

The Impact of Middle School Integration Efforts on Segregation in Two New York City Districts

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Executive Summary

New York State has one of the most diverse and segregated school systems in the country. The state is diverse because its students hail from a wide variety of racial, ethnic, and economic backgrounds. It is segregated because students of different backgrounds generally attend different schools. The state's diversity, however, gives it the *potential* to integrate its schools. This is particularly true when students of different backgrounds live relatively close to one another, as is frequently the case in the state's largest municipality: New York City.

To address segregation, both the state, the city, and local school districts have developed a number of integration plans over the past few years. Among the earliest were middle school integration plans in two of the most segregated community school districts in New York City: District 3 in Manhattan and District 15 in Brooklyn. Both school districts adopted controlled choice programs to prioritize economically disadvantaged students for admission into sixth grade in 2019-20. In this study, we evaluate the impact of both integration initiatives on segregation.

Key findings include:

- In District 15, economic segregation in sixth grade decreased by 55% and racial segregation decreased by 38%; these results are both large and statistically significant, and are robust to various alternative specifications
- In District 3, economic segregation in sixth grade decreased by 8% and racial segregation decreased by 5%; these changes are not statistically significant and are within the bounds of normal year-to-year fluctuations
- While the broad contours of the districts' plans were similar, two key differences appear likely to explain the divergent results. First, District 15 dropped academic screens from all middle schools, while District 3 retained them. Second, District 15 set more aggressive targets, prioritizing economically disadvantaged students for 52% of sixth grade seats, compared to 25% in District 3

Two broad conclusions emerge from this study. First, integration is possible. The results in District 15 show that a carefully designed and implemented integration plan can lead to a significant reduction in segregation, at least in the short term. Second, the details matter. While District 3's plan seems similar to District 15's on the surface – both implemented a controlled-choice plan to prioritize economically disadvantaged students for admission into middle school in 2019-20 – variations in the design led to very different results.

While the results in District 3 and 15 are important, these two districts enroll less than 2% of the public school students in New York State. To assist other districts that decide to design, implement, and track their own integration programs, we have developed the website IntegrateNY.org. This website provides a dashboard for every school district in New York State with data and trends on enrollment, demographics, and segregation.

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About MarGrady Research

MarGrady Research helps education leaders make better decisions to improve the lives of students. We do this through rigorous analysis of data, clear and insightful presentation of results, and the development of lasting partnerships with the school districts, foundations, and other education organizations we work with. Read more at www.margrady.com.

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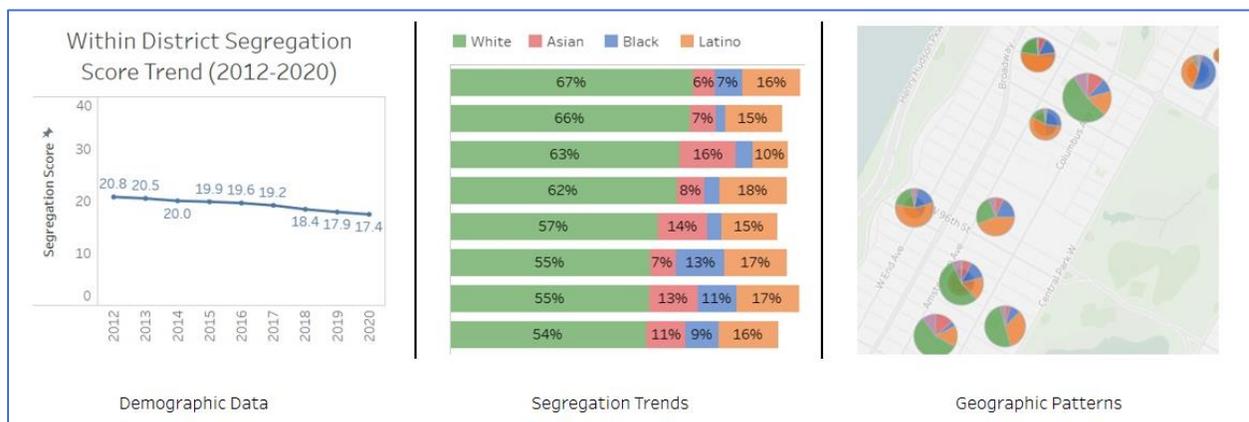
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Integration Dashboards

To support districts in monitoring segregation and developing plans to promote integration, MarGrady Research, along with partners NYSED and the Center for Public Research and Leadership at Columbia University, has developed dashboards to visually display enrollment, demographic, and segregation data for the state’s 724 school districts and 62 counties.

<http://IntegrateNY.org/>



Introduction

The decades since the Supreme Court’s landmark 1954 ruling in *Brown v. Board of Education*, which declared that separate schools were “inherently unequal,” have brought on a series of policies aimed at integrating schools across the country. Although many states and school districts resisted change for several years, Congressional passage of civil rights legislation and subsequent court decisions expanding district-level desegregation policies led to peak levels of within-district integration by the mid-1970s (Reardon & Owens, 2014).

In the last thirty years, however, the majority of districts that were under court-ordered desegregation plans were released from court oversight, ending an era of busing and race-based admission policies (Reardon, Grewal, Kalogrides & Greenberg, 2012). Some scholars argue that the result of the changing legal tide has been a “resegregation” of the public school system (Orfield & Lee, 2007). In practice, many school districts returned to neighborhood-based student assignment plans, which were largely shaped by the increasing socioeconomic stratification of cities, or implemented other school choice policies that intensified racial and socioeconomic disparities rather than alleviating them (Reardon, Grewal, Kalogrides & Greenberg, 2012).

This resurgence of public school segregation may have important negative implications for a wide array of outcomes. A long line of research has found that racial integration increases educational achievement,

educational attainment, and long-term earnings amongst Black students (Billings, Deming & Rockoff, 2014; Guryan, 2004; Johnson, 2011). Other studies have found positive health and behavior outcomes amongst students who attend racially diverse schools (Johnson, 2011; Weiner, Lutz & Ludwig, 2009). More recent research has also found that socioeconomic integration not only has the potential to increase racial diversity (Reardon & Rhodes, 2011), but is important in its own right for improving educational outcomes (Kahlenberg, 2012).

By some measures, New York State has the most segregated schools in the country (Kucera & Orfield, 2014). While much school segregation in New York occurs *between* school district boundaries, a significant portion occurs *within* individual districts. This is particularly true within the state’s largest school district – New York City – and the 32 sub-districts (known as Community School Districts) that comprise it. While the New York City public schools enroll over one million racially, ethnically, and socioeconomically diverse students, few schools reflect the diversity of the city (Mader & Costa, 2017). As in many other districts, the distribution of students in New York City Department of Education (NYCDOE) schools have been largely influenced by housing patterns. The high level of educational segregation in New York City reflects the high level of residential segregation.

Moreover, research has found that New York City’s school choice policies may be exacerbating segregation across the city (Mader et al, 2018). Nearly one out of five NYCDOE middle school students attends an academically screened school that considers

factors such as attendance, behavior, grades, and test scores for admissions (Hemphill, Mader, Quiroz & Zingmond, 2019). The result is that the top screened middle schools, which often feed the city's top high schools, admit a higher proportion of White, Asian, and high-income students, creating what has been referred to as a "segregation pipeline" (*The Hechinger Report*, 2018). According to one analysis, 41% of NYCDOE schools did not reflect the demographics of their Community School District in 2018-19 (Hornick-Becker, Mullan & Drobnjak, 2020).

In recent years, both the city and state have initiated efforts to decrease segregation in New York City. The NYCDOE started the Diversity in Admissions pilot project in 2016, released a citywide diversity plan in 2017, and launched the School Diversity Advisory Group (SDAG), which released two sets of recommendations in 2019. The New York State Education Department (NYSED) has provided millions of dollars in grants to help districts develop integration plans, first through the Socioeconomic Integration Pilot Program (SIPP) announced in 2014 and more recently through the New York State Integration Project – Professional Learning Community (NYSIP-PLC) announced in 2018.¹

Two school districts at the vanguard of integration efforts have been New York City's Community School District 3 in Manhattan and Community School District 15 in Brooklyn. These districts are among the most racially and economically diverse of New York City's 32 community school districts. They are also among the most

segregated, according to various measures described below. Through local efforts – supported by the city and the state – Districts 3 and 15 developed two of the state's first district-wide integration plans. Both districts used a "controlled choice" admissions process to integrate middle schools beginning with students entering sixth grade in the 2019-20 school year, and both districts chose to focus primarily on economic integration.

However, details of the integration plans in Districts 3 and 15 varied in several important ways. First, the District 3 admissions process prioritized students who were low-income and low-achieving, while the District 15 process prioritized students who were low-income or English Language Learners (ELLs). Second, despite similar levels of poverty in both districts, District 15 set significantly more ambitious targets, prioritizing disadvantaged students for 52% of sixth grade seats, compared to 25% of seats in District 3. Finally, District 15 chose to remove academic screens from all middle schools, whereas schools in District 3 retained them.

As we show in this study, the integration efforts in Districts 3 and 15 had a dramatically different impact on sixth grade segregation in 2019-20, the first year in which incoming middle schoolers had been admitted through the new process. In District 15, economic segregation in sixth grade decreased by 55% and racial segregation decreased by 38% compared to the prior year, results that were both meaningful and statistically significant. In District 3, economic segregation in sixth

¹ <http://www.nysed.gov/news/2015/nys-schools-receive-grants-promote-socioeconomic-integration>

<http://www.p12.nysed.gov/funding/2018-title-1-nysip-plc/home.html>

grade decreased by 8% and racial segregation decreased by 5%, changes that were well within the bounds of normal year-to-year fluctuations. While it appears likely that District 15’s policy changes led to a significant decrease in 6th grade segregation, there is no evidence that District 3’s changes had a substantial impact.

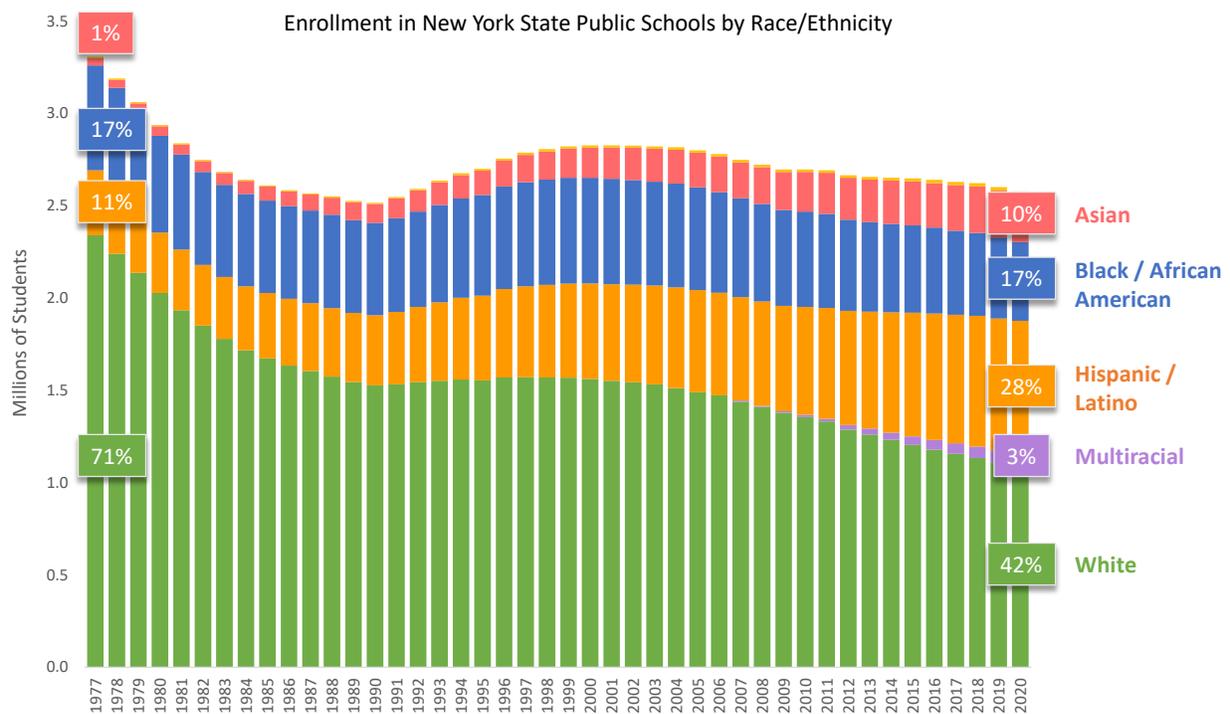
Segregation in New York

New York State has become more racially diverse over time. As shown in Figure 1, between 1977 and 2020, the share of public school students in the state who are White has declined from 71% to 42%. During that time, the share of students who identify as Hispanic or Latino more than doubled, to 28%, while the share of Asian students

increased from 1% to 10%. By at least one measure, New York State has the most racially diverse student body of any state in the country. As shown in Figure A1 in the appendix, if one randomly selects two public school students in New York State, there is a 71% chance they will belong to a different racial or ethnic group, the highest probability among all 50 states.

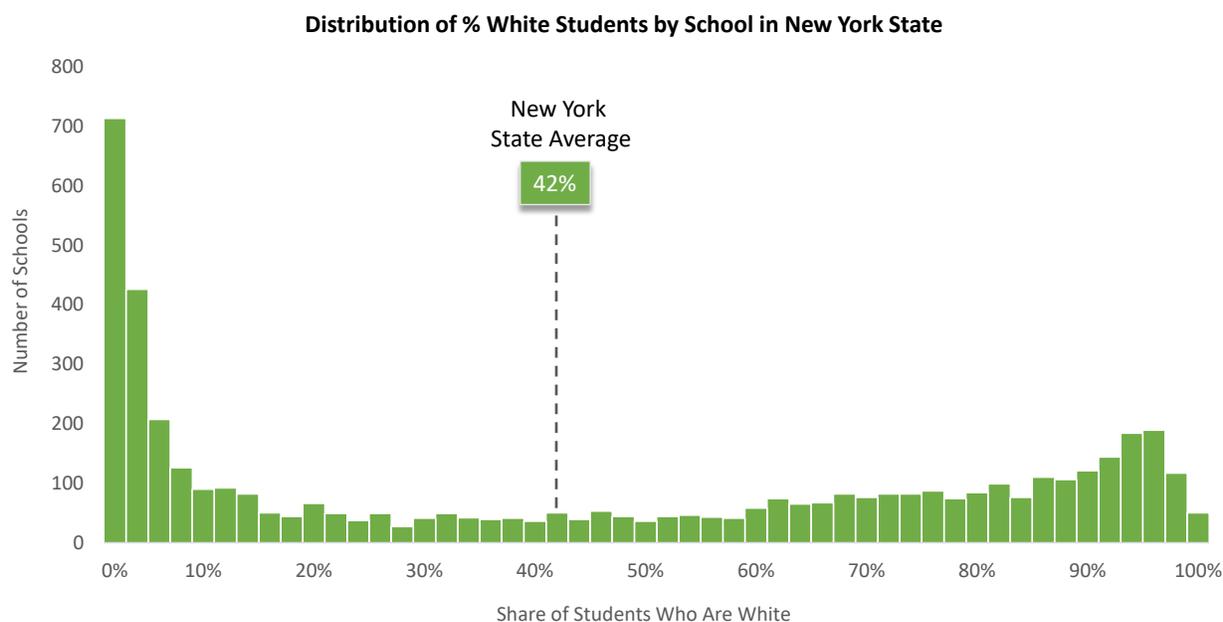
While diverse, New York’s schools are also highly segregated. For example, though 42% of public school students in the state are White, few schools reflect the state average. As shown in Figure 2, the distribution of White students across New York’s schools is the opposite of a bell curve. Rather than cluster around the state average, most schools either have a significantly higher or lower proportion of White students. While

Figure 1 – New York State’s public school student body has become more diverse over time.



