Measuring the Black-White Dissimilarity Index in Williamsburg and James City County Public High Schools

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Abstract

In 2007, the Williamsburg-James City County (WJCC) School Board chose to open a third high school and redistrict the attendance of their public high schools.

I used a measure of racial unevenness to assess what this decision did to racial segregation in the school district. Using the black-white dissimilarity index, I found that the high schools have had increasing racial segregation from 2000 to 2015, with a significant increase due to the new school.

As the WJCC school board, students, and families move forward, they should be careful to measure and address the levels of segregation in the district.

Keywords

Introduction

In 1954, the United States Supreme Court ruled in *Brown v. Board of Education of Topeka* that the segregation of education was "inherently unequal." This decision ruled that *de jure* segregation was a violation of the Equal Protection Clause of the 14th Amendment to the Constitution. As a result, public schools across the country were forced to integrate, consolidating schools, bussing students across counties, and establishing lottery systems.

64 years after *Brown*, numerous academic and policy advisors such as Professor Sheryll Cashin believe that very little school integration has persisted into the 21st century. She writes "we now profess to believe that the United States should be an integrated society and that people of all races are inherently equal…Here is the reality: While we accept these values in the abstract, we are mostly pretending that they are true." (2005, p. x).

Cashin further explains the costs of segregation, both residential and institutional, on student achievement. She connects the growth of the racial achievement gap to the regrowth of segregation in schools, saying "black and Latino children tend to be in schools where large numbers, if not a majority, of their peers come from low-and moderate-income backgrounds." (2005, p. 233). In refusing to accept racial segregation as a byproduct of economic choice, but rather as bound up in centuries of American racialized policy, Cashin makes a compelling argument for integration efforts to continue explicitly including race.

When the Williamsburg-James City County School Board redistricted the middle schools for the 2018-19 school year and the opening of a fourth middle school, *The Virginia Gazette* reported that balancing socioeconomic diversity was one of the main concerns (Williams, 2017).

It is well-accepted that integrating lower income students into a higher median income school has a positive effect on the lower socioeconomic status students with little to no negative effect on the outcomes of the higher socioeconomic status students.

The other concern in redistricting was distance travelled to school and the costs associated with transporting students to a farther away school. (Williams, 2017). The board chose not to redistrict high schools at the same time, the boundaries of which last changed in 2007 with the opening of the third high school, Warhill HS.

Literature Review

There have been economic studies of both the normative impact of integrated schools and the positive scale of integration. This paper focuses on the amount of school integration, not what integration does. Reardon and Owens divide the eras of integration into parts. The first is the desegregation era, from 1954-1980, when the original school integrations began. This period contains the era of Massive Resistance, when parents at white southern schools protested integrations and even succeeded in shutting down their public schools for month or even years rather than integrate. However, this period also contains the Supreme Court's *Green v. County School Board of New Kent County* (1968) decision, which created court-ordered desegregation plans, forcing many school districts to integrate for the first time. Reardon and Owens point out that while within-district segregation decreased after the desegregation era, between-district segregation increased, particularly in the smaller school districts of the North. (2014, p. 202). As this paper examines one school district, it measures within-district segregation.

The second era of integration represents either a stalling of integration or resegregation, depending on the study. Some studies find that since 1980 school segregation has been

increasing, with black-white exposure decreasing since 1988. (Orfield, 2001). Others have found that segregation has not risen significantly. The difference in findings in these studies corresponds with different measures of segregation. The two major types of measurement are measures of isolation or exposure and measures of unevenness.

Reardon and Owens explain that indices of exposure (or isolation) measure "the extent to which students are enrolled in schools with high or low proportions of a given racial group." (2014, p. 201). Unevenness measures, including the black-white dissimilarity index, measure how evenly racial populations are spread out across the schools. Since recent school boundary change discussions in Williamsburg-James City County public schools have focused on the evenness of the distribution of minority and economically disadvantaged students across the district, I chose to measure evenness. Massey and Denton argue that segregation occurs in different ways, and that unevenness and lack of exposure are two of these ways. They argue that the dimensions of segregation, while related, are different, so it makes sense that focusing on different ones yields different results, and that the best practice is for the field to accept measures of all these dimensions. (1988, p. 283).

However, since recent school boundary change discussions in Williamsburg-James City County (WJCC) public schools have focused on the evenness of the distribution of minority and economically disadvantaged students across the district, I chose to measure evenness before and after the boundary changes resulting from addition of the third high school.

