is the average of q_{sj} when restricting attention to black and Hispanic students, can be written as the conditional expectation $E\left[q_{sj}\middle|URM = 1\right]$, where URM (underrepresented minority) is a student-level indicator of being black or Hispanic. The variance ratio index adjusts this term by Q_j, the systemwide black and Hispanic share. The adjustment is intuitive. In a perfectly integrated system, all schools would have a composition equal to Q_j. On the other hand, in a perfectly segregated school system, black and Hispanic students are exposed only to themselves, so the isolation index would equal 1.

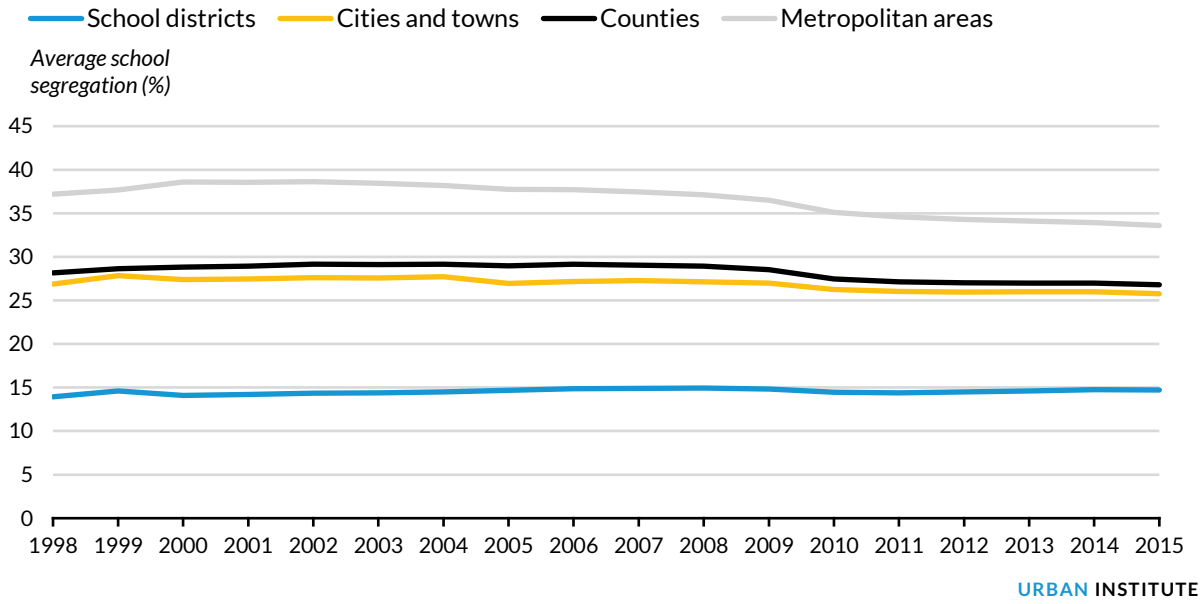
It is a remarkable fact of algebra that the variance ratio index coincides with the second equality, which is the difference in average school exposure to black and Hispanic students between black and Hispanic students and white and Asian students. In other words, the variance ratio index can be interpreted as a gap in exposure to black and Hispanic students. This characterization of the variance ratio index also coincides with the ordinary least squares slope coefficient of a student-level regression of q_{sj} on the black and Hispanic indicator. In other words, the variance ratio index can be interpreted as how predictive a student's own race or ethnicity is of the racial or ethnic composition of her school peers. In addition, studies have established that the variance ratio index can be derived as the correct measure of segregation in an econometric model in which racial or ethnic gaps in student outcomes are generated by racial or ethnic gaps in school resources (Card and Rothstein 2007; Reardon and Owens 2014). Still, to be sure our results are not driven by our choice of segregation measurement, we conduct a parallel analysis using another common relative measure of segregation, the dissimilarity index, a widely used measure of unevenness that ranges from 0 (complete integration) to 1 (complete segregation) and measures the proportion of a group's population that would have to change schools to reach an even distribution across each school in the system.

Trends in School Segregation

Figure 2 reports trends in average segregation nationally using the variance ratio index and four definitions of a school system: school districts, census places (cities and towns), counties, and metropolitan areas. Across these four levels of aggregation, the dynamics of average school segregation tell a similar story. The segregation of black and Hispanic students has remained remarkably stable over the past 15 years, with the exception of metropolitan area–level segregation, which began a slight downward trend beginning in 2010. This flat trend is consistent with similar analyses using measures of unevenness that show flat to declining trends in segregation over the past two decades (Fiel 2013; Logan 2002, 2004; Reardon and Owens 2014; Stroub and Richards 2013, Whitehurst et al. 2017).

FIGURE 2

Trends in School Segregation for Black and Hispanic Students across Different Levels of Aggregation



Source: Authors' calculations using the National Center for Education Statistics' Common Core of Data and US Census Bureau data.

Notes: Observations are weighted by enrollment. Cities and towns correspond to the 2010 definition of census places. Metropolitan areas use 2010 core-based statistical area definitions.

Remarkably, segregation levels across different definitions of a school system are considerably different. When we measure it at the school district level, average segregation is around 15 percent in most years of the data. In contrast, when measured at the metropolitan area level, segregation more than doubles, to about 39 percent. A definition based on cities, towns, or counties generates mean segregation levels between these two, at about 28 percent throughout the sample. The takeaway is that schools are more severely segregated across metropolitan areas than they are within school districts, as has been documented (Clotfelter 1999; Reardon, Kalogrides, and Shores 2019; Reardon and Owens 2014; Reardon, Yun, and Eitle 2000; Stroub and Richards 2013). These differences have important implications for our evaluation of the role of charter schools in determining segregation. In our empirical analysis, we first focus on school districts—the level at which school systems are most commonly defined in the literature—but then turn to a detailed exploration of effects for these different levels of aggregation.[7]

Empirical Framework

The expansion of charter schools in a given school system can affect school segregation in several ways. When a charter school opens, it might draw students enrolled in nearby traditional public schools. The students it draws are likely determined by the charter school mission and intended target population. Charter schools can affect segregation both by enrolling a different student body composition than traditional public schools and by changing the composition of traditional public schools themselves, likely in a manner opposite of charter school composition. This conceptual framework implies that charter schools will likely lead to more segregation if they systematically enroll higher or lower shares of black or Hispanic students. On the other hand, because charter schools' enrollment policies are not constrained by existing and often highly segregated traditional public school attendance boundaries, they could have an integrative effect.

To identify the effects of charter school growth on segregation, we define a school system's "treatment dosage" as the share of total public school enrollment in the charter sector. Thus, our treatment variable is continuous and bounded between 0 and 1.[8] We then estimate the following econometric specification:

$$Y_{igt} = \beta E_{igt} + X'_{igt}\Gamma + \tau_{ig} + \delta_{it} + \epsilon_{igt}$$

where Y_{igt} is the segregation of school system *i* in grade *g* for school year *t*, E_{igt} is the share of school system enrollment going to charter schools in that grade and year, and X_{igt} is a vector of characteristics that vary at the system-grade-year level, such as the log of total enrollment and the share of students that are black or Hispanic. The model includes system-by-grade fixed effects (τ_{ig}) and system-by-year fixed effects (δ_{it}). Finally, ϵ_{igt} is an idiosyncratic error component that varies at the system-grade-year level and, if correlated with E_{igt}, might threaten the validity of the assumptions necessary to interpret β causally.

Our identification strategy, which can be characterized as a generalized difference-in-differences strategy, relies mostly on the inclusion of school system–grade and system-year fixed effects. Including district-grade fixed effects, τ_{ig} restricts comparisons to the same grade level within a single school system. This has a twofold advantage for causal identification. First, it eliminates confounding variation in segregation across the geography of the country and is fixed over time. For instance, school segregation is higher in southern school systems than in western school systems. Charter school penetration also happens to be higher in the West than in the South, but we would not want to attribute this historically driven correlation between charter schools and segregation to the causal effect of the

charter movement. Second, district-grade fixed effects allow us to eliminate temporally fixed confounding variation in segregation across school grade levels. If charter schools open only in the high school sector and the high school sector has historically been more segregated than the elementary school sector, we do not want to attribute this difference to the effects of opening charter schools.