Source: NYSED. Note: K-12 enrollment.

Figure 2 – New York’s school system is highly segregated, with few schools reflecting the state average.



Source: NYSED enrollment data. Note: K-12 enrollment.

across the state, 42% of public school students are White, only 5% of schools, enrolling 161 thousand students, have a share of White students within five percentage points of the state’s overall share (from 37% to 47% White). By contrast, 14% of schools in the state, enrolling 262 thousand students, have a student population that is more than 90% White. And, 33% of schools in the state, enrolling 784 thousand students, have a student population that is less than 10% White.

In 2014, the UCLA Civil Rights Project published a report that identified New York as the most segregated state in the country (Kucera & Orfield, 2014). The authors wrote:

New York has the most segregated schools in the country: in 2009, black and

Latino students in the state had the highest concentration in intensely-segregated public schools (less than 10% white enrollment), the lowest exposure to white students, and the most uneven distribution with White students across schools. Heavily impacting these state rankings is New York City, home to the largest and one of the most segregated public school systems in the nation (p. vi)

The UCLA report was scathing in its criticism of New York and appears to have been influential. At least partly in response, both the state and the city launched significant efforts to combat school segregation. Given federal restrictions on using race in school admissions, these efforts often focused on economic

integration, both as a proxy for race and a worthwhile objective in its own right (see Kahlenberg, 2012, for a summary of the benefits of socioeconomic integration).

The state's first initiative to promote integration, announced in December of 2014, was known as the Socioeconomic Integration Pilot Program (SIPP). Through this program, NYSED made grants of up to \$1.25 million to schools during the 2015-16 to 2017-18 school years to plan and implement economic integration pilots. These grants were provided to schools in ten districts, including New York City's Community School District 1, which used the funds to help develop its district-wide Diversity in Admissions plan for pre-K and kindergarten admissions in 2018-19. While we are aware of no formal evaluation of the SIPP program, NYSED concluded in 2018 that "The SIPP program demonstrated that districts need greater support to be successful."²

In 2018, NYSED launched a new program to provide districts with greater support. That program, known as the New York State Integration Program – Professional Learning Community (NYSIP-PLC), provided grants and professional development to 23 of the most segregated school districts across New York State, including 14 community school districts in New York City. These grants – which are ongoing in 2020 – are meant to help districts develop, pilot, and begin to implement integration plans. The measure of segregation used in this study grew out of an effort to provide NYSIP-PLC districts with a

simple metric to assess their current status and track progress toward their goals.

In recent years, the NYCDOE has also actively supported school integration efforts across New York City. In 2016, the NYCDOE rolled out a pilot project called the Diversity in Admissions initiative, in which participating schools gave priority for a proportion of their seats to particular groups of students, such as low-income students or English Language Learners (ELLs). The pilot grew from seven schools in the fall of 2016 to 42 schools by the fall of 2018, and nearly 90 by the spring of 2020. However, initial findings about the program's efficacy have been mixed, in part due to significant variation in schools' strategies and targets. According to one study, schools that aimed to increase their share of low-income students or ELLs were generally successful, but there was no statistically significant change the racial distribution across the pilot schools, and the long-term impacts have yet to be measured (Mader, Kramer & Butel, 2018).

In 2017, the NYCDOE released a city-wide plan, "Equity and Excellence for All: Diversity in New York City Public Schools." This plan set citywide improvement targets to increase the number of "racially representative" schools (defined as those where 50-90% of students are Black or Hispanic), decrease the number of "economically stratified" schools (defined as those with an Economic Need Index 10 percentage points from the citywide average), and increase the number of "inclusive" schools that have a

² <http://www.nysed.gov/news/2018/new-york-state-education-department-announces-14-million-grants-available-support-school>

representative number of Students with Disabilities and students who speak a language other than English at home. Some critics found the plan underwhelming, and researchers showed how many of the plan's targets were likely to be met by citywide demographic changes, even absent policy changes to promote school diversity (Mader & Costa, 2017).

After releasing its plan, the NYCDOE formed a citywide School Diversity Advisory Group (SDAG) to develop more detailed recommendations. In 2019, the SDAG released two reports containing a number of recommendations to promote greater integration in the city. Among other recommendations, the reports suggested that in the short and medium terms, student populations in elementary and middle schools should be compared to their community school district average, while student populations in high schools should be compared to their borough average. The reports also recommended gifted & talented programs be eliminated, that racial representation consider all races, and that all nine districts with "sufficient demographic diversity of population to develop integration plans" – including Districts 1, 2, 3, 13, 15, 22, 27, 28, and 31 – be required to do so.

Two of these districts – Districts 3 and 15 – are among the farthest along in implementing their integration plans. Like the state and the city, both districts have highly diverse yet segregated school systems. In advance of the 2019-20 school year, both districts changed their middle school admissions policies to promote integration.

New York City's District 3 and District 15

While the NYCDOE is one school system, New York City is divided into 32 community school districts for certain administrative functions. The community school districts have become less important since control of the city's schools were centralized under New York City's mayor in 2002, yet they retain relevance, particularly for elementary and middle school students. Each district has an appointed Community Education Council that is empowered with some functions of a local school board, including the ability to veto changes to school zone lines proposed by the NYCDOE. Additionally, choice processes in grades K-8 are generally run at the district level and most elementary and middle schools prioritize students from their local district.

New York City's District 3 is located in Manhattan and includes the neighborhoods of the Upper West Side, Morningside Heights, and a portion of Harlem below 122nd street. District 15 is in Brooklyn and includes the neighborhoods of Park Slope, Winsor Terrace, Red Hook, and Sunset Park, among others. As shown in Figure 3, both districts are racially and economically diverse, reflecting the diversity of both New York City and New York State. Both districts have a sizable share of students in each major racial or ethnic group, though District 3 has a lower share of Asian students and District 15 has a lower share of Black students than the city or the state. With roughly 50% of students in each district qualifying as economically disadvantaged, Districts 3 and 15 are more affluent than New York City overall, where

Figure 3 – Like the city and state, Districts 3 and 15 are racially and economically diverse.

	District 3	District 15	New York City	New York State
Schools	41	46	1,968	4,856
District Schools	32	37	1,663	4,500
Charter Schools	9	9	305	356
Students	16,357	25,949	1,033,290	2,577,765
% American Indian	0.6	0.4	1.1	0.7
% Asian or Pacific Islander	6.7	17.3	16.4	9.9
% Black or African American	27.9	9.0	25.2	16.5
% Hispanic or Latino	30.0	35.8	41.0	28.1
% Multiracial	4.4	3.9	1.6	2.7
% White	30.3	33.6	14.8	42.0
% Economically Disadvantaged	48.8	52.6	73.7	55.6
% Students with Disabilities	21.2	20.4	21.5	17.4
% English Language Learners	5.6	14.7	13.4	8.9

Source: NYSED enrollment data. Note: All data as of the 2019-20 school year. District 3 and District 15 data include K-8 enrollment only; New York City and New York State data include K-12 enrollment. Charter school students are included in their geographic district.

nearly 74% of students are considered economically disadvantaged.

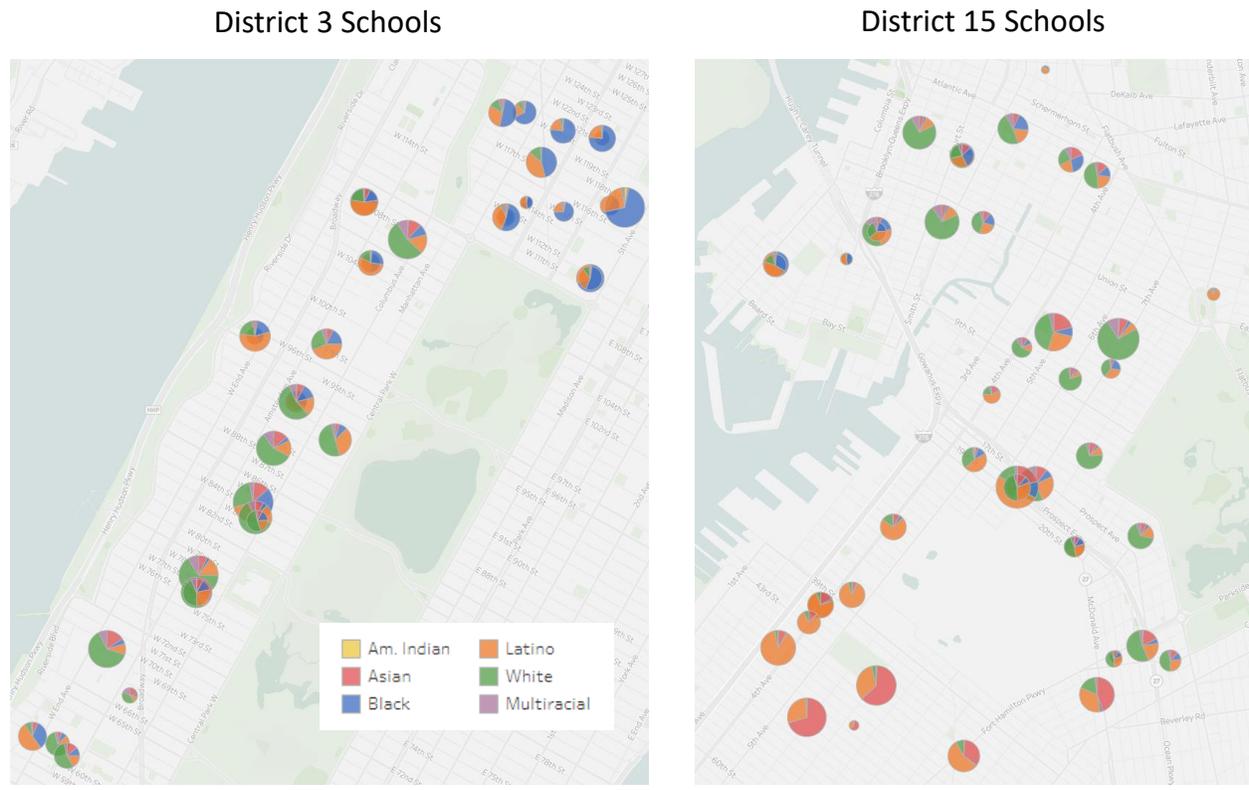
There is a significant geographic component to segregation in both districts, as shown in Figure 4. These maps show the distribution of students by race in all elementary and middle schools in the 2019-20 school year. In District 3, most of schools on the Upper West Side – particularly those below 96th street – are majority White with a substantial minority of students from other racial or ethnic groups. Most of the schools in Harlem are majority Black, with a substantial minority of Hispanic/Latino students and few White or Asian students. In District 15, the northern areas of the district – including the neighborhoods of Carroll Gardens, Park Slope, and parts of Windsor Terrace – have many schools that are majority White, in some cases more notably so than in District 3. The southern part of the district, including South Park Slope and

Sunset Park, have many schools that are majority Asian or Hispanic/Latino, with few White or Black students.

Perhaps due to the geographic nature of segregation in both districts, District 3 and District 15 chose to focus their initial integration efforts on middle school students who can travel more independently on public transportation. Both districts had existing middle school choice processes that were changed in 2018-19, so the class of sixth graders who started middle school in 2019-20 were the first to be impacted. Despite these surface-level similarities, the details of the two districts’ plans differed greatly.

For its integration plan, District 3 revised its middle school admissions system to prioritize 25% of sixth grade seats for students from low-income families with low academic performance. Students were

Figure 4 – There is a significant geographic component to segregation in Districts 3 and 15.



Source: NYSED enrollment data. Note: Each pie chart represents a school with the size of the pie chart proportional to the enrollment of the school and the colors representing enrollment by race/ethnicity. The figure includes only elementary and middle school students.

considered to be low-income if they met the income-threshold to qualify for free or reduced-price lunch (FRPL). Low performance was defined based on a performance index that gave 30% weight to ELA course grades, 30% weight to math course grades, 20% weight to NYS ELA test scores, and 20% weight to NYS math test scores. Low-income students were divided into two groups based on the performance index. Ten percent of seats were reserved for the lowest-performing FRPL students and 15% of seats were reserved for the next lowest-performing group of FRPL students.

The remaining 75% of seats were available to all students. Importantly, 16 of the 19 non-charter middle schools in District 3 had academic screens – where schools selected students based on prior grades, test scores, and other factors – and all 16 of the schools with screens retained them.³

District 15’s plan differed from District’s 3’s plan in several important respects. First, rather than targeting students with low academic performance, District 15 prioritized seats for students who were low-

³ These 19 schools include all schools in District 3 with a sixth grade, including traditional middle schools, K-8 schools, and 6-12 schools. There are also six charter schools in District 3 that have sixth

graders enrolled. All charter schools admit students by lottery, though not all accept students in sixth grade (some K-8 charters only admit students in grades K-4).

Figure 5 – While the integration plans in District 3 and District 15 both targeted rising sixth graders, they differed in several important details.

District 3 (Manhattan)	District 15 (Brooklyn)
<ul style="list-style-type: none"> Revised matching algorithm for rising 6th graders Prioritized 25% of seats for students from low-income families with lower academic performance Maintained screening at all middle schools that had it previously 	<ul style="list-style-type: none"> Revised matching algorithm for rising 6th graders Prioritized 52% of seats for students who qualify as low-income, are English Language Learners (ELLs) and/or are Students in Temporary Housing Removed screening from all middle schools

District 3 source: <https://www.schools.nyc.gov/about-us/news/announcements/contentdetails/2018/06/20/chancellor-carranza-announces-district-3-middle-school-diversity-plan>. District 15 source: http://d15diversityplan.com/wp-content/uploads/2019/06/190620_D15DiversityPlan_FinalReport.pdf

income, English Language Learners, or students in temporary housing. Second, District 15 set significantly more ambitious targets, prioritizing economically disadvantaged students for 52% of sixth grade seats, as opposed to 25% in District 3. Finally, District 15 removed academic screens from all middle schools in the district.

