Cohort Racial Composition: The Impact on Student Achievement

By

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Abstract

I examine the effect racial composition of a classroom has on student achievement. Utilizing a first differencing approach to perform adjacent cohort-to-cohort comparisons, I can allow for randomness of births within a given community to produce variation of racial composition, while indirectly controlling for school and community level variables by utilizing cohort-to-cohort comparisons. I find that racial composition does influence student achievement, but many are potentially practically insignificant, although, a high concentration of Black students may be beneficial for their own math scores, and White students may have English scores that are negatively affected if the percentage of Black students increases. Overall Asian students benefit from a higher percentage of students that are Asian.

1. Introduction

Research has documented racial gaps in student achievement. White students score significantly higher on standardized tests than their minority counterparts, on average (CollegeBoard, and National Assessment of Educational Progress). Research suggests that the gap in achievement nearly dissipates once we account for the economic status of the student. If both students are of equal economic status, the effect of race on academic achievement either no longer persists or becomes practically insignificant (Hoxby and Weingarth, 2005 Todd and Wolpin 2010). Given the overall complexity of reducing the racial gaps in economic status, research has focused on differing classroom compositions that could potentially influence student achievement.

Previous research has largely focused on how different gender compositions of classrooms can affect student achievement. More specifically, how having a higher percentage of males in a classroom, affects student achievement as measured by test scores (Gottfried and Graves 2013). Results would suggest that there are certain compositions of gender that do lead to increased student achievement. I look to extend these findings to the racial composition of classrooms and the effects on student achievement. In the following section, I lay out the possible theoretical outcomes one could observe when examining racial composition differences between cohorts.

If we had two cohorts that were similar, however one cohort had a higher percentage of a specific racial group (i.e., Black students) and a lower percentage of White students we may see changes in student achievement. The achievement for the students that are

Black and are in a cohort with a higher percentage of Black students could have a higher level of achievement compared to other Black students in a different cohort who had a higher percentage of White students. The mechanism for this could potentially be that within a cohort where more individuals look like oneself, one is more capable of interacting during class, asking students for help when needed, and overall having a higher level of comfort while attending school.

Alternatively, if we have a classroom with a higher percentage of a specific racial group and a lower percentage of White students, it could be that students within that specific racial group have a lower level of achievement. Previous results suggest that when examining test scores and only looking at the differences between Black and White students, Black students will on average perform significantly worse than their White counter parts (Hoxby and Weingarth 2005, Todd and Wolpin 2010). This may in large part be due to the average difference of income. Ultimately, income is highly indicative of certain behaviors parents may take with their children prior to entering school (i.e., reading to them) that affect academic success. Therefore, it may be that by increasing the percentage of a cohort that is Black leads to this lower level of achievement. I want to examine if this result persists once we control for parent quality and income. Parent quality is a very broad term. For the current paper and other research in the field, parent quality is addressing aspects such as the education of the parent, the intelligence of the parent, and ways in which they may set their children up for success prior to school, but also during school (i.e., helping them with their homework).

Within any scenario in which the percentage of a specific racial group increases, it necessarily means a percentage reduction of other racial groups within a cohort. If there is a percentage increase in Black students, there is a percentage decrease in White students. If the first explanation (more same race students increases achievement for same race students) presented is true for all races it would suggest that given the increase in the percentage of Black students in the cohort, Black students would benefit and have increased achievement. On the other hand, the decrease in percentage of White students would lead to a negative impact on achievement for the remaining White students. Research does not support a negative effect of White students' achievement due to percentage decreases of White students (Hoxby, 2000).

If the mechanism presented for a decrease in Black student achievement when there is an increase in the percentage of Black students is contingent on the average differences between Black and White families it would not follow that increasing the percentage of White students would have negative effects on other White students' achievement. Indicating, the effect of racial composition differs between racial groups. I will proceed in the current paper trying to determine what those differences are between racial groups.