Subsequent research has acknowledged the importance of other dimensions of segregation, even when only analyzing one. One such study found that black-white unevenness increases with black-white achievement gap. The authors of this paper argue that due to

education's role in determining economic outcomes, which has only increased from the 1950s in the post-industrial knowledge-based economy, "the black/white achievement gap is a vital element in the creation and reproduction of economic inequality between blacks and whites." (Condron, Tope, Steidl, and Freeman, 2012).

Other methodologies and focuses have also entered the field of segregation studies. For example, some researchers have used GIS to measure the effects of charter, private, and magnet schools on segregation using GIS (Sohoni & Saporito, 2009). Others have measured academic achievement in more and less integrated schools (Ryabov & Van Hook, 2006). However, the black-white dissimilarity index, a measure of unevenness, remains widely used and is an excellent place to start a segregation study of a specific area, such as the Williamsburg-James City County (WJCC) public school district.

Data and Methods

Little research has been done on racial segregation at the small WJCC school district, so I measured the black-white dissimilarity index myself. I did this by using the National Center for Education Statistics' Common Core of Data (CCD) for the 2000-2001 to 2015-2016 school years, with 2015-16 as the last year of published data. The CCD reports the number of students in virtually every school in America, , along with some simple demographic data, such as race. I then calculated the black-white dissimilarity index at the high school level using the formula

$$\frac{1}{2}\sum_{i=1}^{N}|\frac{b_i}{B}-\frac{w_i}{W}|$$

where b_i = the black population of each i school, B = total black population of the high schools, w_i = the white population of each school, and W = the total white population of the high schools.

As the CCD publishes these values and not calculated indices such as the black-white dissimilarity index, I did the arithmetic myself to generate the data I needed. The following table shows my results.

Table 1. Annual black-white dissimilarity index of WJCC high schools.

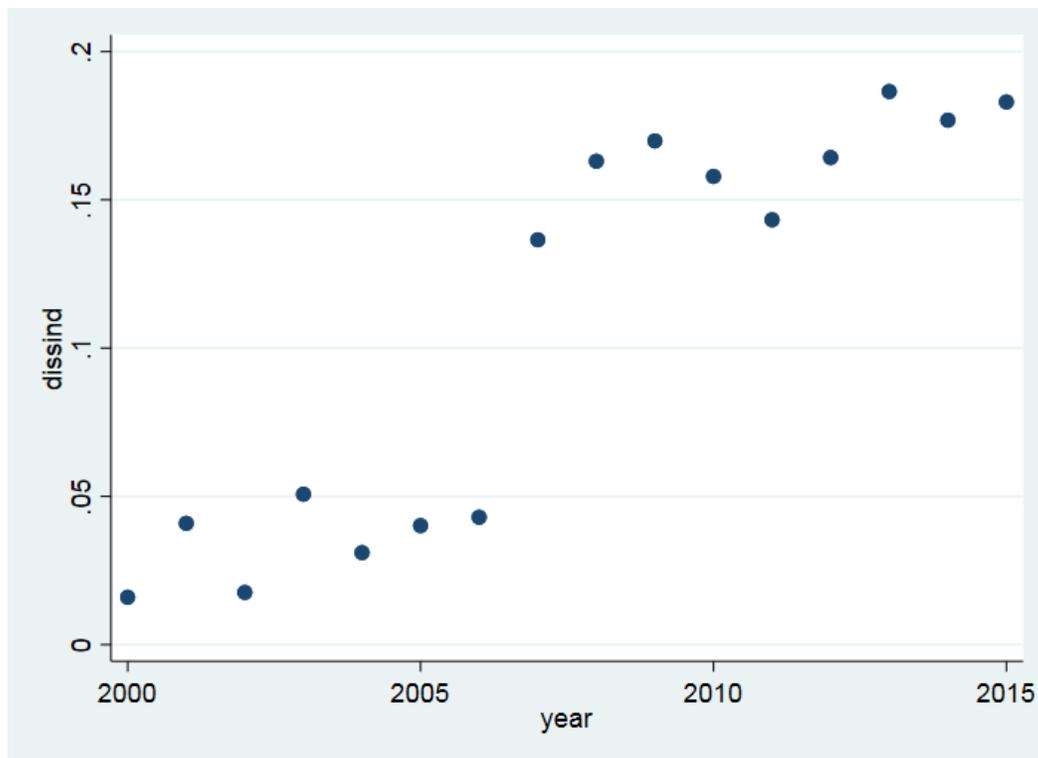| year	dissimilarity index
2000	0.016
2001	0.040911
2002	0.017604
2003	0.050729
2004	0.031025
2005	0.040135
2006	0.042967
2007	0.136514
2008	0.163029
2009	0.169874
2010	0.157907
2011	0.143277
2012	0.16426481
2013	0.186539
2014	0.176865
2015	0.183

The black-white dissimilarity index can be interpreted as the percent of one of the groups that would have to move for the smaller area, in this case the individual high schools, to match the distribution of the larger area, in this case the WJCC school district at the high school level. For example, in 2015, that would mean 18% of the white students would have to be moved to have an even number of white and black students across the three schools.