Measuring Segregation

Over the years, researchers have identified at least twenty different indices of segregation across five key dimensions: evenness, exposure, concentration, centralization, and clustering (Massey & Denton, 1988). According to this literature, the District 3 and District 15 integration goals pertain to evenness, or the equal distribution of groups across units of a population. There are many common measures of the evenness of a distribution,

including the dissimilarity index and Thiel’s H, which we describe in Appendix B.

To measure segregation for the NYSIP project, we collaborated with NYSED and CPRL to develop a simple, intuitive measure of unevenness – the mean absolute percentage point difference – which we use in this study. This measure of segregation, described below, is easy to calculate and can be applied identically to multiple levels of segregation (e.g. between-district, within-district, within-school) and to measures with two or more groupings (e.g. multiple races). For simplicity, we refer to this measure as the segregation index. In Appendix B, we show why the segregation index may be more useful and policy-relevant than other common measures of segregation as school districts develop and evaluate their integration efforts. Our main results are robust to using other common measures of unevenness.

In this study, our focus is on *within-district* segregation, meaning variation in the characteristics of students attending different schools within a single school district. This is by no means the only, or even the most important, form of segregation in New York State. New York also has significant *between-district* segregation, where nearby districts have starkly different student populations. And, in some schools, there is significant *within-school* segregation, where different classrooms have very different student populations. However, in this study, we focus on within-district segregation because this is the form of segregation targeted by the integration plans in both Districts 3 and 15.

When measuring within-district segregation, the segregation index is defined as the mean absolute percentage point difference between the proportion of a particular group of students in each school and the district. Specifically, a district's segregation index for a particular group of students, m , is calculated as:

$$S_m = \sum_{i=1}^n \frac{\tau_i}{T} |p_{i,m} - P_m| \times 100$$

where n is the number of schools in the district, τ_i is the total number of students in school i , T is the total number of students in the district, $p_{i,m}$ is the proportion of students in group m in school i , and P_m is the proportion of students in group m in the district. Conceptually, the segregation index can be interpreted as how far (in percentage

points) a typical school is from the district proportion of students in a particular group.

The index can also be adapted as a population-weighted average of group-level measures to handle multiple groups simultaneously (e.g. multiple race and ethnicity groups):

$$\bar{S} = \sum_{m=1}^M \frac{\tau_m}{T} S_m$$

where M is the number of groups, τ_m is the total number of students in group m , and S_m is the segregation score for each group. For six racial/ethnic groups, for example, \bar{S} would be the mean segregation score for each race/ethnicity, weighted by the proportion of students of that race/ethnicity in the district.

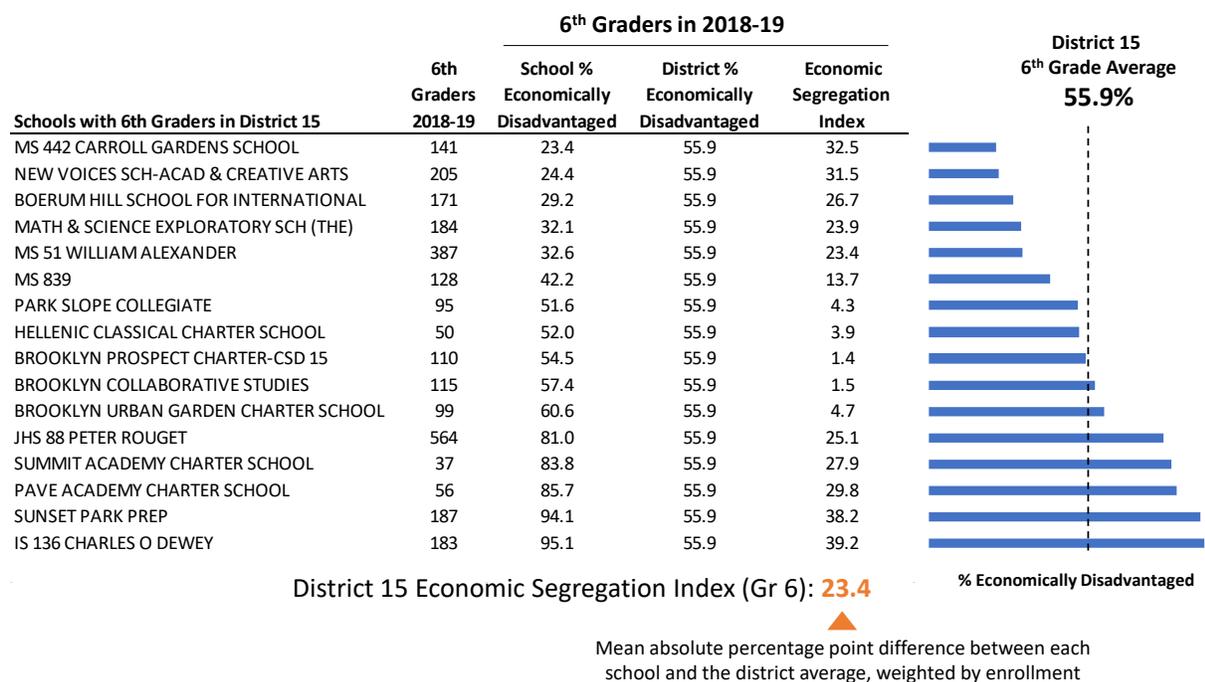
Figure 6 shows an example of how the segregation index is calculated for sixth grade economic segregation in 2018-19 in District 15.⁴ As we see, in 2018-19, there were 16 schools in District 15 that enrolled sixth graders, including 11 district schools and five charter schools.⁵ The share of students who are economically disadvantaged ranged from 23.4% in MS 442 to 95.1% in IS 136. On average, the typical student attended a school that was 23.4 percentage points away from the district's overall share of students who were economically disadvantaged.

⁴ Figure A3 in the appendix shows the same calculation for District 3.

⁵ While only district schools participate in the choice process, we include charter schools in all analyses

because they are an important part of the educational landscape in many districts. Results excluding charter schools are similar to the overall results in both districts and are shown in Figure A5 in the appendix.

Figure 6 – In District 15, the typical school’s sixth grade class had a % Economically Disadvantaged that was 23.4 percentage points away from the district share in 2018-19.



Source: NYSED enrollment data.

As we see in Figure 7, with an economic segregation index score of 23.4 in 2018-19, District 15 had the second highest within-district economic segregation among the 50 largest school districts in New York State.⁶ Only District 3, with an economic segregation index score of 28.0 had more within-district segregation. In terms of racial segregation, Districts 3 and 15 also had high within-district segregation, though to a lesser degree. Among the 50 largest school districts in the state, District 3 had the third highest within-district racial segregation in sixth grade in 2018-19, and District 15 had the eighth highest.⁷

One explanation for the high level of segregation in Districts 3 and 15 is their diversity. As shown in Figure 3, both Districts 3 and 15 have close to 50% of students who are economically disadvantaged and a wide distribution of students across the major racial and ethnic groups. Many of the districts towards the left side of Figure 7 have more homogenous student populations, either economically, racially, or both.

⁶ While Figure 7 shows only the 50 largest school districts by 6th grade enrollment in 2018-19, Districts 3 and 15, in fact, had the highest within-district economic segregation scores among all 711 school

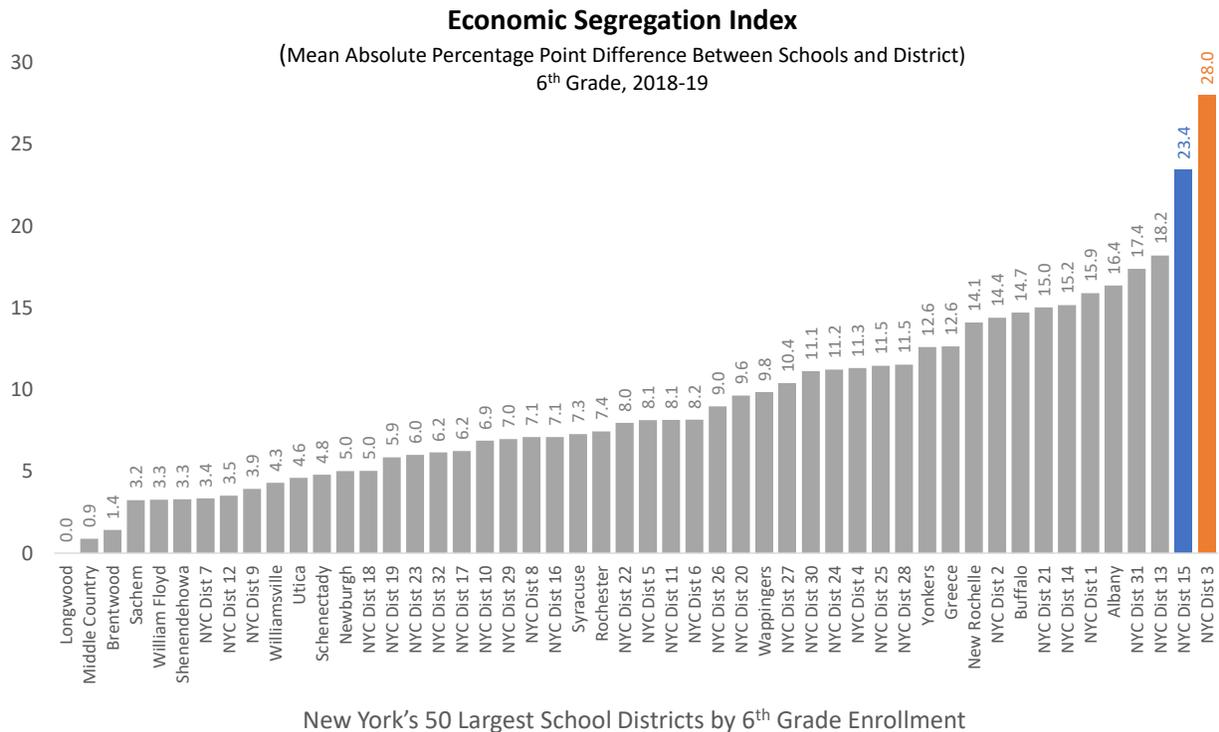
districts in the state that enrolled sixth graders in 2018-19.

⁷ See Figure A2 in the appendix for details.

While diversity is a necessary condition for high within-district segregation – as it is defined in this study – it is not a sufficient condition. All segregated districts are diverse. Not all diverse districts are segregated. An interesting counterexample is Schenectady, a city with a highly diverse student body. In 2018-19, 29% of Schenectady’s sixth graders were Black, 21% were Hispanic, 21% were White, 19% were Asian, and 9% were multi-racial. By

one measure, sometimes called the *USA Today Diversity Index*, Schenectady is the most racially diverse school district in New York State.⁸ However, with a sixth grade racial segregation score of 1.6 in 2018-19, Schenectady had much lower racial segregation than either District 3 (17.6) or District 15 (14.7). Diverse but segregated districts, like Districts 3 and 15, have the potential to integrate without going beyond their district boundaries.

Figure 7 – In 2018-19, Districts 3 and 15 had the highest within-district economic segregation in 6th grade among New York’s 50 largest school districts.



Source: NYSED enrollment data.

⁸ The diversity index answers the following question: if one selects two students at random, what is the chance they come from different racial/ethnic groups? In Schenectady, if one selects two sixth

graders at random, there is a 78% chance they come from a different racial or ethnic group. In District 3, the same figure is 73%, and in District 15 it is 71%.

Impact Analysis

We assess the impact of integration plans on economic and racial segregation in Districts 3 and 15 in three ways. First, we do a first difference analysis, looking at the change over time in the segregation index in both districts. Second, we do a difference-in-difference analysis, where we compare the change over time in sixth grade segregation to the change over time in seventh and eighth grade segregation in each district. In this case, we assume that seventh and eighth graders largely attend the same schools as sixth graders but would not have been affected by integration plans that targeted sixth graders. Thus, seventh and eighth graders serve as the control group to sixth graders, who make up the treated group. Third, we do a synthetic control study. Following Abadie, Diamond, and Hainmueller (2010), we compare District 3 and District 15 to a synthetic control group made up of other large districts in New York with similar pre-intervention levels and trends in segregation.

For each method, we also conduct a similar analysis of the segregation trends in 40 other large districts in New York State. Since none of these districts implemented integration plans between 2018-19 and 2019-20, they serve as “placebos” and

provide us with a sense of the typical year-to-year noise one might expect to see in the segregation index, absent an integration plan. This allows us to assess the statistical significance of our results for Districts 3 and 15.

First Difference

Figure 8 shows the trends in the sixth grade economic segregation index for both District 3 and District 15.⁹ Prior to implementing the integration plans, sixth grade economic segregation in both districts had remained fairly stable, with some year-to-year variation.¹⁰ In 2019-20, the first year of its integration plan, sixth grade economic segregation in District 3 dropped by 2.3 points, a decline of 8% from the prior year’s level of segregation. In the same year, sixth grade economic segregation in District 15 dropped by 12.8 points, a decline of 55%.¹¹

From Figure 8, we can see that the segregation index clearly declined by a substantial amount in District 15 in 2019-20. However, we also see that the segregation index varied from year-to-year prior to 2019-20 – sometimes increasing and sometimes decreasing – even though no districtwide integration plan was being implemented. To get a sense of how much “noise” we might expect in the segregation

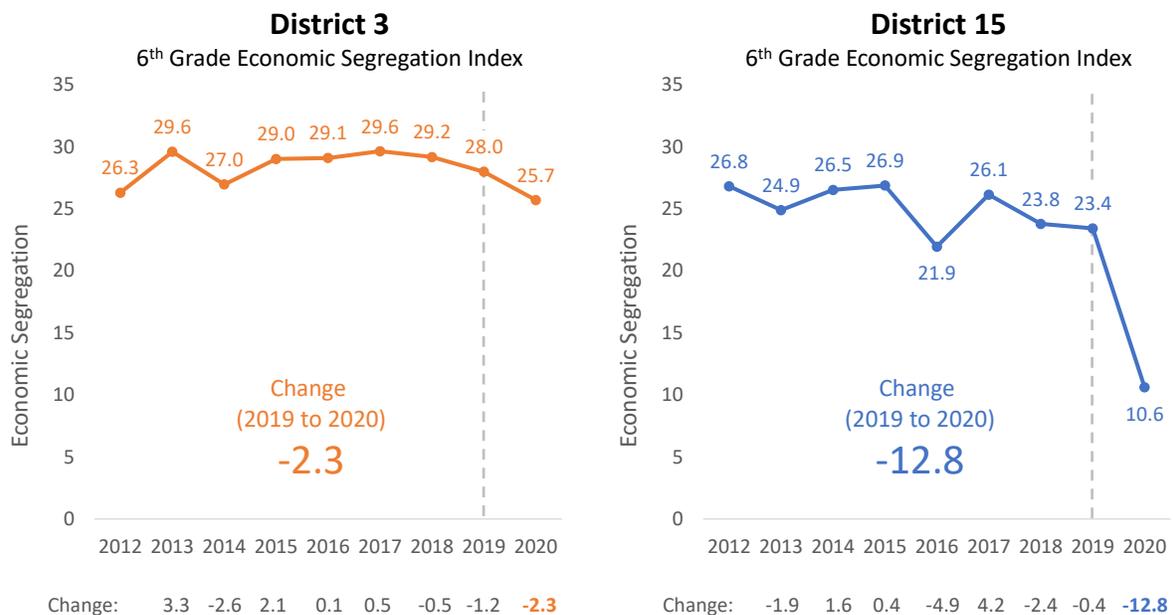
close to the district proportion. The rest of the drop appears to have been caused by idiosyncratic changes in the make-up of the incoming class at several large middle schools, which moved them closer to the percent economically disadvantaged in the district for one year.