It could be that the effect of racial composition of a cohort on student achievement is non-linear. For example, an increase in the percentage of Black students within a class may have a positive effect for other Black students and no effect for their White counter-parts for low percentages of Black students, but once a certain percentage of a class is Black students, their White counter-parts have a decrease in achievement. It could be that at low percentages of Black students, White students are not negatively affected because the percentage of students that are lower achieving (Black students) is low enough to not remove resources (i.e., instructors time) from the typically higher achieving students (White students). Whereas if the percentage of Black students reaches a certain percentage, the number of struggling students no longer allows sufficient time for teachers to address students that are doing well, ultimately hurting their overall growth.

For the purposes of the current paper, I use cohort-to-cohort comparison, looking at the differences in the percentage of the cohort that is Asian, Black, Hispanic, and Other races, while using the percentage of White students as the reference group, to determine which of the above arguments is supported by data. In the current paper, Hispanic and White are mutually exclusive. My results show that having a higher percentage of Black students has a negative effect on reading scores for Hispanic students, and an increase in the percentage of White students in a cohort has a positive effect on other White students reading scores. In addition, an increase in the percentage of students that are Asian increases reading scores for other Asian students.

For math scores I find that an increase in the percentage of Black students leads to an increase of Black student achievement, but a decrease in Hispanic student achievement. An increase in White students also helps Blacks students up until a certain threshold, and Asian students benefit in math from a higher percentage of Asian students.

2. Literature Review

Overall, research that has investigated the effect racial composition of a class has on student achievement is unresolved. The following portion of the current paper will examine research that finds contrary results; ultimately, I attempt to incorporate aspects from each of the following papers in order to shed light on the true affect racial composition has on student achievement.

Haushek and Rivkin (2009) examine the achievement gap, and how it may widen throughout a students' academic career. More specifically, they examine the way the achievement gap grows between Black and White students and how initial achievement of the students may have different outcomes on the gap moving forward. To examine this question, they used the Texas Schools Project data set that consists of a panel of Texas school administration data. Each cohort contains over 200,000 students and more than 3,000 public schools.

Using results from the Texas Assessment of Academic Skills (TAAS) Haushek and Rivkin analyzed student achievement in math, of students in the same cohort. Focusing on students that progress within the same class for six consecutive years, grades third through eighth. Starting at third grade, they split students into quartiles and examine the change in achievement at fifth grade and eighth grade between Black and White students who started in the same quartile. They include fixed effects for the school grade and the year. In addition, they control for the proportion of the class that is Black and Hispanic. They also control for whether the teacher had zero years of teaching experience.

Their results suggest that for Black students, who started in the top quartile of achievement, having an increased proportion of Black students within a class lead to 0.15 standard deviation decrease of achievement in math. Whereas White students appear to be unaffected by the change. They also find that Black and White students' achievement in math is negatively affected by having a teacher with zero years of experience at both the elementary and middle school levels. Ultimately, they suggest that having a more even distribution of teaching experience, along with Black students no longer being highly concentrated in classrooms would eliminate a portion of the achievement gap.

Diette (2011) examines racial composition and the effect on student placement in advanced courses. He attempts to answer the following question: How does racial composition of a school, along with the racial composition of teachers within that school affect the representation of Black students enrolled in Algebra 1, relative to their White counter-parts? He uses data from the North Carolina Department of Public Instruction (NCDPI) for the 1997-1998 to the 2002-2003 school years. This data contains end of course examinations that will indicate whether a student had taken Algebra 1 prior to high school.

To answer the question of interest he calculates an odds ratio that suggests the likelihood of a student being placed in Algebra 1 within a specific school. The main variables of interest in this method are the percentage of the students in the grade who are

White, and that percentage squared. In addition, size of the grade, racial composition of teachers, the percent of students in the grade eligible for free and reduced lunch, the percent of students with parents who have completed a bachelor's degree, and the average test score of students on the end of the year exam are all included as controls.

Overall the results suggest that Black students as a whole in North Carolina middle schools are less likely to be placed in Algebra 1 compared to their White counter parts. However, this effect is strongest when schools most closely reach a 50% White student population. When comparing Black females to White females, a Black female is 69% less likely to enroll in Algebra 1 than a White female when the school is 50% White. This number falls to 58% less likely if the school is only 5% White and falls to 53% less likely if the school is 95% White. Results are similar for male comparisons and students overall. These results may suggest that racial composition does affect achievement. Although the work by Haushek and Rivkin and Diette suggests that racial composition of a classroom affect student achievement other research may suggest otherwise.