The system-year effects δ_{it} also serve more than one purpose to strengthen the case of causal identification. They eliminate confounding variation driven by the secular trends in charter school enrollment and school segregation described above. They ensure our causal estimates are not driven by state-level shocks, including different segregation and charter school trends across states as well as unobserved state-level policy changes. Moreover, the system-year effects also account for unobserved time-varying shocks at the school system level that have equal impact on segregation across grade levels. For instance, we know our estimates are not driven by districts enacting a school desegregation policy that applies to all grade levels and whose timing coincides with charter school entry.

Our econometric specification identifies causal estimates from variation in charter school enrollment dynamics across grade levels within each school system. For example, if in 2010, the share of ninth-grade charter school enrollment in Washington, DC, increased more than in other grades and there was a corresponding increase in ninth-grade segregation relative to other grade levels, our model would attribute this to charter schools having a causal effect on increased segregation.

Our national estimate of β is a weighted average of these types of comparisons across all school systems and school grade levels from 1998 to 2015.

Table 2 summarizes our estimation sample, showing the mean of key analysis variables in the sample of district-grades for the years 2000, 2003, 2010, and 2015. Districts with charter schools tend to be more urban, they tend to enroll higher shares of black and Hispanic students, and they are more likely to be racially segregated. The share of charter schools, whether measured as a share of schools or as a share of enrolled students, has increased over our study period. Across all districts, the isolation of black and Hispanic students and their overall enrollment share has increased, while segregation has remained stable.

TABLE 2

Summary Statistics of the District-Grade Estimation Sample

	2000 mean	SD	2003 mean	SD	2010 mean	SD	2015 mean	SD
Number of schools	51.5	(115.3)	49.5	(113.7)	54.8	(127.7)	59.7	(143.8)
Enrollment	7,567.2	(16,089.1)	6,767.8	(14,244.7)	6,737.8	(14,320.3)	6,996.2	(14,721.8)
Racial or ethnic composition (%)								
Black	21.5	(21.8)	20.7	(21.2)	18.8	(19.6)	18.2	(18.8)
Hispanic	21.1	(23.7)	23.5	(24.2)	26.8	(24.6)	29.4	(24.4)
White	51.6	(29.4)	49.6	(29.1)	45.3	(27.7)	42.0	(26.5)
Charter schools								
Number of charter schools	1.6	(4.2)	3.3	(7.2)	6.0	(14.5)	9.8	(24.7)
% of district	3.8	(8.4)	6.5	(11.3)	8.9	(13.3)	12.1	(15.3)
Enrollment	109.6	(371.7)	219.7	(563.0)	442.6	(1176.0)	830.0	(2,182.8)
% of district	1.2	(3.3)	2.6	(5.3)	4.4	(7.4)	7.0	(10.4)
Segregation (black or Hispanic)								
Variance ratio	15.1	(13.8)	15.0	(13.7)	14.7	(13.3)	14.9	(13.1)
Dissimilarity	36.1	(17.7)	35.6	(17.4)	34.6	(16.8)	34.4	(16.5)
Isolation	49.3	(29.2)	50.7	(29.0)	52.0	(28.1)	53.9	(27.3)
Segregation (black)								
Variance ratio	14.0	(17.0)	13.0	(16.3)	12.2	(15.6)	11.8	(14.8)
Dissimilarity	38.1	(19.0)	37.0	(18.7)	36.5	(18.2)	36.4	(17.6)
Isolation	30.2	(26.8)	28.8	(26.1)	26.8	(24.8)	26.1	(24.0)
Segregation (Hispanic)								
Variance ratio	10.6	(13.1)	10.8	(12.9)	11.0	(12.5)	11.3	(12.2)
Dissimilarity	37.1	(18.0)	34.7	(17.0)	32.6	(16.1)	31.4	(15.2)
Isolation	28.0	(26.8)	30.4	(26.8)	33.5	(26.7)	36.2	(26.1)
Segregation (white)								
Variance ratio	14.2	(12.8)	14.0	(12.5)	13.5	(12.0)	13.4	(11.6)
Dissimilarity	35.5	(18.5)	35.0	(18.3)	34.2	(18.2)	34.1	(17.7)
Isolation	60.2	(23.9)	58.2	(24.1)	54.0	(23.4)	51.0	(22.6)
Observations	26,527		32,551		33,341		33,821	

Source: Authors' calculations using the National Center for Education Statistics' Common Core of Data.

Notes: SD = standard deviation. The level of observation is district-grade. Observations are weighted by total enrollment.

Results

As the national averages in table 2 show, charter school enrollment growth has coincided with overall district enrollment dynamics and shifts in student body composition. Total enrollment and systemwide racial or ethnic composition are important components in computing segregation indexes. But we are interested in isolating charter school effects on racial or ethnic stratification patterns between schools. If total enrollment and overall composition are correlated with the variation in charter school penetration that we employ to estimate causal effects, this might confound our estimates. To examine this, table 3 presents regression-adjusted estimates of the correlation between the natural log of total district-grade enrollment and the charter school enrollment share. Column 1 of panel A presents univariate ordinary least squares estimates, which show that when pooling all variability in the data, the charter school enrollment share is positively correlated with larger student populations. Similarly, column 4 of panel A and columns 1 and 4 of panel B show a raw correlation between the racial or ethnic composition of school districts and higher charter school enrollment. District-grades with charter school penetration tend to have higher black and Hispanic representation and lower white representation. This is consistent with the school-level patterns in table 2.

Adding district-grade effects removes between-district-grade comparisons from our estimation of the correlation between charter school penetration and district-grade characteristics. Column 2 of panel A shows that the correlation between log total enrollment and charter schools was mostly driven by spurious comparisons between districts. The same goes for the correlation with district-grade composition, shown in column 5 of panel A and columns 2 and 3 of panel B. None of these coefficients are statistically distinguishable from zero. We next add district-year in addition to district-grade effects, our preferred specification for identifying the causal charter school effect. Interesting patterns emerge. Although the coefficient on charter schools is of a lower magnitude than in the univariate ordinary least squares model, we cannot reject that charter schools have a null effect on total district-grade enrollment or racial or ethnic composition.

The coefficient estimate on total enrollment suggests that a 1 percentage-point increase in charter school enrollment share leads to a 0.1 percentage-point increase in total enrollment (column 3 of panel A). Charter schools have no average treatment effect on the district-grade share of black students (column 6 of panel A), but they do have an effect on Hispanic and white shares of total enrollment. A 1 percentage-point increase in charter school enrollment share leads to a 0.03 percentage-point decrease in the Hispanic share and a corresponding 0.03 percentage-point increase in the white share of

enrollment. This is consistent with an increase in districtwide enrollment of white students caused by charter schools, a topic we revisit below.

TABLE 3

Correlation between Charter School Enrollment Share and Total Enrollment and Student Body Composition

Panel A

	Log total enrollment			Racial or ethnic composition (%)		
	(1)	(2)	(3)	(4) Black	(5) Black	(6) Black
Charter share	0.015***	-0.000	0.001**	0.269***	0.012	-0.001
	(0.002)	(0.002)	(0.000)	(0.055)	(0.008)	(0.007)
Dependent variable mean	7.73			14.12		
District-year fixed effects		X	X		X	X
District-grade fixed effects			X			X
R^2	0.011	0.977	0.988	0.009	0.988	0.992
N	556,115	556,115	556,115	556,115	556,115	556,115

Panel B

	Racial or ethnic composition (%)					
	(1) Hispanic	(2) Hispanic	(3) Hispanic	(4) White	(5) White	(6) White
Charter share	0.358***	-0.021	-0.028***	-0.668***	-0.005	0.026***
	(0.044)	(0.018)	(0.009)	(0.062)	(0.019)	(0.009)
Dependent variable mean	24.55			46.81		
District-year fixed effects		X	X		X	X
District-grade fixed effects			X			X
R^2	0.013	0.985	0.992	0.028	0.977	0.984
N	556,115	556,115	556,115	556,115	556,115	556,115

Source: Authors' calculations using the National Center for Education Statistics' Common Core of Data.