¹¹ If one excludes charter schools, the economic segregation index among sixth graders declined by 9% in District 3 and by 59% in District 15 between 2018-19 and 2019-20. Details are shown in Figure A5 in the appendix.

⁹ Figure A4 in the appendix shows the same graph for two common measures of segregation, the Dissimilarity Index and Thiel’s H. The graph shows a similar pattern, with a small drop in segregation in District 3 and a large drop in District 15.

¹⁰ The biggest change was between 2014-15 and 2015-16 in District 15, when the segregation index dropped by five points, from 26.9 to 21.9. About one percentage point of this decline was related to the opening of a new middle school (MS 839) that admitted sixth grade students by lottery and had a proportion of economically disadvantaged students

Figure 8 – In 2019-20, the sixth grade economic segregation index declined by 8% in District 3 and by 55% in District 15.



Source: Analysis of NYSED enrollment data. Note: Years use an end-of-year convention, so 2020 represents the 2019-20 school year.

index from year to year, we calculated the change in the segregation index between 2018-19 and 2019-20 for 40 large districts in New York State that did not implement an integration plan. These districts are a subset of the 50 largest districts shown in Figure 7, with two groups of exclusions. First, we excluded Districts 1, 3 and 15, all of which implemented integration plans¹². Second, we excluded seven districts where fewer than 80% of sixth graders went to a school that also enrolled seventh graders.¹³ We did this to focus our comparison group on districts where sixth graders are likely to attend the same schools as seventh and eighth graders, thus making them more reasonable comparison districts for the difference-in-difference analysis in the next section.

Figure 9 shows a histogram of sixth grade economic segregation score changes in District 3, District 15, and the 40 largest comparison districts. None of the 40 comparison districts implemented a district-wide integration plan between 2018-19 and 2019-20, and therefore provide a sense of the typical year-to-year noise one might expect in the segregation index. The distribution is centered around zero, with 90% of the comparison districts seeing a change of three percentage points or less. As shown in the figure, District 15's change of 12.8 percentage points is well outside the bounds of typical year-to-year noise. District 3's change of 2.3 percentage points is to the left of zero, as it represents a decline in segregation, though it is smaller in

¹² District 1's plan was implemented in 2018-19 and primarily targeted incoming kindergarten students.

¹³ These seven districts were Albany, Longwood, Middle Country, Rochester, Utica, Wappingers, and Yonkers.

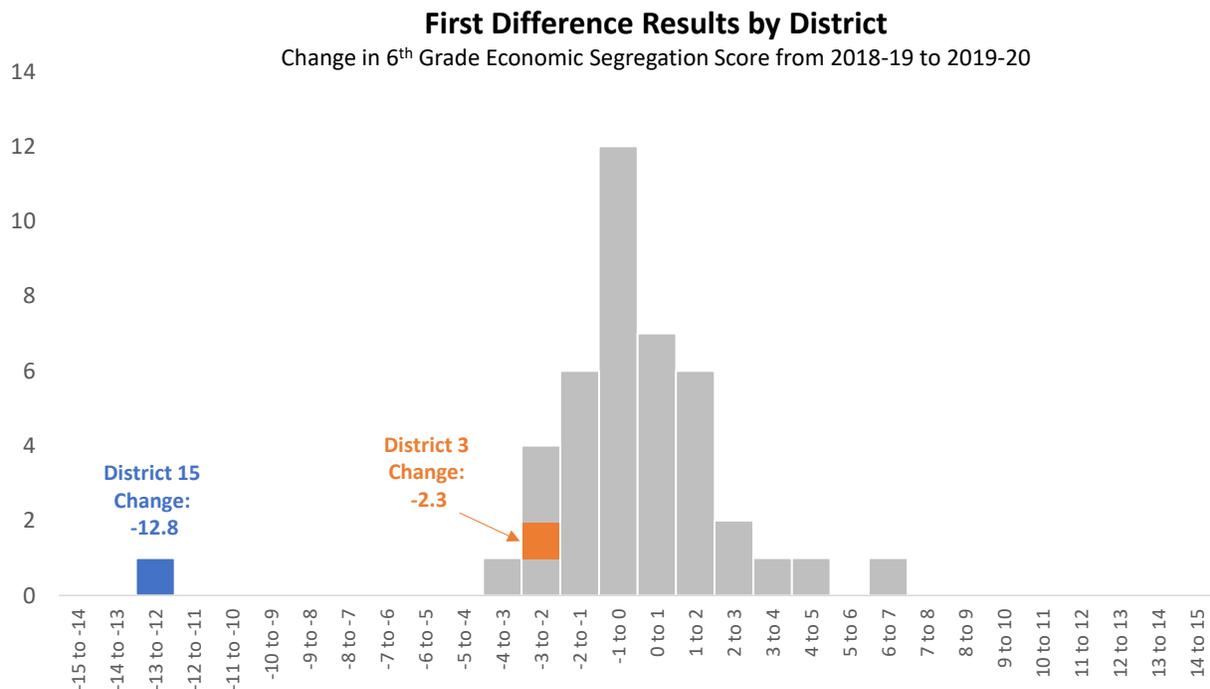
magnitude than the variation observed in a number of districts that did not implement integration plans.

To formalize what can be intuitively seen in Figure 9, we calculate a p-value for the observed changes in Districts 3 and 15. P-values are commonly reported in statistical analyses and represent the probability of observing a result as large or larger than the one observed, if in fact the treatment had no impact. In our case, we want to know how likely we are to see a change in the segregation index as large as those observed in Districts 3 and 15, if in fact the

integration plan had no impact. To calculate the p-value, we use the ordinal rank of the absolute value of the changes shown in Figure 9.¹⁴

Figure 10 shows the results of the p-value calculation. Nine districts, including District 3, had a change in sixth grade economic segregation that was as large as or larger than (in absolute value) the change observed in District 3. Divided by the 41 total districts in our analysis – District 3 and the 40 “placebo” comparison districts – we calculate a p-value of 0.22. This means that even in a district that wasn’t implementing

Figure 9 – The distribution of segregation score changes between 2018-19 and 2019-20 shows that the District 15 change was far outside the norm.



Note: The figure shows a histogram of the change in the sixth grade economic segregation score between 2018-19 and 2019-20 for District 3, District 15, and the 40 largest districts in New York State that have at least 80% of sixth graders attending schools that also enroll seventh graders. District 1 is also excluded because it implemented a segregation plan in 2018-19.

¹⁴ This method is inspired by Abadie, Diamond, and Hainmueller (2010), though they do not refer to the result of their calculation as a p-value.

Figure 10 – A p-value calculation shows that District 15’s change is statistically significant, while District 3’s change is within the bounds of ordinary year-to-year noise.

P-Value Calculation	District 3	District 15
A. Observed Change in 6th Grade Economic Segregation Score	-2.3	-12.8
B. Numbers of Districts with a Change as Large or Larger	9	1
C. Total Number of Districts	41	41
P-Value (B / C)	0.22	0.02

Note: District 3 and District 15 are included in the comparison group for their own p-value calculation, but not for the other district’s calculation. In row B, the number of districts with a change as large or larger includes the district being analyzed (e.g. District 3 or 15).

an integration plan, we would expect to see a change in the segregation index as larger or larger than the one observed in District 3 about 22% of the time. While there is no single definition of statistical significance, a common rule of thumb in social science research is that results with a p-value of 0.05 or lower are statistically significant. Results with a p-value of 0.10 or lower are often called marginally statistically significant. District 3’s results clearly do not meet this threshold and are well within the bounds of ordinary year-to-year noise.

The p-value for District 15, however, is 0.02. This is the lowest possible p-value given the number of comparison districts we are using. Among the 40 districts in the comparison group plus District 15, the observed change of 12.8 percentage points was the largest. Assuming that District 15’s integration plan had no impact on segregation, there is only a 2% chance that we would see a change as large or larger than the one observed. More precisely, if one randomly assigned districts to the actual segregation changes observed between 2018-19 and 2019-20 in these 41 districts,

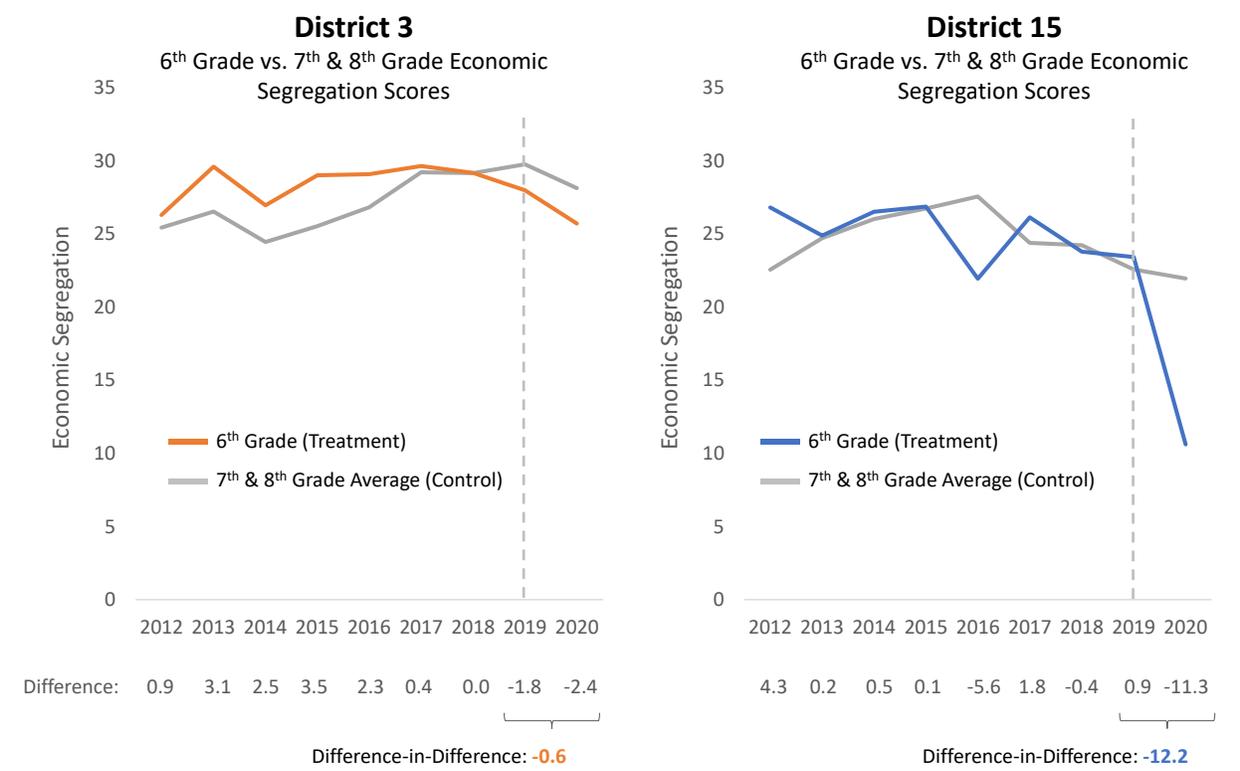
there is only a 2% chance that District 15 would be assigned to the largest change.

From Figure 9, we can see that this p-value – which is based only on the rank order of changes – is perhaps an underestimate of the true probability of observing a change as large as District 15’s if the integration plan had no impact. Not only was District 15’s change the largest in absolute value, but it was approximately twice as large as the next largest change. The decrease in sixth grade economic segregation observed in District 15 was both large and statistically significant.

Difference-in-Difference

It is possible that the segregation score changes observed in Districts 3 and 15 were due to factors unrelated to the integration plans targeting those grades and districts. If, for example, the decline in District 15 segregation was due to district-wide changes in demographics or school enrollment patterns – not the specific admissions changes targeting the incoming 6th grade class – we would expect to see a decline in segregation in other grades. To better

Figure 11 – In District 15, the economic segregation index in 7th and 8th grade remained stable in 2019-20, while the segregation index in 6th grade declined dramatically



Note: Years use an end-of-year convention, so 2020 represents the 2019-20 school year.

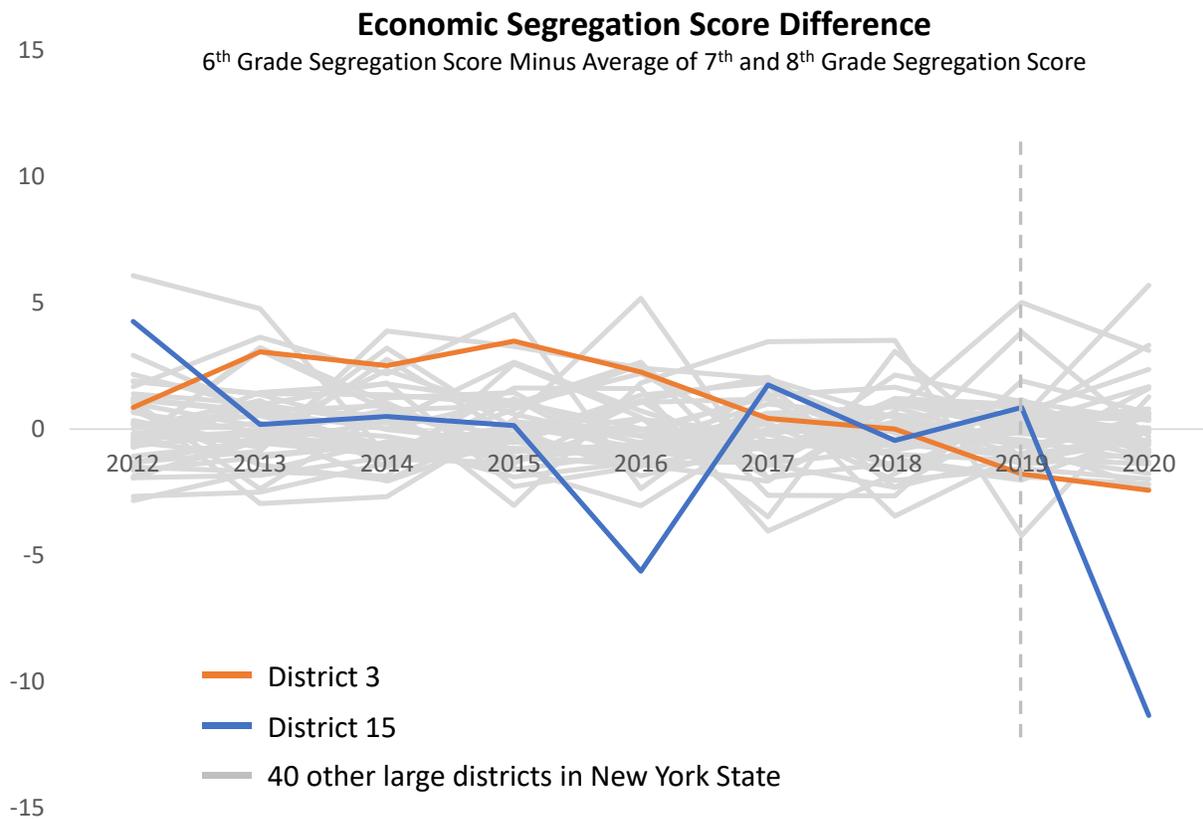
control for this possibility, we run a difference-in-difference model using the seventh and eighth grade segregation scores as a control.