Todd and Wolpin (2007) examine the White-minority achievement gap and incorporate factors that may suggest that, although, racial composition may affect achievement, the magnitude of the effect potentially is being overstated due to the absence of important controls. They investigate how a mother's ability, as measured by the The Armed Forces Qualifying Test (AFQT), in addition, to home inputs can possibly account for a large portion of the variation we see in White-minority achievement gaps. AFQT is used as a measure of premarketing skill due to the timeframe the mother has completed the assessment (age 17-22). To go about determining the effect, these additional controls have, Todd and Wolpin use the National Longitudinal Surveys of Labor Market Experience-Children Sample (NLSY79-CS) with school quality data from the Common Core Data (CCD) and the American Federation of Teachers (AFT). The NLSY79-CS includes a Home Observation Measurement of the Environment survey. This survey includes questions that would produce data on whether or not a child has home inputs that have been suggested to influence cognitive abilities (i.e., how often do you read stories to your children?).

The framework for the methodology operates under the assumption that knowledge acquisition is a cumulative process that consists of current and past inputs along with a child's genetic mental capacity to produce their cognitive outcome. Given the in-depth information within the NLSY79-CS they were able to use all the aspects previously mentioned to obtain an achievement production function. To measure a child's achievement, they use the Peabody Individual Achievement Test in Reading and in Math (PIAT-R PIAT-M). Their results suggest that home inputs and a mother's abilities as measured by the AFQT are significant factors in determining a child's test score. Following these results, they look specifically at the racial test score gap between Whites and minorities. They find that if home inputs and mother's abilities are equalized anywhere from 10-20 percent of the racial test score gap is eliminated. Other research also supports the effect of racial composition on student achievement is reduced when controlling for other important factors, for example, family income. Hoxby and Weingarth (2005) investigate this aspect.

To answer the question, how does peers' race and income affect student achievement, Hoxby and Weingarth use data on third through eighth grade students in Wake County, North Carolina. Data was obtained from the North Carolina Education Research Data Center. The data set includes measures of race, gender, and free and reduced lunch eligibility. In addition, they have student scores on the North Carolina statewide end-of-grade test, which is used as the measure of achievement.

Wake County has implemented two policies that have led to the reassignment of students. Initially they attempted to reassign students based off racial desegregation. Second, based off a more normal distribution of income. Both reassignment policies are hypothesized to be a reason for student achievement discrepancies. Using these reassignments, Hoxby and Weingarth attempt to answer their question on classroom composition. They determine classroom composition through students that share the same teacher code and school year. The North Carolina Education Research Data Center claims the teacher code to have 95 percent accuracy. They then determine the year-to-year transition reasoning of a student and use the different classifications for the transition as a simulated instrument.

Their study suggests that both racial composition and the income level of students do not affect peer achievement in and of themselves. They find that if a student that is Black and poor has a ten-percentage point increase of his/her class that is also Black and poor, their achievement will fall by 0.6 points, which equates to roughly 2.5 percent of a standard deviation. For Hispanic poor students an additional ten-percentage points of students who are also Hispanic and poor leads to an achievement decline of 1.3 points, which is roughly 5 percent of a standard deviation. Both results are statistically significant, but Hoxby and Weingarth argued they are so small that they are practically insignificant, and suggest that the policies implement by Wake County are misguided. Previous research examined within the current paper has looked at the racial composition of the students within a class and the effect on student achievement, however, racial composition of the teacher may matter as well.

Dee (2004) attempts to answer the question, how does teacher and student racial matching affect student achievement? To address this question Dee uses the Tennessee Project STAR, which is a four-year longitudinal study that randomly assigns both students and teachers within participating schools into random class compositions. All data for the results were obtained through the Project STAR public-access database. Dee explains that due to the very restricted number of Asian, Hispanic, and American Indian students in the STAR project they are eliminated from the data set and only Black and White students are examined.