Note: Standard errors are clustered at the district level in all models.

** $p < 0.05$; *** $p < 0.01$.

To ensure that these aggregate compositional changes caused by charters don't drive our main estimates on the effects on segregation, we control for student body racial composition (percentage black and percentage Hispanic) and log total enrollment in all our subsequent regression models. Table A.2 shows that our main results are robust to excluding these controls and to adding controls for the number of schools serving each district-grade. The estimates in table 3 demonstrate that our econometric specification does an ample job netting out potential confounders.

Table 4 presents our main estimates of charter school effects on school district segregation. For completeness, each panel presents parallel models of the segregation of black or Hispanic students (together as one category) and the segregation of black, Hispanic, and white students separately. Columns 1 through 3 use the variance ratio index of segregation, while columns 4 through 6 present the dissimilarity index (as a check on robustness to our choice of segregation measurement). As controls are gradually included in the model, the coefficient on charter school enrollment share remains positive and highly statistically significant in every one of the 24 specifications presented in the table. The coefficient estimate in column 3 of the first panel—our preferred specification—implies that a 1 percentage-point increase in charter school enrollment share leads to a 0.11 percentage-point increase in within-district segregation. Put a different way, if the average district-grade in the sample eliminated its charter schools, we would expect its segregation to decrease 4.98 percent. Thus, this average treatment effect, while significant, is small. Estimates using the dissimilarity index as the outcome generate similar conclusions.

The second, third, and fourth panels of table 4 show that an increase in the charter school share of district enrollment leads to higher segregation of black, Hispanic, and white students separately. Thus, our main qualitative conclusions are not driven by our choice to group black and Hispanic students in the main estimates. Charter schools have led to modest increases in school district segregation for each of the racial or ethnic groups that make up the majority of students in most districts.

TABLE 4

Charter School Effects on School District Segregation

	Variance ratio index			Dissimilarity index		
	(1)	(2)	(3)	(4)	(5)	(6)
			Black or Hispanic			
Charter share	0.130***	0.152***	0.106***	0.130***	0.250***	0.139***
	(0.020)	(0.027)	(0.016)	(0.025)	(0.034)	(0.021)
Dependent variable mean	14.95			35.32		
Covariates	X	X	X	X	X	X
District-year fixed effects		X	X		X	X
District-grade fixed effects			X			X
R^2	0.245	0.806	0.930	0.098	0.676	0.826
N	556,115	556,115	556,115	556,115	556,115	556,115
			Black			
Charter share	0.105***	0.102***	0.085***	0.182***	0.303***	0.181***
	(0.018)	(0.017)	(0.013)	(0.031)	(0.035)	(0.021)
Dependent variable mean	12.67			36.99		
Covariates	X	X	X	X	X	X
District-year fixed effects		X	X		X	X
District-grade fixed effects			X			X
R^2	0.358	0.850	0.941	0.006	0.610	0.756
N	556,115	556,115	556,115	556,115	556,115	556,115
			Hispanic			
Charter share	0.118***	0.086***	0.053***	0.035	0.224***	0.098***
	(0.018)	(0.026)	(0.010)	(0.025)	(0.036)	(0.020)
Dependent variable mean	10.88			34.26		
Covariates	X	X	X	X	X	X
District-year fixed effects		X	X		X	X
District-grade fixed effects			X			X
R^2	0.238	0.811	0.929	0.035	0.611	0.753
N	556,115	556,115	556,115	556,115	556,115	556,115

	Variance ratio index			Dissimilarity index		
	(1)	(2)	(3)	(4)	(5)	(6)
	White					
Charter share	0.129***	0.142***	0.085***	0.145***	0.242***	0.140***
	(0.020)	(0.027)	(0.015)	(0.026)	(0.035)	(0.021)
Dependent variable mean	13.73			34.78		
Covariates	X	X	X	X	X	X
District-year fixed effects		X	X		X	X
District-grade fixed effects			X			X
R^2	0.211	0.794	0.910	0.170	0.723	0.850
N	556,115	556,115	556,115	556,115	556,115	556,115

Source: Authors' calculations using the National Center for Education Statistics' Common Core of Data.

Notes: Standard errors are clustered at the school district level in all models. Covariates include log total enrollment, the black enrollment share, and the Hispanic enrollment share.

* $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$.

Treatment Effect Heterogeneity by District Type and Geographic Region

Across all school districts, the evidence presented thus far suggests that, on average, charter schools increase school district segregation. The average effect is small, which is likely both a function of charter schools' small share of total enrollment and a function of heterogeneity in charter school effects across different types of districts. In table 5, we begin trying to recover effect heterogeneity by estimating models that interact the charter school enrollment share with indicators of three quantiles (low, middle, and high) of baseline (2003) levels of the black or Hispanic enrollment share, as well as the share of students receiving free and reduced-price lunch (FRPL). We further disaggregate effects by estimating these interacted models separately for urban and suburban school districts. For completeness, each panel estimates parallel models of the segregation (variance ratio index) of black, Hispanic, and white students separately. The coefficients are interpreted directly, not relative to an omitted group.

Columns 1 and 4 of table 5 show that differences in main treatment effects between districts with high or midlevel representation of minority and FRPL students are small and statistically indistinguishable from each other. One interesting exception to this pattern is that the segregative charter school effects for black students and white students is almost double in districts with a high share of low-income students, compared with those with a low FRPL share. Moreover, charter school effects on segregation are smaller in districts with few minority or low-income students. In low-minority districts, we fail to reject that charter schools have no effect on the segregation of white or Hispanic students. The effect on black segregation, however, is still present.

In columns 2 and 5, we present effect estimates separately for three quantiles of the black and Hispanic share and FRPL share distribution across districts, focusing on urban districts. Charter schools increase segregation, especially in high-minority and low-income urban districts. Interestingly, low-minority or low-poverty urban districts generally see no increases in segregation because of charter schools. For white students in these districts, charter schools appear to increase integration.

Columns 3 and 6 estimate parallel models for the sample of suburban districts. Compared with the heterogeneity patterns in urban districts, we see the relationship between the magnitude of charter school effects reverse in suburban districts. Suburban districts with few black and Hispanic and low-income students tend to see the largest increases in segregation caused by charter school penetration. This is especially the case for white students in suburban districts with few black and Hispanic students,

for which we estimate that a 1 percentage-point increase in charter school enrollment share leads to a 0.19 percentage-point increase in segregation, almost double our main estimates of the average effect nationally.

TABLE 5

Treatment Effect Heterogeneity by District Baseline Characteristics

	Black or Hispanic share			Free and reduced-price lunch share		
	(1)	(2)	(3)	(4)	(5)	(6)
			Black			
Low	0.046***	0.033*	0.103***	0.061***	0.027***	0.149***
	(0.016)	(0.017)	(0.029)	(0.017)	(0.010)	(0.041)
Middle	0.082***	0.081*	0.178***	0.066***	0.055*	0.159***
	(0.021)	(0.044)	(0.041)	(0.018)	(0.029)	(0.042)
High	0.098***	0.095***	0.053	0.116***	0.125***	0.030
	(0.021)	(0.027)	(0.034)	(0.023)	(0.031)	(0.036)
District-year fixed effects	X	X	X	X	X	X
District-grade fixed effects	X	X	X	X	X	X
R^2	0.941	0.965	0.939	0.941	0.965	0.939
N	556,115	556,115	556,115	556,115	556,115	556,115
			Hispanic			
Low	0.017	-0.043	0.129**	0.042	0.008	0.113***
	(0.029)	(0.029)	(0.056)	(0.026)	(0.046)	(0.034)
Middle	0.049***	0.081**	0.078***	0.051***	0.079***	0.056**
	(0.014)	(0.032)	(0.024)	(0.012)	(0.022)	(0.026)
High	0.065***	0.075***	0.044**	0.060***	0.069***	0.040**
	(0.011)	(0.016)	(0.019)	(0.013)	(0.020)	(0.020)
District-year fixed effects	X	X	X	X	X	X
District-grade fixed effects	X	X	X	X	X	X
R^2	0.929	0.953	0.927	0.929	0.953	0.927
N	556,115	556,115	556,115	556,115	556,115	556,115
			White			
Low	0.036	-0.056**	0.194***	0.063**	0.009	0.188***
	(0.038)	(0.022)	(0.066)	(0.030)	(0.042)	(0.043)
Middle	0.079***	0.120**	0.160***	0.070***	0.084*	0.115***
	(0.021)	(0.050)	(0.037)	(0.022)	(0.045)	(0.042)
High	0.103***	0.122***	0.019	0.112***	0.142***	0.002
	(0.022)	(0.033)	(0.028)	(0.024)	(0.034)	(0.028)