Figure 11 shows the initial results of the difference-in-difference calculation in Districts 3 and 15. In District 3, while the sixth grade segregation index fell by 2.3 points (as shown earlier), the average of the seventh and eighth grade segregation indices fell by 1.7 points. The difference in the difference was -0.6 points, as the sixth grade segregation index fell by 0.6 percentage points more than the average of the seventh and eighth grade indices. In District 15, the corresponding difference-in-difference result was -12.2, as the average of the seventh and

eighth grade segregation indices fell by only 0.4 points while the sixth grade segregation index fell by 12.6 points. In District 15, sixth grade segregation fell by substantially more than seventh and eighth grade segregation, consistent with the change in the sixth grade admissions system causing the changes. The same was not true in District 3.

To estimate the significance of the change, we once again look at the same measure in the 40 largest comparison districts in New York State. Figure 12 plots the difference between the segregation index in sixth grade and the average of the segregation indices in seventh and eighth grade for District 3, District 15, and all 40 comparison districts.

Figure 12 – In District 15, the economic segregation index in 7th and 8th grade remained stable in 2019-20, while the segregation index in 6th grade declined dramatically.



Note: Each line shows the difference between the segregation index in sixth grade and the average segregation index in seventh and eighth grade in the same district. Years use an end-of-year convention, so 2020 represents the 2019-20 school year.

As one might expect, these numbers are fairly close to zero, as sixth grade segregation in most districts in most years tends to be very similar to seventh and eighth grade segregation.¹⁵ The most notable exception is District 15 in 2019-20 when the segregation index in sixth grade was 11.3 percentage points lower than the average segregation index in seventh and eighth grade. This was a decline from 2018-19, when the segregation index in sixth grade in District 15 was 0.9 percentage points higher than in seventh and eighth grade, for a

difference-in-difference result of -12.2 percentage points.

Following the same process outlined earlier, we calculate a p-value for the difference-in-difference results in District 3 and District 15. District 3’s difference-in-difference result of -0.6 was the same or smaller (in absolute value) than the result observed in 25 districts, which gives a p-value of $25 / 41 = 0.61$. District 15’s difference-in-difference result of -12.2 was the largest (in absolute value) of all 41 districts, which gives a p-

¹⁵ This is especially likely to be true because we limit our universe of districts to those where sixth graders and seventh graders largely attend the same schools.

value of $1 / 41 = 0.02$. As with the first difference analysis, a difference-in-difference study shows that sixth grade economic segregation in District 15 saw a large and statistically significant decline in 2019-20. In contrast, the changes in sixth grade economic segregation in District 3 were small and well within the bounds of normal year-to-year fluctuations for districts that did not implement an integration plan.

Synthetic Control Method

The difference-in-difference analysis above used seventh and eighth grade segregation *in the same district* to control for changes in sixth grade segregation due to factors unrelated to the integration plans implemented. An alternative is to control for external segregation changes in the target districts using segregation in districts unaffected by integration plans. While there are many ways to do this, one recent and promising approach is known as the synthetic control method (Abadie, Diamond, and Hainmueller, 2010).

The synthetic control method provides a systematic way to estimate the counterfactual for a treatment unit (in our case, District 3 or District 15) when there are a large number of potential control units (districts without integration plans). In particular, the synthetic control method identifies a weighted average of control units that best matches the treatment unit on the pre-treatment level of the variable of interest and other characteristics. For this study, the goal is to find a set of districts

from our comparison group that provide a good match for District 3 and a (potentially) separate set of districts that provide a good match for District 15.

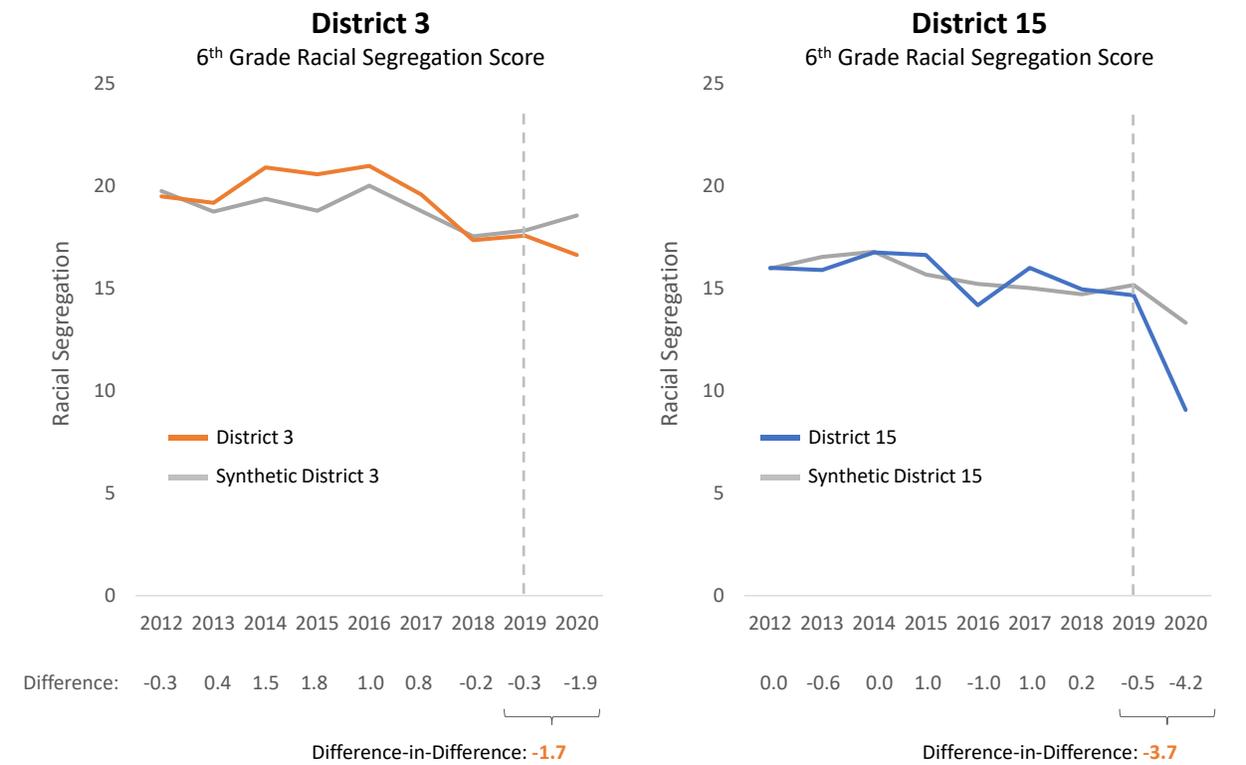
When looking at economic segregation, it is impossible to find a set of districts that are a good match for Districts 3 and 15 because Districts 3 and 15 have higher economic segregation than any other district in New York. No weighted combination of districts can possibly equal the economic segregation in either district.¹⁶ Given this issue, we illustrate the synthetic control method using racial segregation. For an individual race or ethnicity, we define racial segregation in a manner parallel to economic segregation, as the mean absolute percentage point difference between the share of that race in each school and the share of that race in the district, weighted by the school's enrollment in the grade being studied. Overall racial segregation is defined as the weighted average of all individual race segregation measures, where the weights are based on the district's percent of the population in each race category. As shown in Figure A2 in the appendix, while Districts 3 and 15 have high levels of overall racial segregation, there are several other large districts in New York with similar (or occasionally higher) levels of racial segregation.

To run the synthetic control method, we used the Synth package in R with the overall racial segregation score as our dependent variable, the overall racial segregation score, economic segregation score, and sixth grade

¹⁶ This is true when looking at the level of economic segregation. However, when looking at the difference between economic segregation in sixth grade and economic segregation in seventh and eighth grade, it

is possible to find districts that are a good match for Districts 3 and 15. Results from such an analysis are shown in Figure 15.

Figure 13 – Both District 3 and District 15 showed a decline in sixth grade racial segregation in 2019-20 compared to their synthetic control groups.



Note: years use an end-of-year convention, so 2020 represents the 2019-20 school year.

enrollment in the districts as our predictor variables, and a predictive time period from 2011-12 to 2018-19 (Abadie, Diamond, and Hainmueller, 2011). Through this process, a “Synthetic District 3” was created that was a weighted average of New York City’s District 29 with 81% weight and Buffalo with 19% weight. For District 15, its synthetic control group was comprised of New York City’s District 31 with 50% weight, New Rochelle with 44% weight, and various other districts with a combined weight of 6%.

As shown in Figure 13, both District 3 and District 15 saw a decline in sixth grade racial segregation between 2018-19 and 2019-20, both in absolute terms and relative

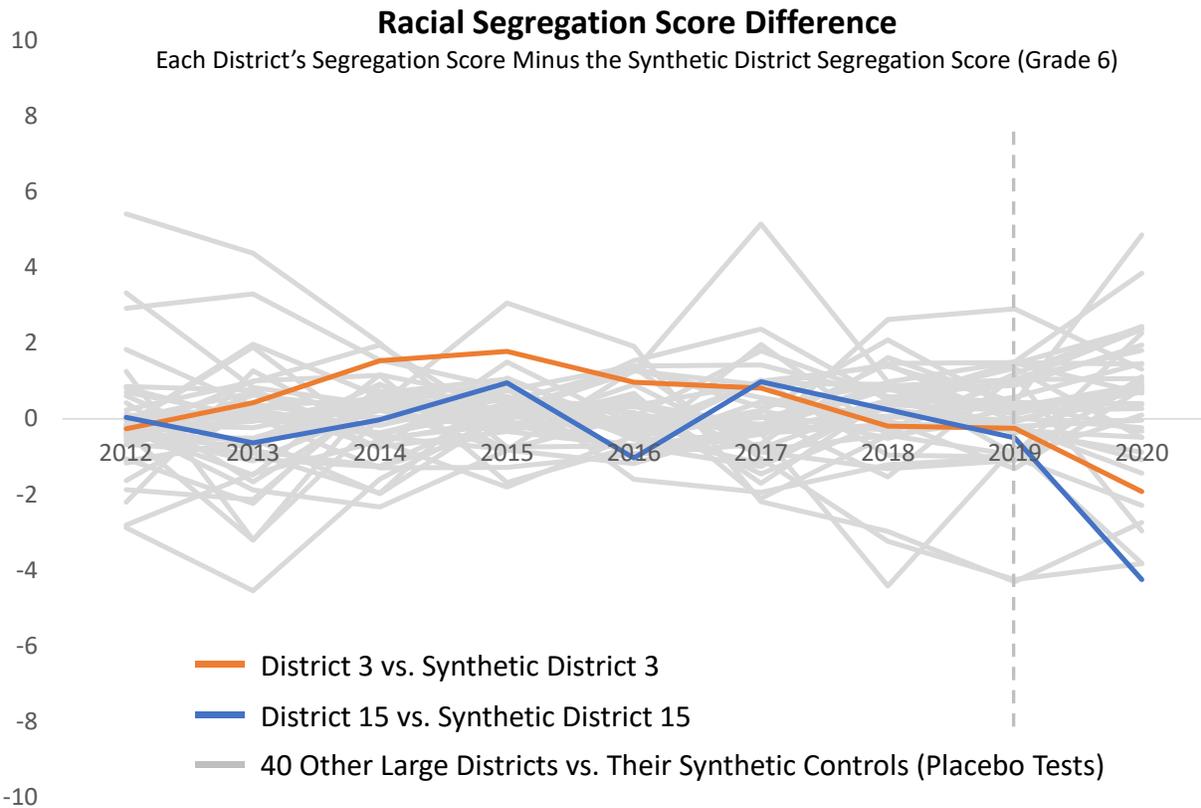
to their synthetic control groups. In District 3, sixth grade racial segregation declined by 0.9 percentage points, or 5%, between 2018-19 and 2019-20. Because the segregation score in the synthetic District 3 increased by 0.8 points, the difference-in-difference result for District 3 was a decline of 1.7 percentage points. In District 15, the racial segregation score declined by 5.6 percentage points, or 38% percent. Because the segregation score in the synthetic District 15 declined by 1.9 points, the difference-in-difference result for District 15 was a decline of 3.7 points. In other words, the sixth grade racial segregation score declined by 3.7 percentage points more in District 15 than in synthetic District 15.

To test the statistical significance of these findings, we run the same synthetic control analysis for each of the comparison districts, repeating the process we implemented for Districts 3 and 15. For each of the 40 comparison districts, we estimate a synthetic control group that best matches the district in question, and we calculate the difference between the district in question and its synthetic control. Since none of these 40 districts implemented an integration plan, these districts serve as “placebo” tests of the synthetic control method. As in our prior analyses, this allows us to quantify the amount of noise we might expect to see

from this method, simply by chance. Figure 14 displays the results.

In Figure 14, each line represents the difference between the sixth grade racial segregation score in a district and its synthetic control group. These lines tend to be close to zero, as the synthetic control groups generally provide a good approximation for the level of racial segregation in the district for which they are a control. In 2019-20, Figure 14 shows that the racial segregation score in both District 3 and District 15 declined relative to their synthetic control groups, as noted

Figure 14 – In 2019-20, racial segregation in both districts declined relative to their synthetic control group, though more substantially in District 15.



Note: each line shows the difference between the racial segregation index in sixth grade in a district and the racial segregation index in sixth grade in its synthetic control group. Years use an end-of-year convention, so 2020 represents the 2019-20 school year.

previously. Relative to the comparison districts, the decline in District 15 appears more substantial than in District 3, though less significant than the decline in economic segregation shown earlier. A p-value calculation for the change in racial segregation between 2018-19 and 2019-20, following the methodology outlined earlier, leads to a p-value of 0.24 (10/41) for District 3 and a p-value of 0.07 (3/41) for District 15. Based on the results of the synthetic control method, District 15's change in racial segregation in 2019-20 was marginally statistically significant, while District 3's change was within the bounds of typical noise.

Summary

Figure 15 summarizes the impact estimates presented earlier and displays the results of

several additional analyses. In addition to the first difference, difference-in-difference, and synthetic control method in levels, all of which were outlined earlier, Figure 15 also presents the results from a synthetic control study that used the difference-in-difference results as the outcome of interest. This study is, in effect, a triple difference (DDD) study, with one difference being over time, another difference being across grade levels, and the third difference being across school districts. The results are very similar to the simpler methods presented earlier.