To answer this question initially, Dee simply identifies whether a student had a same race teacher or not and then examines the achievement of the students. Achievement was measured with the Stanford Achievement Tests (SAT) in math and reading. Given the four years of the Project STAR, Dee includes an unrestricted binary indicator that accounts for potential cumulative effects of having a same race teacher. His results suggest that for students that were assigned to a same race teacher, there was a 4-5 percentile point increase in the subject of math. In addition, there is anywhere from a 3-6-percentile point increase in the subject of reading for students that were assigned to a same race teacher. Given these results, I attempted to control for the race of the teacher within a class in my own work. Next, I shift to explanations of the papers that the current work models the identification strategy, after.

I use two papers as reference for the identification strategy. The first of the two focuses on gender compositions specifically, whereas the second will look at both gender and racial compositions of classrooms and the effects on student achievement.

Lavy and Schlosser (2011) research the way in which the gender composition of a class can potentially affect the academic achievement of students. To attempt to answer this question they use the Growth and Effectiveness Measures for Schools (GEMS) for the years 2002-2005. The GEMS is an evaluation given to all elementary and middle schools once every two years in Israel. The paper examines the effect gender composition has on high school students as well, but the results may not be applicable to the current paper. To investigate the effect gender composition has Lavy and Schlosser use a comparison of different cohorts. Using a school level fixed effect, they are able to examine how student achievement in a given school changes as the gender composition of that school changes. They find that as the percentage of female students in a class went up so did the math and science scores of students. Their results suggest that having complete gender segregation would increase achievement for female students, whilst not having a negative effect on male student achievement.

Like Lavy and Schlosser, Hoxby (2000) investigate a similar question with a similar approach. Her questions are: how do changes in gender and racial composition in adjacent years' affect student achievement? To answer these questions data was drawn from the Texas School Microdata Sample. This dataset uses administrative data on the student population of Texas public schools. The dataset includes school years 1990-91 to the school year 1998-99. She examines the effects in grades three, four, five, and six. Within this dataset, there are results for the statewide achievement test called the Texas Assessment of Academic Skills (TAAS), which includes the Stanford 9 test, which is used to measure student achievement.

The identification strategy to answer these questions is an adjacent cohort-to-cohort comparison. Hoxby examines the achievement of students that were in the same grade and school and first differenced them with the achievement of students that were in the same grade and school in the following cohort. The ideology being that the gender composition of a given class changes due to the randomness of births within a cohort. Given the students being in the same school in adjacent years, one can very plausibly eliminate important unobserved effects on achievement (policies within a school). Therefore, one can isolate the effect a change in gender composition in a given class has on student achievement. The same strategy is similarly employed to the changes in racial composition. However, one can reasonably understand the validity of the claim of racial composition of a cohort being random is potentially weaker than with gender. There could be other aspects within a community or school that are affecting the racial composition of a class that also affect achievement. For example, it could be that property value is decreasing, because of this, White families are leaving the area, and minority families are moving into the area. In addition, the drop of property value lowers tax revenue and negatively affects student achievement. To address the issue Hoxby uses the residuals of individual regressions on student achievement, that controlled for, students that are in the same school and are the same race (i.e., Black students in school three), and uses these residuals as instruments for actual racial composition. For the purpose of this paper, I do not employ this method. Instead, I argue that the use of a cohort-to-cohort comparison and the addition of school and class level controls is strong enough to eliminate the potential omitted variable bias.

The results of the analysis show that both females and males perform better on average in reading when they have a class that is a higher percentage female. More specifically in the third-grade results, Hoxby finds that a 10-percentage point increase of female students in a class leads to a rise in reading scores of .0374 points. Similar results hold true for math as well. The results for the racial composition of a class show that Black, Hispanic, and White students all perform worse in reading and math assessments, on average if the percentage of the class that was Black increases. A change in the percentage of Hispanic students only has a significant effect on other Hispanic students reading scores, leading to a slight decrease in scores. Other results include, an increase in the percentage of Asian students increases Black students' math achievement and an increase of the percentage of Native American students decrease White students' achievement in both math and reading.