	Black or Hispanic share			Free and reduced-price lunch share		
	(1)	(2)	(3)	(4)	(5)	(6)
District-year fixed effects	X	X	X	X	X	X
District-grade fixed effects	X	X	X	X	X	X
R^2	0.910	0.935	0.898	0.910	0.935	0.898
N	556,115	556,115	556,115	556,115	556,115	556,115

Source: Authors' calculations using the National Center for Education Statistics' Common Core of Data.

Notes: Standard errors are clustered at the school district level in all models. Covariates include log total enrollment, the black enrollment share, and the Hispanic enrollment share.

* $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$.

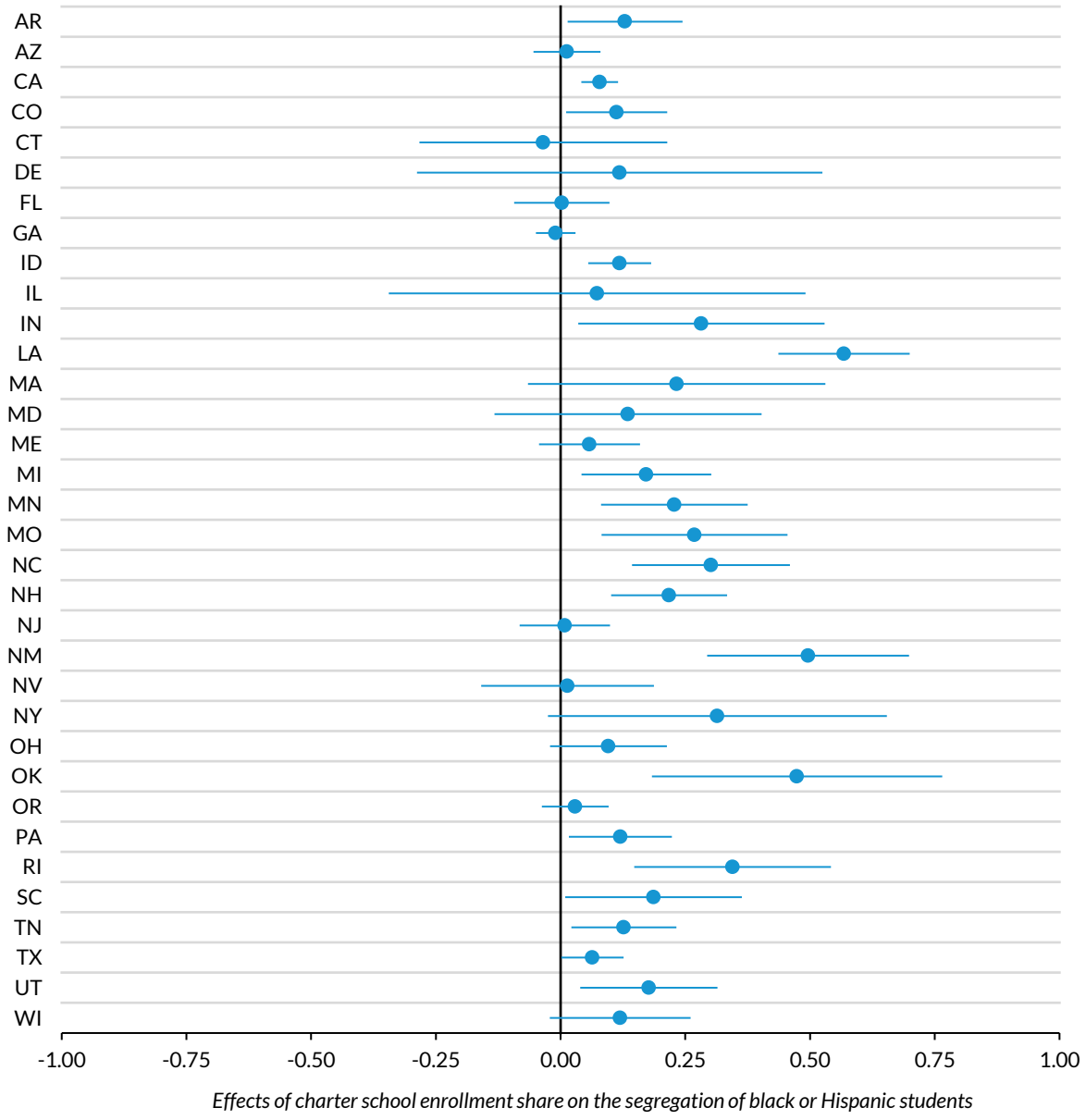
Previous studies have analyzed charter school effects on school segregation in particular cities or states and found mixed results, and some studies have found that charter schools increase or decrease segregation (Ritter et al. 2016). To test for the extent of such geographic heterogeneity in the effects of charter school penetration, we estimate models akin to our main empirical framework that interact the share of enrollment in charter schools with indicators for school district states. We specify the following model:

$$Y_{igt} = \sum_{s} \beta_s E_{igt} D_{s(i)} + X'_{igt}\Gamma + \tau_{ig} + \delta_{it} + \epsilon_{igt}$$

where all variables are defined as in the main equation and $D_{s(i)}$ is an indicator of the state the district is located in, with state-specific average treatment effects β_s indexed by s. State effects are interpreted directly, not relative to an omitted category. Our estimates of the state effects in this equation (and their confidence intervals) are reported in figure 3, which uses the segregation of black or Hispanic students as the outcome. We restrict the sample to states where at least 1 percent of public school enrollment was in a charter school at some point during the sample period, 1998–2015.

FIGURE 3

Charter School Effects on the School District Segregation of Black or Hispanic Students, by State



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Source: Authors' calculations using the National Center for Education Statistics' Common Core of Data.
Notes: Standard errors are clustered at the school district level. The estimation sample is restricted to states that have had at least 1 percent of total enrollment at charter schools at some point from 1998 to 2015. All models control for district-grade-year log enrollment and the black and Hispanic share of students.

In most states with charter schools, our point estimate of the effects of the charter school enrollment share is positive. Therefore, consistent with the results above, we find that in most states,

charter schools have increased segregation. States in which charter school effects on segregation are particularly severe include Louisiana, New Mexico, North Carolina, Oklahoma, and Rhode Island. But there is substantial heterogeneity in the magnitude of this estimate, and in many cases, it is statistically indistinguishable from zero. States for which we cannot reject that charter schools have no effect on segregation are Arizona, Florida, Illinois, Maryland, and New Jersey. Finally, for a couple states, our point estimates suggest that charter schools increased integration. Although none of these are statistically significant, charter schools increased school district integration in Connecticut and Georgia.

Robustness Checks

Our main identification strategy relies on a generalized difference-in-differences research design that measures changes in the charter school share of district-grade enrollment on changes in district-grade segregation. This method arguably identifies the causal effects of charter schools on segregation in the districts that see differing levels of charter school penetration at different grade levels over time. But unobserved factors could be simultaneously associated with charter school growth in particular grade levels and with corresponding increases in segregation. Though our method inherently addresses many potential confounding explanations, we test the validity of these assumptions with two informative robustness checks.