In District 15, we consistently see a large and statistically significant decrease in segregation across all methods. The decline in racial segregation in District 15 is somewhat smaller than the decline in economic segregation, and sometimes only marginally statistically significant.

Figure 15 – Various methods show consistent and robust evidence of a significant decrease in segregation in District 15, and little evidence of a change in District 3.

Impact of Integration Plans on 6th Grade Segregation in 2019-20

Economic Segregation	District 3		District 15	
	Estimate	P-Value	Estimate	P-Value
● First Difference	-2.3	0.22	-12.8	0.02
● Difference in Difference	-0.6	0.61	-12.2	0.02
Synthetic Control Method (Levels)	NA	NA	NA	NA
Synthetic Control Method (DDD)	-0.2	0.80	-12.5	0.02
Racial Segregation	Estimate	P-Value	Estimate	P-Value
First Difference	-0.9	0.61	-5.6	0.02
Difference in Difference	0.0	1.00	-5.0	0.05
● Synthetic Control Method (Levels)	-1.7	0.24	-3.7	0.07
Synthetic Control Method (DDD)	0.1	0.93	-3.0	0.07

● Results highlighted earlier in the text

Note: each line shows the difference between the racial segregation index in sixth grade in a district and the racial segregation index in sixth grade in its synthetic control group. Years use an end-of-year convention, so 2020 represents the 2019-20 school year.

However, taken as a whole, the analyses presented here provide strong evidence that District 15's policy decreased economic segregation, as it was designed, and also had an indirect impact on reducing racial segregation.¹⁷

In District 3, we see little evidence of a decrease in economic or racial segregation. While the point estimates for economic segregation are all negative, implying a decline in segregation, they are small in magnitude and far from traditional levels of statistical significance. When looking at racial segregation, we see point estimates that are negative using only two of the four methods. Broadly speaking, the changes observed in District 3 are well within the bounds of typical year-to-year noise. At best, the integration plan in District 3 may have led to a small change in segregation, and we cannot confidently conclude that it led to any change at all.

Conclusion

New York City's Community School Districts 3 and 15 are, in some ways, microcosms of the city and the state. Both districts are economically and racially diverse, yet highly segregated. In 2019-20, both districts launched integration initiatives that targeted incoming sixth graders and sought to make their middle schools better reflect the diversity in each district. The

results of these efforts differed dramatically and can provide insight to other school systems seeking to improve integration.

District 15 saw a substantial decrease in segregation in the first year of its integration plan. In sixth grade, economic segregation in District 15 decreased by 55% and racial segregation decreased by 38%. These results are statistically significant and robust to numerous alternative methods of analysis. By contrast, District 3 saw, at best, a small decrease in segregation. In sixth grade, economic segregation in District 3 decreased by 8% and racial segregation decreased by 5%, changes that are well within the bounds of typical year-to-year fluctuations.

At first, the divergence in these results may be surprising due to the broad similarities in the districts' integration plans: both districts used a controlled-choice admissions mechanism to target reduced economic segregation among sixth graders entering middle school. However, the plans differed in two important details. First, District 15 removed academic screens from all middle schools, admitting students by lottery within priority groups. District 3, by contrast, retained all academic screens. Second, District 15 set a significantly more ambitious target for enrolling economically disadvantaged students, prioritizing low-income students for 52% of sixth grade seats, compared to 25% of seats in District 3.

¹⁷ One potential unintended consequence of implementing integration policies in urban schools relates to the concept of "White flight." White flight often refers to White residents moving out of a residential area in response to non-White residents moving in. The term became a common way to describe White residents moving from the inner city to suburban areas in the 1950s and 1960s, though

researchers have identified White flight as a cause of segregation as early as 1900 (Shertzer and Walsh, 2019). While it is still early, the first year of integration efforts in District 3 and District 15 do not appear to have led to a reduction in White enrollment. As shown in Figure A6 in the appendix, the share of sixth grade students categorized as White increased in both districts in 2019-20.

One clear lesson from this study is that the *details* of an integration plan matter. Simply introducing a “controlled-choice” admissions policy, or prioritizing economically disadvantaged students, is not enough to ensure a meaningful change in segregation. As other districts in New York and beyond look to better integrate their schools, they must carefully consider the specific design decisions they make when developing plans to reduce segregation.

A second – and simpler – lesson is that integration is possible. Through the combined efforts of many people, District 15 developed and implemented a policy that dramatically decreased economic and racial segregation in sixth grade. To date, the results are limited to a single year in a single grade. Nevertheless, District 15 provides an important success story for those communities that decide that they too want their children to grow up in less segregated schools.

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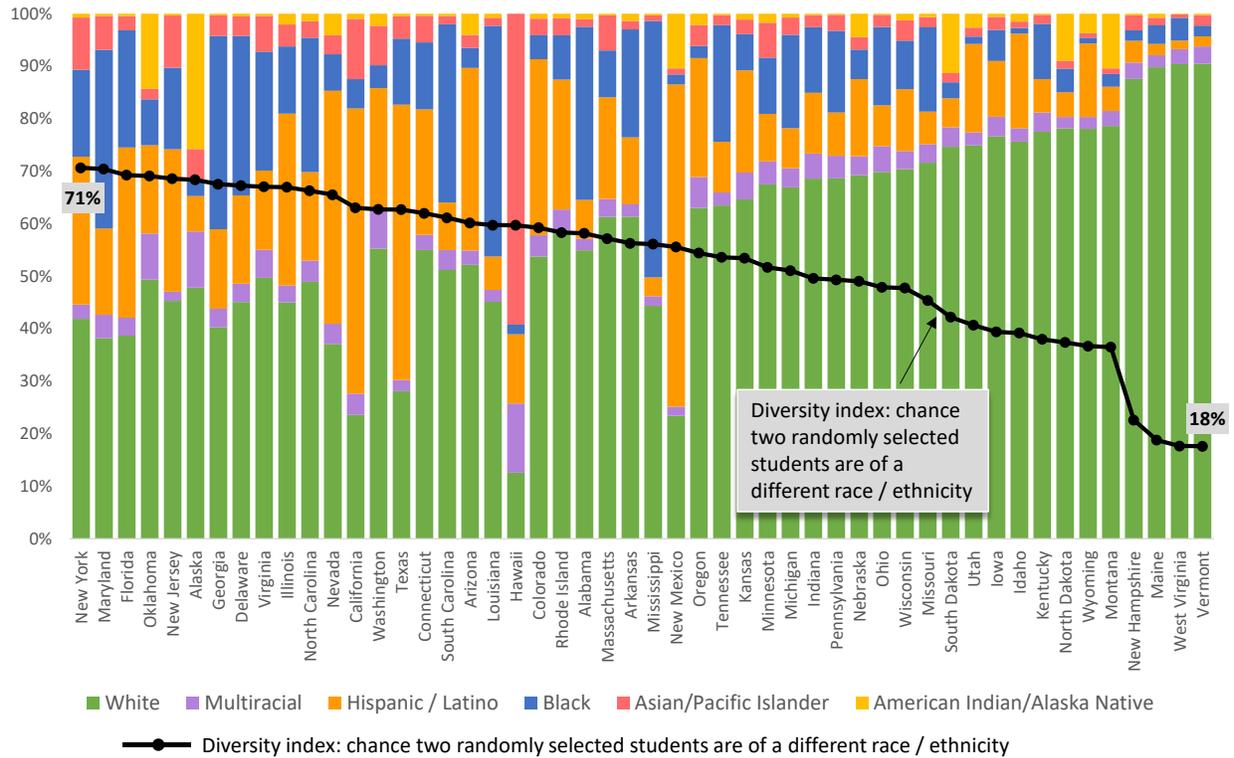
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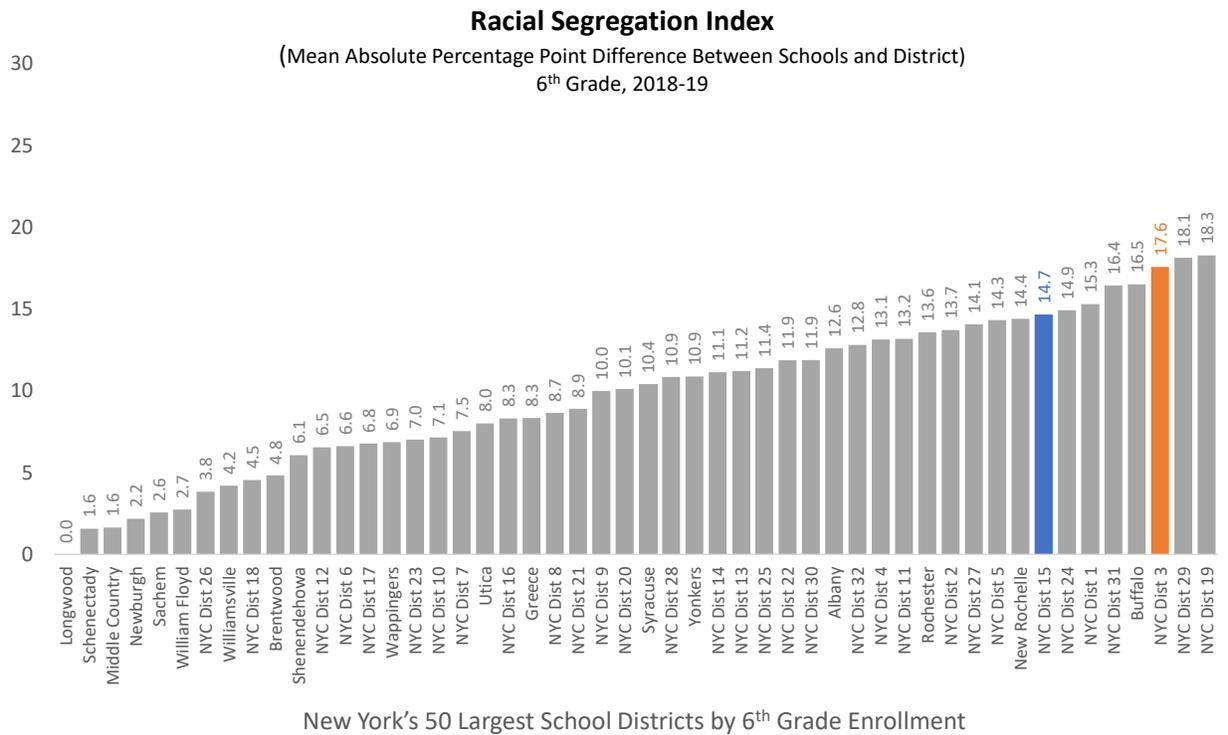
Appendix A – Additional Figures

Figure A1 – By one measure, New York State has the most diverse public school system in the country.



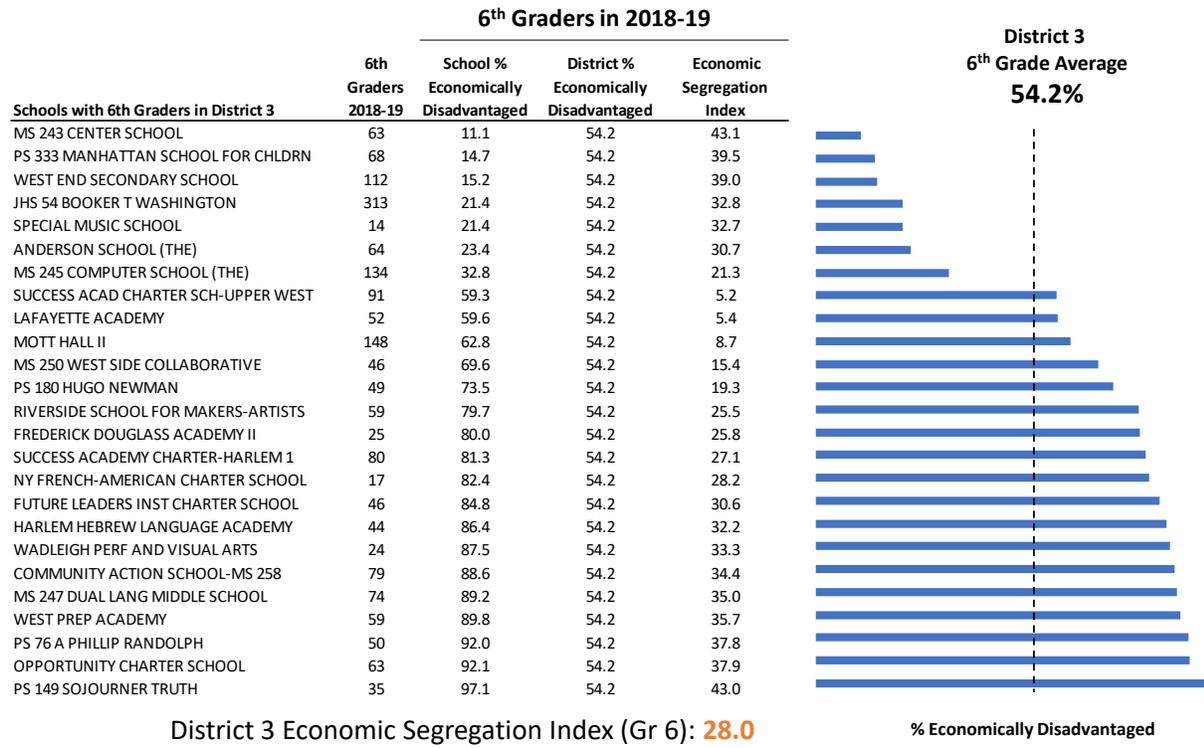
Source: Data for New York is from the New York State Education Department. Data for all other states is from the National Center for Education Statistics (<https://nces.ed.gov/ccd/pubschuniv.asp>). Note: In Hawaii, students categorized as American Indian or Alaska Native have been recategorized here as Pacific Islanders. Note: the diversity index is calculated as one minus the sum of squares of the proportions for each race/ethnicity.

Figure A2 – In 2018-19, Districts 3 and 15 had higher levels of racial segregation than most other large districts in New York State.