Analysis

My hypothesis was that opening a new high school and redrawing the boundaries of all of them would increase integration, as measured by the black-white dissimilarity index across the

three high schools. I hypothesized that the opening of the third high school in 2007 would increase evenness, as it gave the school board the chance to move students from one school to another, since in 2017, the school board made it clear that such a balance was one of their goals. Instead, the 2007- 08 school year and the opening of Warhill HS shows a marked increase in the dissimilarity index, as shown below. When I checked the online archives of papers that covered the 2017 redistricting, I could not find a similar diversity statement for the 2007 decision.

Fig 1. Annual black-white dissimilarity index of WJCC high schools.

I ran regression analysis to examine this relationship. First using a simple descriptive model of $Y = b_0 + b_1 X_a + \varepsilon$, where Y = the dissimilarity index, X_a is a dummy variable for whether or not there was new high school built that year, and ε is the error term. Since this is time series-data, which may be non-stationary, I performed an Augmented Dickey-Fuller test. With lags of 0, 1, and 2, the ADF could not reject the null hypothesis that the data was

nonstationary. The test stopped at two lags since this is annual data. When I ran the regression in first differences, or $D.Y = b_0 + D.b_1 X_a + \varepsilon$, the data was stationary.

I then graphed the residuals of the regression over time, indicating heteroskedasticity. Since these residuals appeared to have a pattern where they become less spread out over time, I added a time trend to the regression. This makes the model $D.Y = b_0 + D.b_1 X_a + X_t + \varepsilon$, where X_t is the time trend. The addition of time eliminated the pattern in the residuals. Since this sample is so small, heteroskedasticity was a big concern, but the addition of time resolved it.

I then preformed a Breusch-Godfrey test for autocorrelation, which did not indicate the presence of autocorrelation. The final regression showed the opening of the new school as a statistically significant explanatory variable for the change in black-white dissimilarity indices. However, the amount of explanation is quite small. After seeing the pattern in Figure 1, I was interested in the separate slopes of the dissimilarity indices before and after the break in 2007.

I regressed the dissimilarity index from 2000 to 2006 and 2007 to 2015 on time and found a significant, positive relationship for both. This means that the slight upward trend that I thought I observed in each half of the plot in Figure 1 is a real, significant trend.

These findings suggest that independent of the boundaries drawn by the school board, segregation is increasing in WJCC high schools. One reason could be parental perceptions about the reputations of the schools. I was informed by a student teacher that Jamestown HS was known as the "country club school" due to its high concentration of white, upper- middle class students. Jamestown HS also has a partnership with the science Governor's School, a highly selective program for upperclassmen. The draw of this elite program could also contribute to white affluent parents moving to the Jamestown boundary area, an effect known as "residential selection", resulting in an excess of white students at Jamestown HS.

Conclusion

The results from this analysis show that the 2007 WJCC redistricting increased black-white dissimilarity and that dissimilarity has increased (more slowly) over time without redistricting. Further analysis, including calculating dissimilarity indices for the WJCC middle and elementary schools is needed to see if the problem persists across grade levels. Since the high schools are the largest units in the district, I would be surprised if the middle and elementary schools had lower levels of unevenness. These results fit into the larger pattern of studies, across the United States, where measures of unevenness show increasing school segregation.

A weakness of this paper was the small sample size. I am skeptical of the true significance of the regression of dissimilarity on the new school dummy for this reason. With more historical data and data from the elementary and middle schools, the regression could be strengthened. While generating my own dissimilarity indices by hand was a time-consuming process, the index itself consolidates raw data into a more understandable form. In the future, I recommend computing this measure automatically and using it to further study segregation in the WJCC public schools.

In order to meet its objectives in achieving racial and social economic diversity across its schools, WJCC should consider a number of actions to improve inter-district integration of its schools. One option is establishing school lotteries to allow more school choice from families. Another is to redistrict so that public housing and more affluent single-family home neighborhoods are zoned to the same school. The school board should use racial segregation measures such as the demonstrated trend in the black-white dissimilarity index to inform their policymaking.

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