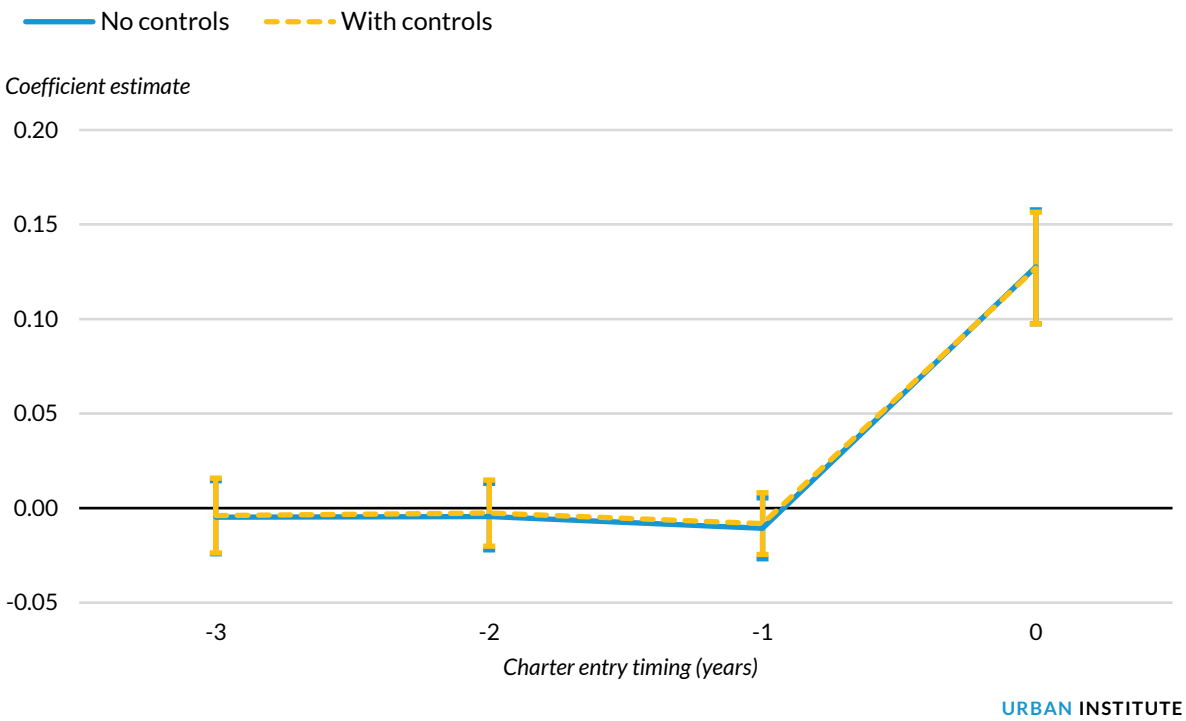
First, we test whether pre-trends in district segregation are correlated with charter school penetration in a given district-grade. We do so with the following distributed lag econometric specification:

$$Y_{igt} = \sum_{k=0}^{3} \beta_k E_{ig,t+k} + X'_{igt}\Gamma + \tau_{ig} + \delta_{it} + \epsilon_{igt}$$

Here, β_k captures the effect of k leads of charter school enrollment share, $E_{ig,t+k}$, on current segregation levels. In other words, it tests whether future increases in the share of students enrolled at charter schools are predictive of current levels of district segregation, which would threaten our identification assumption. Figure 4 shows that our estimates of this equation are consistent with a generalized parallel trends assumption. One-, two-, and three-year leads of the charter school share of enrollment are not significantly associated with contemporaneous levels of segregation. Only the contemporaneous share of enrollment in charter schools is positive and statistically significant, as one would expect if the parallel trends assumption holds.

FIGURE 4

Pre-trend Test on Charter School Entry, Distributed Lag Model



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Source: Authors' calculations using the National Center for Education Statistics' Common Core of Data.
Note: Standard errors are clustered at the district level.

Second, we conduct a placebo test exploiting the structure of our data at the district by grade by year level. This test is based on the notion that increases in the charter school enrollment share in, say, primary schools should not have a direct contemporaneous impact on the racial or ethnic segregation of high schools. We conduct this test by restructuring our data by grade, resulting in a district-year panel with segregation and charter school enrollment measured for different grade levels. We then estimate the following model:

$$Y_{it}^{G} = \beta_1 E_{it}^{K5} + \beta_2 E_{it}^{68} + \beta_3 E_{it}^{912} + X_{it}'\Gamma + \tau_i + \delta_{s(i)t} + \epsilon_{it}$$

where E_{it}^{G} is the charter school enrollment share for groups of school grades $G = K5, 68, 912$—that is, grades K through 5, grades 6 through 8, and grades 9 through 12. When estimating models of segregation from kindergarten through fifth grade, Y_{it}^{K5}, the test requires positive estimates of β_1 and null effects for both β_2 and β_3. The same logic applies to segregation measured at other grade levels.

Similar to our first robustness test, the results of the placebo test provide reasonably strong evidence that the relationships we have identified in our main models are well-identified causal

relationships (table 6). Across 18 coefficients, the results are significant in all 6 instances where we would expect a causal relationship to exist (e.g., primary school charter schools have an effect on primary school segregation). On the other hand, the charter school enrollment share in mismatched grade levels fails to reach significance in 10 instances (e.g., primary schools do not have an effect on middle or high school segregation). In the remaining 2 instances, our method fails the placebo test, but in those cases, the relationships are smaller in magnitude and the statistical relationship tends to be weaker than the actual measures expected to have a causal relationship. This is likely because of multicollinearity between the grade-aligned measure of charter school growth and other grade bands in the same school systems. For example, a charter school serving students in grades 5 through 12 does not fall cleanly into the categories below.

TABLE 6

Placebo Test: Charter School Effects on Segregation across Difference School Grade Levels

	Variance ratio index			Dissimilarity index		
	(1) K–5	(2) 6–8	(3) 9–12	(4) K–5	(5) 6–8	(6) 9–12
K–5 charter school share	0.08***	0.03	-0.01	0.12**	-0.01	0.02
	(0.03)	(0.03)	(0.03)	(0.05)	(0.04)	(0.06)
6–8 charter school share	-0.02	0.10***	-0.01	-0.03	0.20***	-0.03
	(0.04)	(0.03)	(0.04)	(0.05)	(0.05)	(0.06)
9–12 charter school share	0.03	0.04**	0.13**	0.08**	0.00	0.23***
	(0.02)	(0.02)	(0.05)	(0.03)	(0.03)	(0.06)
State-by-year fixed effects	X	X	X	X	X	X
District fixed effects	X	X	X	X	X	X
Covariates	X	X	X	X	X	X
R^2	0.92	0.90	0.88	0.89	0.88	0.88
N	8,751	8,743	8,737	8,751	8,743	8,737

Source: Authors' calculations using the National Center for Education Statistics' Common Core of Data.
Note: Standard errors are clustered at the district level.
** $p < 0.05$; *** $p < 0.01$.

Charter School Effects on Segregation at Varying Levels of Aggregation

That charter schools increase the segregation of schools within districts is especially important given that local school districts are the governing units with the most influence over student assignment polices. District officials have the most direct access to policy levers to address racial or ethnic segregation (e.g., setting school assignment policy). From a geographic perspective, however, charter schools are not constrained from enrolling students from multiple districts. Moreover, the bulk of

school segregation in the United States occurs between districts, not within districts (Clotfelter 1999; Owens, Reardon, and Jencks 2016; Whitehurst et al. 2017). Because charter schools often draw students from beyond the school district where they are geographically located, how we define the geographic school systems may influence our estimates.

To test this theory, table 7 redefines the data structure and examines charter school effects on segregation across four levels of aggregation: school districts (n = 4,574), incorporated cities and towns (census places) (n = 1,222), counties (n = 827), and metropolitan areas (n = 253). These analysis samples are determined by the same restrictions we use in the school district–level analysis. For ease of presentation, we present only fully controlled models with the variance ratio index as our measure of segregation, but these results hold if we use the dissimilarity index. The results in table 7 demonstrate that measuring segregation at different levels of geography matters for our estimates. For comparison, column 1 presents school district estimates for the same model in column 3 in table 4.