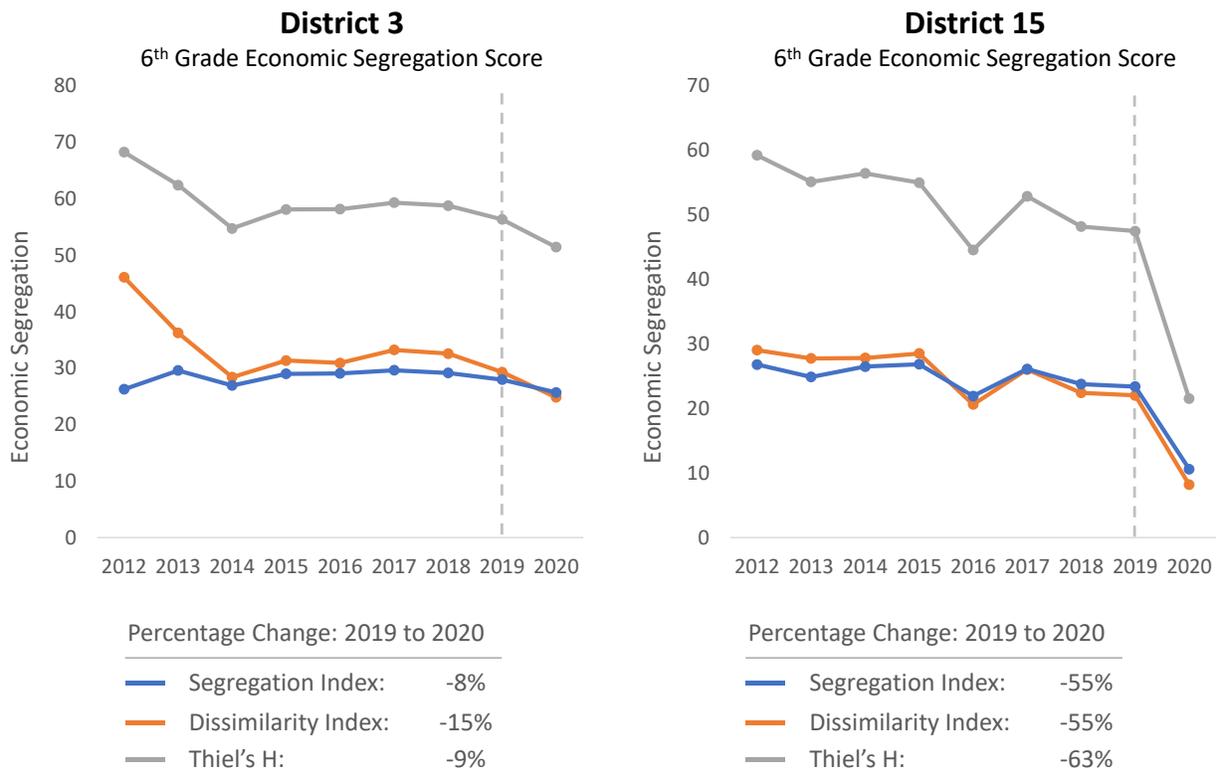
Source: NYSED enrollment data. Note: Racial segregation index is a weighted average of the segregation index for each individual race/ethnicity: American Indian, Asian, Black, Hispanic/Latino, Multiracial, and White, weighted by the enrollment of each group in the district.

Figure A3 – In District 3, the typical school’s sixth grade class had a % Economically Disadvantaged that was 28.0 percentage points away from the district share in 2018-19.



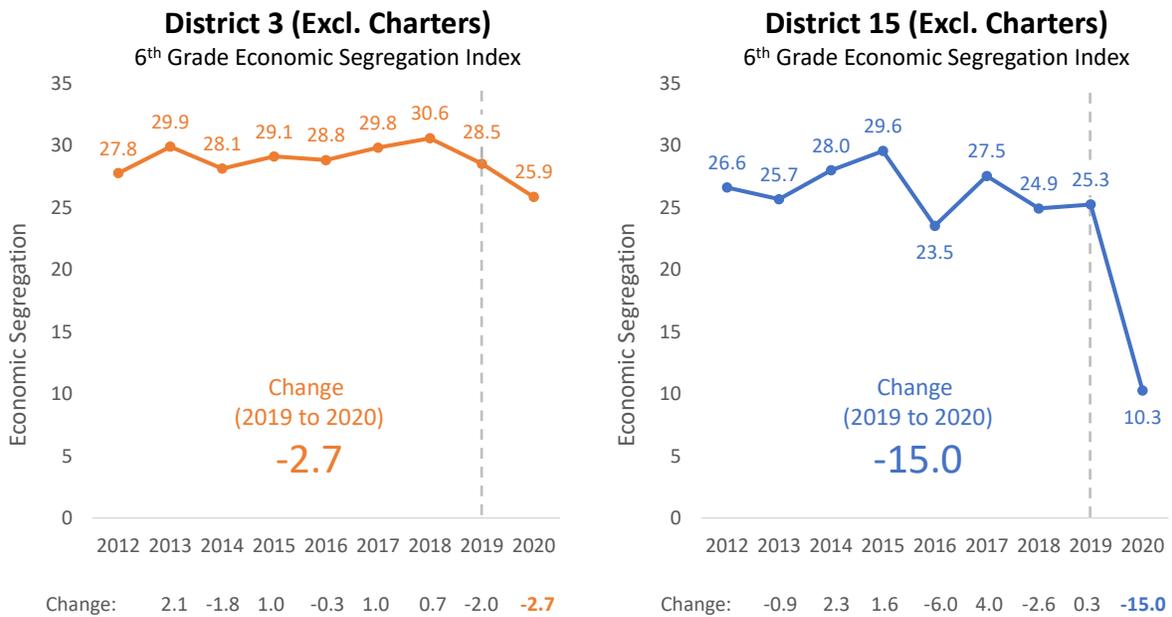
Source: NYSED enrollment data.

Figure A4 – Alternative measures of segregation show similar results for Districts 3 and 15.



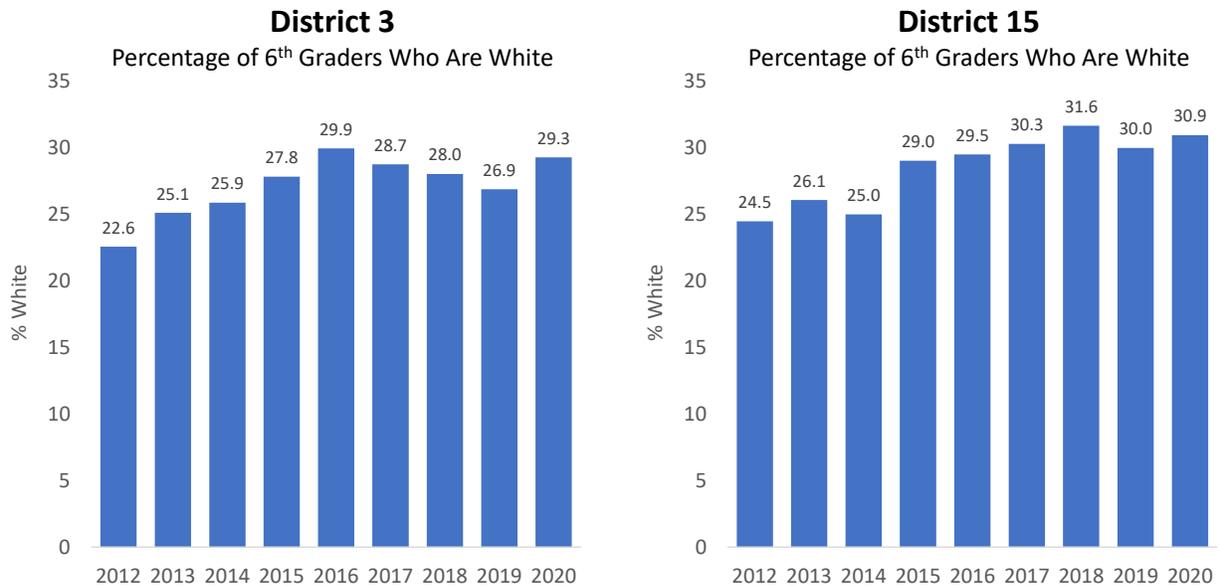
Source: Analysis of NYSED enrollment data.

Figure A5 – Excluding charter schools shows similar results in both districts, with a decline in sixth-grade economic segregation of 9% in District 3 and 59% in District 15.



Source: Analysis of NYSED enrollment data.

Figure A6 – The integration plans do not appear to have led to “White flight” in their first year, as the share of White sixth graders increased in both Districts 3 and 15 in 2019-20.



Source: NYSED enrollment data. Note: years use an end-of-year convention, so 2020 represents the 2019-20 school year.

Appendix B – Other Common Measures of Segregation

Two of the most common measures of segregation that focus on how evenly distributed a population is across units are the dissimilarity index and Theil’s H, also called the entropy index. In this appendix, we define these measures and show how they compare to the segregation index used in this study.

Dissimilarity Index

The dissimilarity index is the most widely used evenness measure of segregation. It is both simple to calculate and has a straightforward interpretation. For two groups, for example, White and Black students, the dissimilarity index for a district is:

$$D = \frac{1}{2} \sum_{i=1}^n \left| \frac{w_i}{W} - \frac{b_i}{B} \right|$$

where n is the number of schools in the district, w_i is the number of White students in school i , b_i is the number of Black students in school i , W is the number of White students in the district overall, and B is the number of Black students in the district overall. Conceptually, the dissimilarity index measures the percentage of one group’s population that would have to switch schools to produce a distribution in each school that matches that of the district. The dissimilarity index is minimized to 0 when the proportion of each group in each school is the same as the proportion of each group in the district (Forest, 2005).

Theil’s H

Although it is easily interpretable, a limitation of the dissimilarity index is that it can only measure the segregation of two groups compared to each other. Theil’s H – otherwise known as the information index or the entropy index – is a segregation measure that also captures evenness, but can also reflect the spatial distribution of multiple groups simultaneously (White, 1983).

When calculating Theil’s H, the first step is to calculate entropy, a measure of diversity. In general terms, entropy can be defined as “the degree of disorder or uncertainty in a system” (Merriam-Webster, 2020). The more diversity there is in a particular school or district, the more uncertainty there is about the characteristics of any particular student, and the higher the entropy score. The entropy of a school or district is:

$$E = \sum_{m=1}^M p_m \ln \left(\frac{1}{p_m} \right)$$

where M is the number of groups and p_m is the proportion of students in that group. The maximum value of E is $\ln(M)$, which would indicate that there is an equal proportion of each of the M groups, whereas a school or district with an entropy of 0 contains students belonging to only one group.

Theil's H for the district relates a district's overall entropy with the entropy of each of its schools:

$$H = \sum_{i=1}^n \frac{\tau_i}{T} \left(1 - \frac{E_i}{E}\right)$$

where E is the entropy of a district, E_i is the entropy of school i , τ_i is the total number of students in school i , and T is the total number of students in the district. In terms of within-district segregation, Theil's H measures the population-weighted average deviation of each school from its district's Entropy. Districts with higher values of H have a less uniform distribution of students across groups relative to the district's distribution of students.

Segregation Index

When measuring within-district segregation, the segregation index is defined as the mean absolute percentage point difference between the proportion of a particular group of students in each school and the district. As described in the body of this report, a district's segregation index for a particular group of students, m , is calculated as:

$$S_m = \sum_{i=1}^n \frac{\tau_i}{T} |p_{i,m} - P_m| \times 100$$

where n is the number of schools in the district, τ_i is the total number of students in school i , T is the total number of students in the district, $p_{i,m}$ is the proportion of students in group m in school i , and P_m is the proportion of students in group m in the district. Conceptually, the segregation index can be interpreted as how far (in percentage points) a typical school is from the district proportion of students for a particular group.

The index can also be adapted as a population-weighted average of group-level measures to handle multiple groups simultaneously (e.g. multiple race and ethnicity groups):

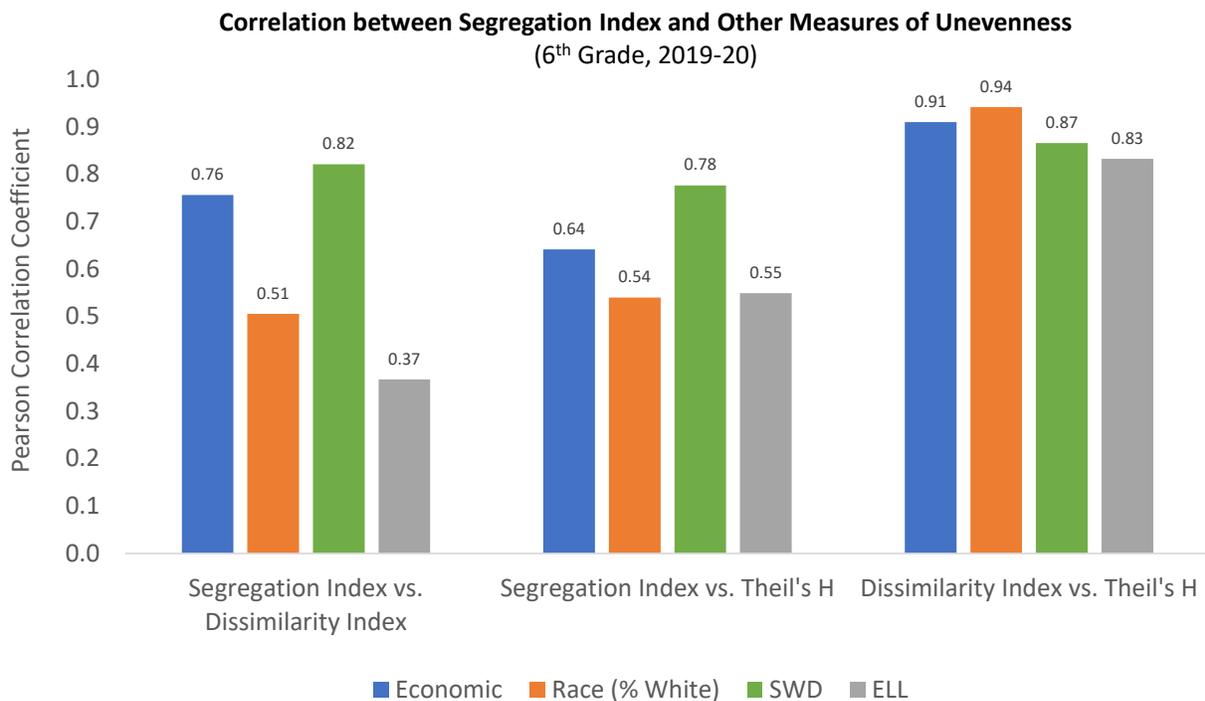
$$\bar{S} = \sum_{m=1}^M \frac{\tau_m}{T} S_m$$

where M is the number of groups, τ_m is the total number of students in group m , and S_m is the segregation score for each group. For six racial/ethnic groups, for example, \bar{S} would be the weighted mean segregation score for each race, weighted by the proportion of that race/ethnicity in the district.

Comparison

When applying these figures to 2019-20 data for sixth graders in New York State, we see that the segregation index used in this report is positively correlated with the dissimilarity index and Thiel’s H. Figure B1 shows the Pearson correlation coefficient between the segregation index and both other measures of segregation across four dimensions of segregation: % economically disadvantaged, % White, % students with disabilities, and % English Language Learners. We focus on % White here rather than the aggregate race measure because the dissimilarity index is not well defined for multiple racial groups, and White students are the most common racial/ethnic group in New York’s schools statewide.

Figure B1 – The segregation index is positively correlated with other measures of unevenness.