Looking at the level of incorporated cities and towns in column 2 provides the same qualitative takeaways, albeit with smaller estimates. The same goes for US counties in column 3. The coefficient in this model is similar to our school district estimates, likely driven by the fact that counties and school districts are coterminous across much of the South. Finally, column 4 tests for effects at the highest level of aggregation we use, metropolitan areas. The point estimate is positive but is only marginally statistically significant for black student segregation, not for black or Hispanic, Hispanic, or white segregation. The lack of significance is partly driven by issues of statistical power at this level (i.e., our clustering of standard errors means we are basing inference on a dataset of roughly 250 observations), but it might also be because of a different mechanism counteracting the segregative charter school effects at the metropolitan area level.[9]

TABLE 7

Charter School Segregation Effects at Different Levels of Geography

	School districts (1)	Cities and towns (2)	Counties (3)	Metro areas (4)
			Black or Hispanic	
Charter share	0.106***	0.055**	0.094***	0.029
	(0.016)	(0.023)	(0.023)	(0.032)
Dependent variable mean	8.06	15.76	17.25	26.15
Covariates	X	X	X	X
System-year fixed effects	X	X	X	X
System-grade fixed effects	X	X	X	X
R^2	0.930	0.954	0.975	0.985
N	556,115	172,677	137,442	50,375
			Black	
Charter share	0.085***	0.049***	0.077***	0.045*
	(0.013)	(0.014)	(0.024)	(0.026)
Dependent variable mean	5.86	11.41	12.39	19.54
Covariates	X	X	X	X
District-year fixed effects	X	X	X	X
District-grade fixed effects	X	X	X	X
R^2	0.941	0.968	0.975	0.990
N	556,115	556,115	556,115	556,115
			Hispanic	
Charter share	0.053***	0.036***	0.033***	0.017
	(0.010)	(0.011)	(0.011)	(0.025)
Dependent variable mean	4.97	10.49	9.35	12.43
Covariates	X	X	X	X
District-year fixed effects	X	X	X	X
District-grade fixed effects	X	X	X	X
R^2	0.929	0.956	0.965	0.978
N	556,115	556,115	556,115	556,115
			White	
Charter share	0.085***	0.052**	0.083***	0.006
	(0.015)	(0.025)	(0.025)	(0.030)
Dependent variable mean	7.92	16.87	17.06	25.85
Covariates	X	X	X	X
District-year fixed effects	X	X	X	X
District-grade fixed effects	X	X	X	X
R^2	0.910	0.951	0.962	0.980
N	556,115	556,115	556,115	556,115

Source: Authors' calculations using the National Center for Education Statistics' Common Core of Data.

Note: Standard errors are clustered at the school system level in all models.

* $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$.

One explanation for the failure of our models to detect effects at the metropolitan area level could be that charter schools have different simultaneous and counteracting effects on school segregation at

the metropolitan area level. In table 3, we detected evidence of charter school effects on districtwide racial or ethnic composition, which we interpret as preliminary evidence that as charter school enrollment shares increase, changes occur not only in within-district student stratification but also in which students are entering or leaving these school systems. We test this hypothesis by decomposing charter school effects on metropolitan area–level school segregation into two components: segregation within districts and segregation between districts.

We decompose metropolitan area segregation into within- and between-district components following the methodology introduced by Clotfelter (1999). The key to computing between-district segregation is to assume a counterfactual in which school districts are perfectly integrated, such that every school in the jurisdiction has a racial composition corresponding exactly to the districtwide composition. Computing metropolitan area segregation under this counterfactual focuses on differences in the compositions of entire districts, giving us a measure of the extent of racial or ethnic stratification between school districts in a metropolitan area. The difference between total metropolitan area segregation and between-district segregation is a measure of the component of total metropolitan area segregation that is caused by within-district segregation. We perform this decomposition for all metropolitan areas in our sample.

Table 8 presents our estimates of the effects of charter school enrollment share on each component of metropolitan area school segregation. Column 1 replicates the result on total metropolitan area segregation in column 4 of table 7, for reference. In this model, only the segregation of black students appears to increase significantly because of charter schools. Column 2 uses the within-district component as the dependent variable, for which we estimate a significant segregative charter school effect for every racial or ethnic group. This coefficient estimate is similar to our estimates in table 4. We interpret this as further corroboration of our main estimates, given that the models in tables 4 and 8 are estimated under different data structures. Column 3 presents estimates for the between-district component of metropolitan area segregation. This coefficient is negative and statistically significant for Hispanic and white segregation but not for black segregation. This suggests that charter schools cause slightly lower levels of the between-district component of metropolitan area segregation for certain groups.

TABLE 8

Decomposition of Metropolitan Area Effects into Within- and Between-District Segregation

	Total MA segregation (1)	Within-district segregation (2)	Between-district segregation (3)
		Black or Hispanic	
Charter share	0.029	0.108***	-0.079***
	(0.032)	(0.030)	(0.021)
Dependent variable mean	26.15	8.94	17.55
Covariates	X	X	X
System-year fixed effects	X	X	X
System-grade fixed effects	X	X	X
R^2	0.985	0.972	0.990
N	50,375	50,375	50,375
		Black	
Charter share	0.045*	0.055***	-0.026
	(0.026)	(0.019)	(0.019)
Dependent variable mean	19.54	6.69	11.99
Covariates	X	X	X
District-year fixed effects	X	X	X
District-grade fixed effects	X	X	X
R^2	0.990	0.981	0.993
N	50,375	50,375	50,375
		Hispanic	
Charter share	0.017	0.068***	-0.046***
	(0.025)	(0.026)	(0.010)
Dependent variable mean	12.43	5.33	6.44
Covariates	X	X	X
District-year fixed effects	X	X	X
District-grade fixed effects	X	X	X
R^2	0.978	0.965	0.984
N	50,375	50,375	50,375
		White	
Charter share	0.006	0.074**	-0.066***
	(0.030)	(0.030)	(0.020)
Dependent variable mean	25.85	8.62	17.87
Covariates	X	X	X
District-year fixed effects	X	X	X
District-grade fixed effects	X	X	X
R^2	0.980	0.963	0.987
N	50,375	50,375	50,375

Source: Authors' calculations using the National Center for Education Statistics' Common Core of Data.

Note: Standard errors are clustered at the school system level in all models.

* $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$.

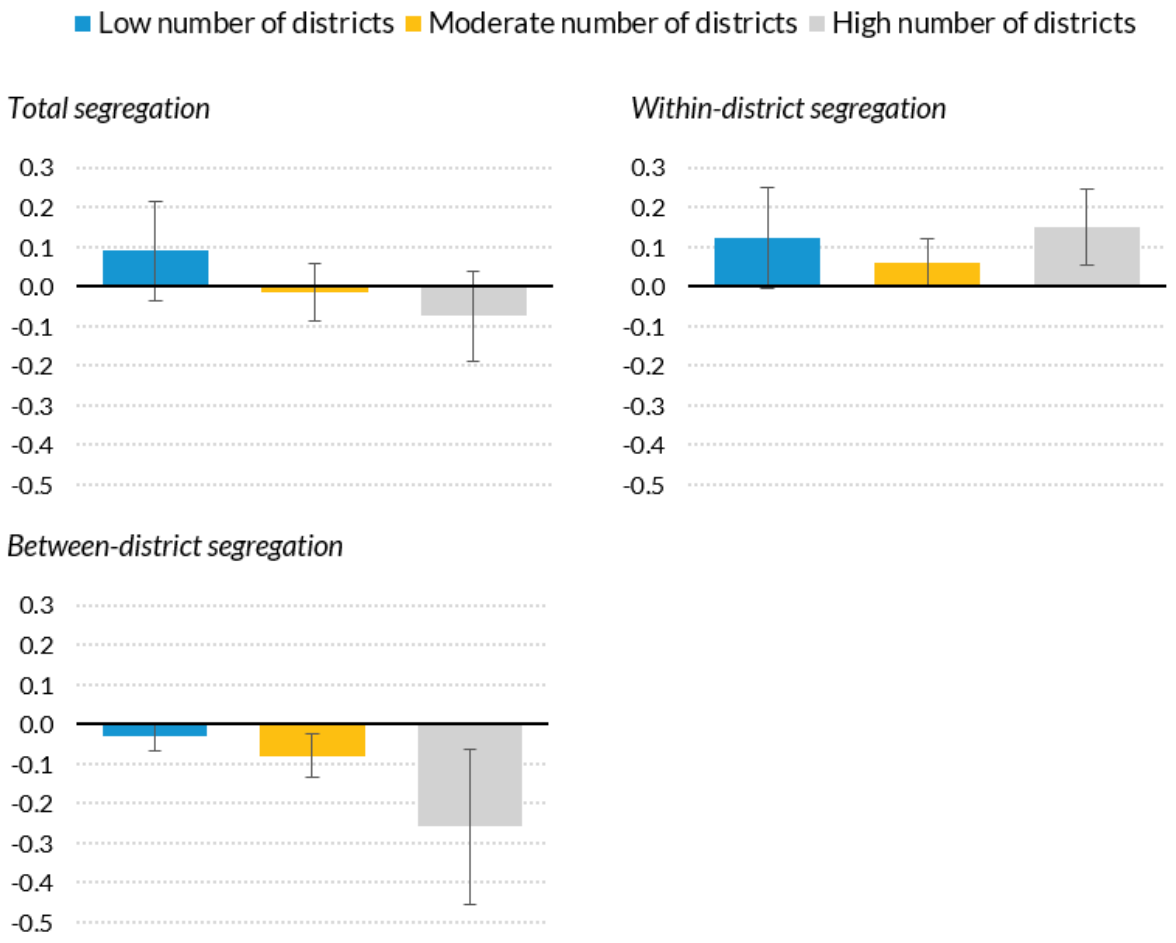
The results in table 8 suggest that charter schools have counteracting effects on segregation at the metropolitan area level. As established before, charter schools increase segregation inside school districts. On the other hand, they tend to diminish compositional imbalances between districts in the same metropolitan area. The effect on within-district segregation is larger and our estimate on total metropolitan area segregation is still positive, but we cannot reject that it is equal to zero given the large standard errors. One interpretation of these results is that charter schools echo the role of magnet schools during the era of court-ordered desegregation. Magnet schools were introduced to attract white families to schools within urban school districts in the hope of limiting white flight to suburban districts. Magnet schools were meant to sacrifice the within-district integration objective to limit the more severe problem of growing segregation between districts. Charter schools today appear to have this type of dual effect. Charter schools alleviate certain compositional imbalances across district lines, but this has not led to a net increase in school integration.

Our findings on counteracting charter school effects at the metropolitan area level motivate an additional heterogeneity analysis. First, prior research finds that citywide segregation tends to be higher in metropolitan areas that are fragmented into numerous smaller districts. To examine how this might affect our analysis, we break our results into three quantiles based on the total number of districts in a metropolitan area (figure 5). The first panel shows that point estimates for total metropolitan area segregation effects, while not significant, are positive in cities with fewer districts and are close to zero or negative in cities with high school district fragmentation. In contrast, effects for within-district segregation are positive and at least marginally statistically significant across the board. Interestingly, effects for the between-district component are consistently more negative and significant as the number of districts in the metropolitan area increases.

FIGURE 5

Within- and Between-District Effects by Number of Districts in the Metropolitan Area

Effect of charter school enrollment share



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Source: Authors' calculations using the National Center for Education Statistics' Common Core of Data.
Note: Standard errors are clustered at the metropolitan area level in all models.

One explanation for these findings is that metropolitan areas that are highly fragmented are those in which white animosity toward school integration was historically more intense. This would be consistent with higher white flight to suburban districts and more district secessions, which translate into a higher number of districts. If charter schools are bringing white students back to urban districts, but into white-isolated charter schools, this would lead to higher within-district segregation but lower between-district segregation.

Conclusion

Employing a generalized difference-in-differences identification strategy that controls for a wide range of observable and unobservable school system characteristics, we demonstrate that charter school growth from 1998 to 2015 has increased racial and ethnic segregation in schools. Our main estimates suggest that this effect is modest—eliminating charter schools in the average school district would decrease segregation 5 percent. We show that this effect is highly heterogenous across different types of school systems and by state, highlighting the importance of nuance in interpreting our main estimates. Moreover, our analysis suggests that charter schools reduce segregation between school districts in the same metropolitan area. But such rebalancing of district demographics has not translated into integration gains. These results are robust to several robustness tests and measurement choices.

Our analysis constitutes a compelling case for the notion that charter schools slightly increase racial and ethnic segregation, on average. But we do not take a normative stance on this result. If a family chooses a charter school because of the school's intention to serve the special needs of certain students and this leads to higher segregation levels, we cannot say such an increase in segregation is necessarily detrimental for academic outcomes. Simply put, segregation that takes place under such a school choice environment is fundamentally different from the forced school segregation that took place during the pre-*Brown* era of de jure segregation.

Although segregation by race or ethnicity is a salient and important topic in US public education, it is not the only important type of segregation. Policymakers and stakeholders are also rightly concerned about socioeconomic segregation, as well as segregation by disability status or English language learner status (Fiore et al. 2000; GAO 2012). Future work should similarly explore charter school effects on the distribution of these students in school systems.

Our analysis suggests that charter school providers should consider the potential problems introduced when families can compete for a public good and how relative advantages across families might manifest in increased stratification. One promising strategy comes from policies that centralize school choice options into common enrollment systems. Research suggests that areas that adopt common enrollment systems reduce the burden of choosing a school and increase the proportion of disadvantaged students entering charter schools (Winters 2015). To the extent that charter school effects on within-district segregation are related to parents' differential abilities to navigate charter

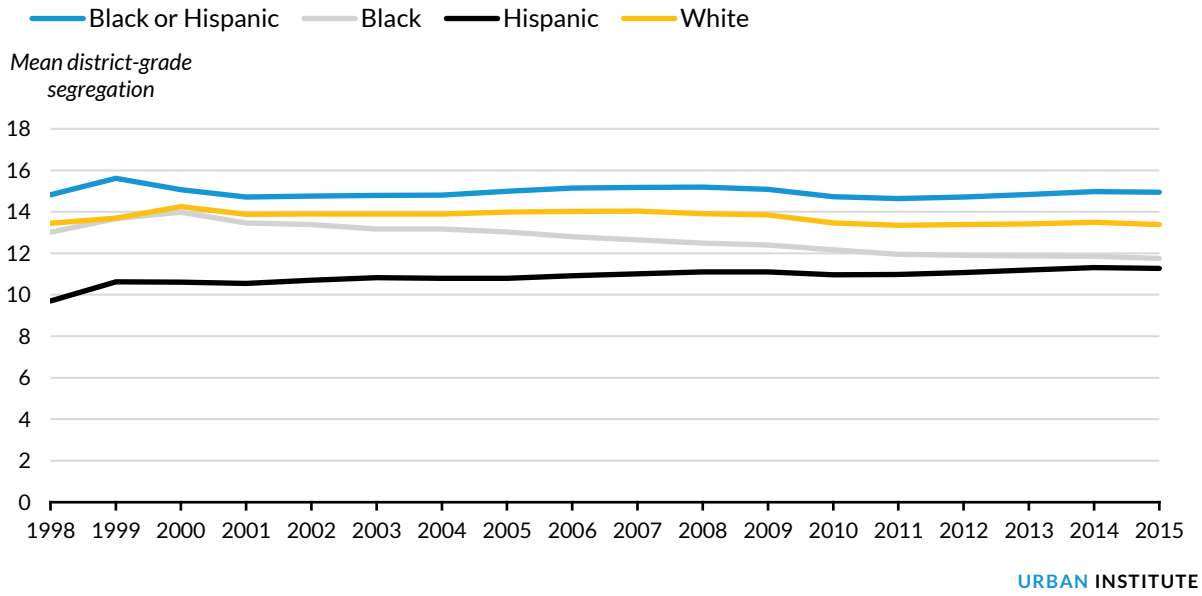
school options, common enrollment systems might ameliorate the problem. Related strategies include incorporating weights in common enrollment systems that increase diversity.[10]

Other promising strategies involve so-called diverse-by-design charter schools. Though only a few charter schools fall into this category, they represent a growing trend.[11] Because charter schools have broad freedom to target their recruitment strategies from broader geographic areas, such designs can use charter schools as agents for integration. Although research has yet to evaluate the effectiveness of such policies, strategies to encourage diversity, such as weighted admissions lotteries and targeted recruitment efforts, show promise. In some areas, such as San Antonio, a holistic approach that includes district charter schools, magnet schools, and traditional public schools is being pursued that not only incorporates common enrollment systems and weighted admissions lotteries but strategically locating new schools of choice and increased funding for transportation.[12] Time will tell if the right design features can fulfill the promise of school choice as an agent of integration.