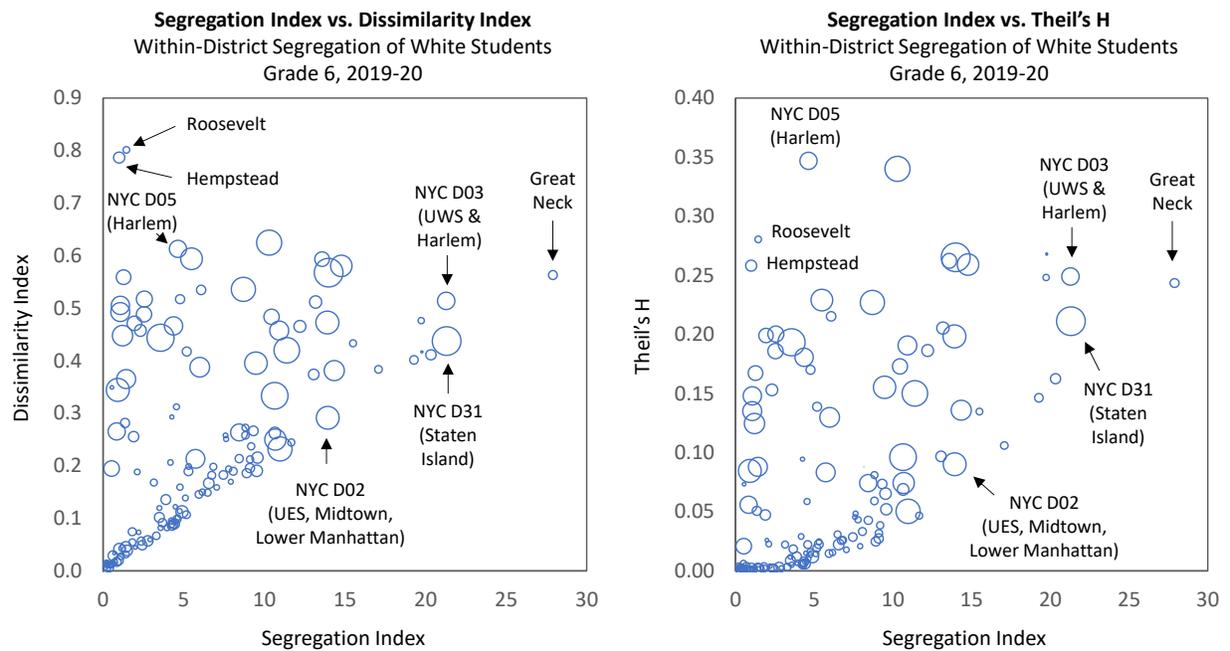


Note: The bars show the Pearson correlation coefficient between one measure of segregation and another for all districts in New York State that have the potential to have a non-zero segregation score (i.e. that have more than one school with sixth graders).

When comparing the segregation index to the other measures of unevenness, we see the lowest correlations are for % White and % ELL. To better understand the differences between these three measures, we use the segregation of White students as an example. Figure B2 shows two

scatterplots, with the one on the left comparing the segregation index to the dissimilarity index, and the one on the right comparing the segregation index to Theil's H. The figure plots all school districts in New York State that had at least two schools enrolling sixth graders in 2019-20. On both scatterplots in the figure, the x-axis shows the segregation index, the primary measure used in this study. In the scatterplot on the left, the y-axis shows the dissimilarity index. In the scatterplot on the right, the y-axis shows Theil's H.

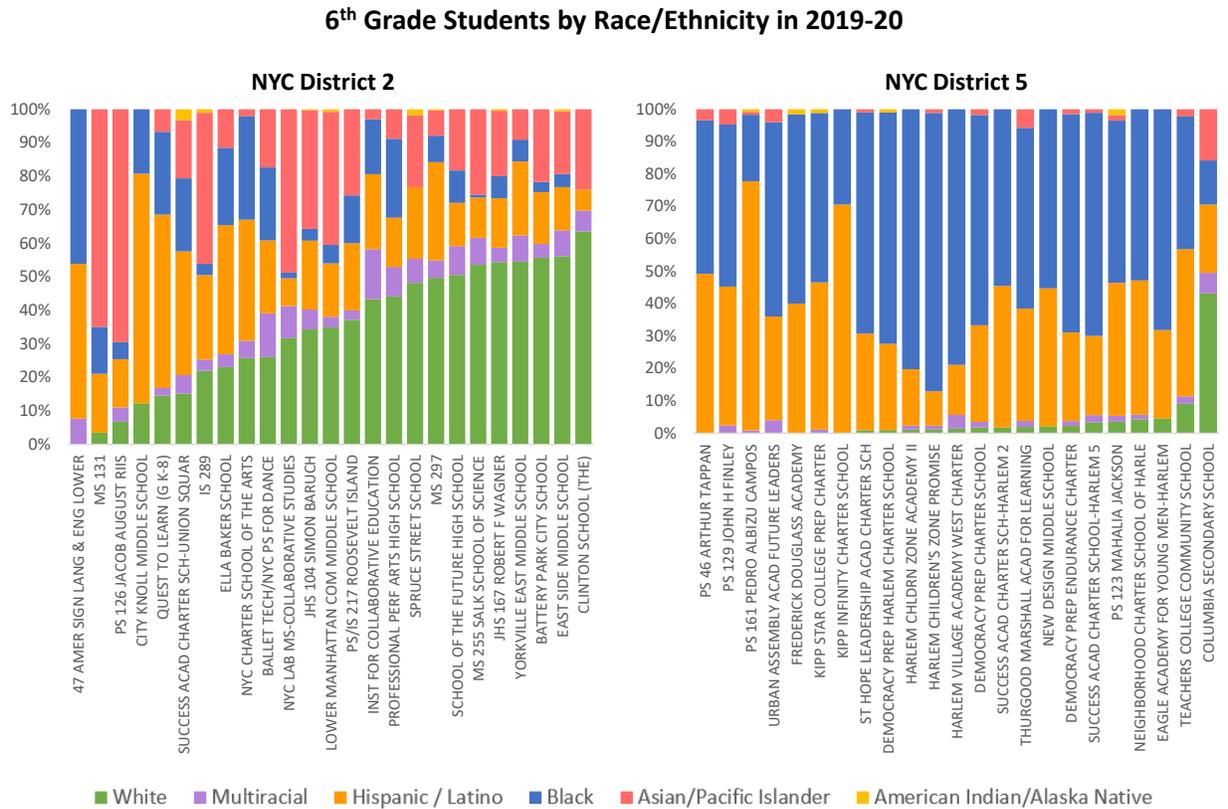
Figure B2 – For several districts, the dissimilarity index and Thiel's H indicate high segregation of White students when the segregation index indicates low segregation.



Note: the size of the bubble is proportional to the number of sixth graders enrolled in the district in 2019-20. Includes all districts in New York State that had at least two schools with sixth graders enrolled in 2019-20.

As shown in Figure B2, the segregation index is aligned with the dissimilarity index and Theil's H for many districts. On the right side of both scatterplots, for example, Great Neck, New York City's District 3, and New York City's District 31 have high within-district segregation of White students according to all three measures. However, there are a number of districts for which the segregation index comes to a very different conclusion than the dissimilarity index or Theil's H. To better understand these discrepancies, we can look at two districts in Manhattan: NYC's District 2 and NYC's District 5. District 2 spans a large area of the southern half of Manhattan and 40% of the sixth graders in the district are White. District 5 includes central Harlem and the southern part of Washington Heights and 4% of the sixth graders in the district are White. According to the segregation index, District 2 has significantly more segregation of White students than District 5. However, according to both the dissimilarity index and Theil's H, District 5 has significantly more segregation of White students than District 2. In fact, according to Theil's H, District 5 has higher within-district segregation of White sixth graders than any other district in the state.

Figure B3 – New York City’s District 2 and District 5 have very different enrollment patterns by race/ethnicity.



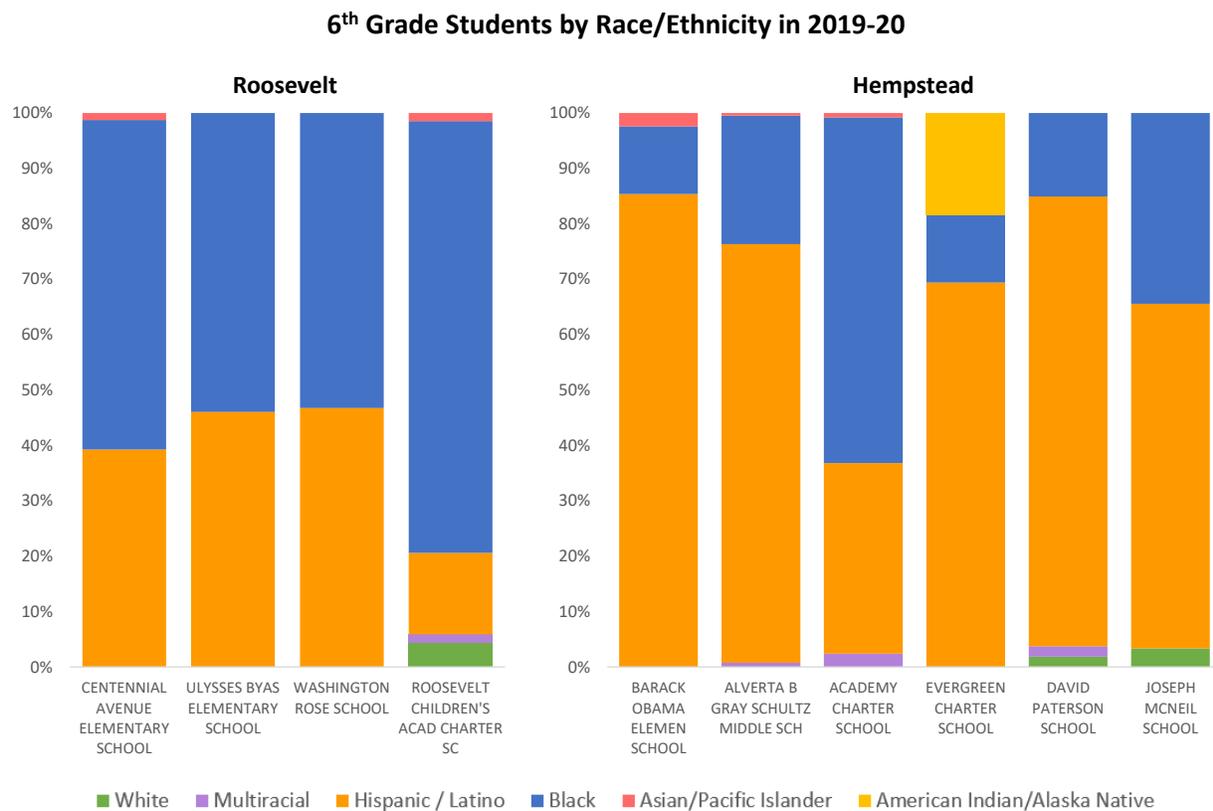
Source: NYSED enrollment data. Includes all schools in each district that enrolled sixth graders in 2019-20.

Figure B3 shows sixth grade enrollment by race/ethnicity for every school that enrolls sixth graders in both districts. As shown on the left side of the figure, in District 2, the enrollment share of White sixth graders ranges from under 5% to over 60%, with schools at many points in between. In District 5, by contrast, the vast majority of schools have either no or few White sixth graders with one notable exception. At Columbia Secondary School, 43% of sixth graders are White, with this one school accounting for 48 of the 68 total White sixth graders in the district.¹⁸ The dissimilarity index for White students in District 5 is 0.61, which identifies the district as having very high within-district segregation of White students (the fourth highest in the state). A large share of White students – approximately 61% – would have to move schools to have an even distribution of White students across the district. The Theil’s H score of 0.35 has a less natural interpretation but comes to largely the same conclusion. According to Theil’s H, District 5 has more within-district segregation of White students than any other districts in the state, and nearly four times as much within-district segregation of White students as District 2.

¹⁸ The Columbia Secondary School is a screened school located in District 5 that draws students from Districts 3, 4, 5, and 6. While one could argue about whether it should or shouldn’t be located in District 5 for an analysis of segregation, its inclusion is helpful to illustrate an example where the segregation index comes to a very different conclusion about the level of segregation than the dissimilarity index or Thiel’s H.

The segregation index, by contrast, estimates that District 2 has nearly three times as much within-district segregation of White students as District 5. According to the segregation index, the average school in District 2 is 13.9 percentage points away from the district-wide percentage of White sixth graders, while the average school in District 5 is 4.6 percentage points away. While one school in District 5 has a vastly different share of White sixth graders than all the others, the segregation index treats this as just one of 23 schools in District 5. Because the majority of schools are fairly close to the districtwide average share of White sixth graders, District 5 is considered to have modest within-district segregation of White students. District 2, by comparison, is considered to have higher within-district segregation of White students because a large number of schools have a considerably higher or lower share of White sixth graders than the district average.

Figure B4 – According the dissimilarity index, Roosevelt and Hempstead have the highest within-district segregation of White students in New York State.



Source: NYSED enrollment data. Includes all schools in each district that enrolled sixth graders in 2019-20.

The emphasis that the dissimilarity index and Theil’s H place on small groups of students can perhaps best be seen in two school districts on Long Island: Roosevelt and Hempstead. According to the dissimilarity index, these two districts have the most within-district segregation of White sixth graders in New York State. According to Theil’s H, Roosevelt and Hempstead have the third and eighth most within-district segregation of White sixth graders, respectively.

According to the segregation index, there is a negligible amount of within-district segregation of White sixth graders in the two districts.

What distribution of White enrollment leads to such disparate conclusions? Figure B4 provides the answer. Roosevelt has three White sixth graders, all of whom are concentrated in a single school. Hempstead has five White sixth graders, four of whom attend one school and the fifth of whom attends a second school. While spreading out these students so that each school had approximately one White student would technically lower the dissimilarity index and Theil's H to zero – changing these districts from the highest to the lowest within-district segregation for White students – it would be hard to argue that any meaningful change had taken place. Both the dissimilarity index and Theil's H can be heavily influenced by unusual distributions of very small groups of students. By contrast, when used for calculating within-district segregation, the segregation index gives little weight to groups that make up a small share of a district's enrollment.

Ultimately, none of these three metrics is inherently better than the others. Each metric measures segregation as it is defined, and there are pros and cons to using each. For this study, we define and use the segregation index because we feel it has several properties that make it useful for tracking segregation longitudinally over time. First, it is straightforward to calculate and understand, with the result simply indicating how many percentage points a school is from the district average for a particular characteristic. Second it can be calculated for non-binary categories and for multiple levels of segregation (e.g. within-school, within-district, between-district) in an intuitive way. Third, as we have shown in this appendix, it tends to focus attention on those districts where integration efforts are likely to have the biggest impact. While changes in the distribution of small groups of students might significantly alter the dissimilarity index or Theil's H, these small changes will be given little weight by the segregation index.

As shown in Figure A4, all three segregation measures lead to similar conclusions for economic and racial segregation in Districts 3 and 15. However, for many smaller districts, or districts with fewer students in a particular group, they might lead to very different conclusions. We think the segregation index defined in this study provides a useful and consistent measure for states, districts, and researchers to use when prioritizing districts for integration efforts and tracking the results of those efforts over time.