Appendix

FIGURE A.1

Trends in Segregation (Variance Ratio Index) for Varying Racial and Ethnic Groups



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Source: Authors' calculations using National Center for Education Statistics' Common Core of Data.
Note: Observations are weighted by enrollment.

TABLE A.1

Robustness to Parametrization of Treatment Variable

	Segregation of black or Hispanic students		
	(1)	**(2)**	**(3)**
Charter share of enrollment	0.106***		
	(0.016)		
Charter share of schools		0.035***	
		(0.006)	
Number of charter schools			0.105*
			(0.057)
Log population	-0.261	-0.286	-0.241
	(0.189)	(0.189)	(0.190)
Black share (%)	0.079***	0.078***	0.079***
	(0.023)	(0.024)	(0.024)
Hispanic share (%)	0.006	0.004	0.005
	(0.012)	(0.012)	(0.012)
Constant	8.259***	8.529***	8.316***
	(1.516)	(1.517)	(1.521)
District-year fixed effects	X	X	X
District-grade fixed effects	X	X	X
R^2	0.930	0.930	0.930
N	556,115	556,115	556,115

Source: Authors' calculations using National Center for Education Statistics' Common Core of Data.

Note: Standard errors are clustered at the school district level in all models.

* $p < 0.1$; *** $p < 0.01$.

TABLE A.2

Robustness to Controls for a Different Set of Covariates

	Variance ratio index			Dissimilarity index		
	(1)	(2)	(3)	(4)	(5)	(6)
			Black or Hispanic			
Charter share	0.1056***	0.1061***	0.0869***	0.1442***	0.1395***	0.1078***
	(0.0160)	(0.0160)	(0.0149)	(0.0206)	(0.0206)	(0.0190)
Demographic covariates		X	X		X	X
Number of schools covariates			X			X
District-year fixed effects	X	X	X	X	X	X
District-grade fixed effects	X	X	X	X	X	X
R^2	0.930	0.930	0.931	0.826	0.826	0.827
N	556,115	556,115	556,115	556,115	556,115	556,115
			Black			
Charter share	0.0846***	0.0846***	0.0682***	0.1813***	0.1809***	0.1425***
	(0.0130)	(0.0132)	(0.0122)	(0.0204)	(0.0206)	(0.0189)
Demographic covariates		X	X		X	X
Number of schools covariates			X			X
District-year fixed effects	X	X	X	X	X	X
District-grade fixed effects	X	X	X	X	X	X
R^2	0.940	0.941	0.942	0.754	0.756	0.757
N	556,115	556,115	556,115	556,115	556,115	556,115
			Hispanic			
Charter share	0.0498***	0.0526***	0.0412***	0.1100	0.0985***	0.0601***
	(0.0096)	(0.0096)	(0.0093)	(0.0191)	(0.0200)	(0.0181)
Demographic covariates		X	X		X	X
Number of schools covariates			X			X
District-year fixed effects	X	X	X	X	X	X
District-grade fixed effects	X	X	X	X	X	X
R^2	0.928	0.929	0.930	0.751	0.753	0.754
N	556,115	556,115	556,115	556,115	556,115	556,115

	Variance ratio index			Dissimilarity index		
	(1)	(2)	(3)	(4)	(5)	(6)
	White					
Charter share	0.0853***	0.0851***	0.0689***	0.1425***	0.1401***	0.1121***
	(0.0155)	(0.0153)	(0.0146)	(0.0208)	(0.0205)	(0.0192)
Demographic covariates		X	X		X	X
Number of schools covariates			X			X
District-year fixed effects	X	X	X	X	X	X
District-grade fixed effects	X	X	X	X	X	X
R^2	0.909	0.910	0.911	0.850	0.850	0.851
N	556,115	556,115	556,115	556,115	556,115	556,115

Source: Authors' calculations using the National Center for Education Statistics' Common Core of Data.

Notes: Standard errors are clustered at the school district level in all models. Demographic covariates include log total enrollment and the black and Hispanic enrollment share. Number of schools covariate is a quartic polynomial in the number of schools serving a district-grade-year.

*** $p < 0.01$.

Notes

[1] Ivan Moreno, "US Charter Schools Put Growing Numbers in Racial Isolation," *Associated Press*, December 3, 2017, https://www.apnews.com/e9c25534dfd44851a5e56bd57454b4f5.

[2] Laura Fay, "Education Reform Groups Decry Associated Press Analysis of Charter School Segregation," The 74, December 6, 2017, https://www.the74million.org/education-reform-groups-decry-associated-press-analysis-of-charter-school-segregation/.

[3] Tim Walker, "Racial Isolation of Charter School Students Exacerbating Resegregation," *NEA Today*, May 4, 2018, http://neatoday.org/2018/05/04/racial-segregation-in-charter-schools/.

[4] Fay, "Education Reform Groups"; and Robin Lake, "In a Deeply Flawed 'Analysis,' the Associated Press Blames Public Charter Schools for America's Segregated Cities," The 74, December 4, 2017, https://www.the74million.org/article/lake-in-a-deeply-flawed-analysis-the-associated-press-blames-public-charter-schools-for-americas-segregated-cities/.

[5] See also Tomas Monarrez, "Segregated Neighborhoods, Segregated Schools?" Urban Institute, accessed June 20, 2019, https://www.urban.org/features/segregated-neighborhoods-segregated-schools.

[6] See also Fred Harris and Alan Curtis, "The Unmet Promise of Equality," *New York Times*, February 28, 2018, https://www.nytimes.com/interactive/2018/02/28/opinion/the-unmet-promise-of-equality.html; and Brian Kisida and Olivia Piontek, "Is School Segregation Really Getting Worse?" *EducationNext*, May 22, 2019, https://www.educationnext.org/is-school-segregation-really-getting-worse/.

[7] Appendix figure 1 presents trends in the segregation of school districts for each the following groups of students: black or Hispanic, black, Hispanic, and white.

[8] In the appendix, we present robustness checks using other treatment parameters, namely the share of schools that are charter schools and the simple count of charter schools in a school system.

[9] In appendix figure 2, we provide pre-trend tests for each of these levels of aggregation. We find no indication that there are pre-trends in segregation correlated with charter entry timing.

[10] Beth Hawkins, "78207: America's Most Radical School Integration Experiment," The 74, September 25, 2018, https://www.the74million.org/article/78207-americas-most-radical-school-integration-experiment/; and Beth Hawkins, "The Architect: How One Texas Innovation Officer Is Rethinking School Integration," The 74, September 25, 2018, https://www.the74million.org/article/the-architect-how-one-texas-innovation-officer-is-rethinking-school-integration/.

[11] Halley Potter and Kimberly Quick, "Diverse-by-Design Charter Schools," The Century Foundation, May 15, 2018, https://tcf.org/content/report/diverse-design-charter-schools/?agreed=1.

[12] Hawkins, "78207"; and Hawkins "The Architect."

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