3. Identification strategy

The identification strategy I implement is similar to the approach used by Hoxby (2000), however, I do not use the same instrumental variable techniques. Instead, I implement additional models that include controls that one would expect to impact student achievement as robustness checks of my baseline model.

3.1 Baseline Model

The baseline model examines the average achievement of students of a specific race, in both math and reading that are in the same grade and school, and compares them to the achievement of students that are in that same grade and school the following year (adjacent cohort-to-cohort comparison). The only control for the baseline model is the percentage change in the racial composition between adjacent cohorts. To achieve this cohort-to-cohort comparison the model is first differenced, which leads to the following:

$$Eq\ 1: A_{Black,gfc} - A_{Black,gfc\text{-}1} = \beta_0 + \beta_1(p_{Black,gfc} - p_{Black,gfc\text{-}1}) + \beta_2(p_{Asian,gfc} - p_{Asian,gfc\text{-}1}) + \beta_3(p_{Hispanic,gfc} - p_{Hispanic,gfc\text{-}1}) + \beta_4(p_{other,gfc} - p_{other,gfc\text{-}1}) + (\boldsymbol{t}) + (\epsilon_{Black,gfc} - \epsilon_{Black,gfc\text{-}1})$$

where $A_{Black,gfc}$ is the achievement in math or reading as measured by the California Standardized Test (CST) of Black students in grade g in school f in cohort c. With first differencing, I then subtract the achievement of Black students in grade g in school f in cohort c-1 (the previous cohort). The variables of interest are the change in percentage,

$p_{Black,gfc,}$ $p_{Hispanic,gfc,}p_{Asian,gfc,}p_{Other,gfc}$ of Black, Asian, Hispanic, and other students respectively in the same grade, school, and cohort with the students in the previous cohort. β_0 is a constant term and ϵ is the error term of Black students' achievement in grade g in school f in cohort c which is then differenced with the error term on Black students' achievement in grade g in school f in the previous cohort. I would expect the error term to be correlated with observations of the same school in different years, therefore all models are cluster at the school level. t_y are year dummies. $\beta_1, \beta_2, \beta_3, and\ \beta_4$ are the coefficients of interest that measure the effect a percentage point change of a specific racial group has on Black students' achievement.

Parallel equations are implemented to examine the achievement of each race previously controlled for in the baseline model besides students of other racial groups, instead the achievement of White students is examined, with other as the reference group (Asian, Black, Hispanic, and White). As mentioned previously, a simple cohort-to-cohort comparison may not examine the true relationship between racial composition changes and student achievement; therefore, I implement three additional models. First a model that will examine if racial composition still has an effect on achievement while I control for other factors, second I examine if racial composition has a non-linear effect, and finally I implement a non-linear model while also adding additional controls that have been supported to impact student achievement.

3.2 Linear Model with School Level Controls

The linear model with additional controls examines the same dependent variables, student achievement as measure by the CST, and a vector of school level variables that is described below. This model is as follows:

$$Eq\ 2: A_{Black,gfc} - A_{Black,gfc\text{-}1} = \beta_0 + \beta_1(p_{Black,gfc} - p_{Black,gfc\text{-}1}) + \beta_2(p_{Asian,gfc} - p_{Asian,gfc\text{-}1}) + \beta_3(p_{Hispanic,gfc} - p_{Hispanic,gfc\text{-}1}) + \beta_4(p_{other,gfc} - p_{other,gfc\text{-}1}) + \delta_1(\boldsymbol{X_f} - \boldsymbol{X_{f\text{-}1}}) + (\boldsymbol{t}) + (\epsilon_{Black,gfc} - \epsilon_{Black,gfc\text{-}1})$$

δ_1 is a school level vector that consists of percentage of students, free and reduced lunch eligible, average years of experience of teachers, percentage of the teachers that are female, percentage of the teachers who have at least their master's degree, percentage of the teachers who are Black, percentage of the teachers who are Hispanic, and percentage of the teachers who are White. This vector is first differenced with the values from the previous year. $A_{Black,gfc}, \beta_1, \beta_2, \beta_3, \beta_4 \beta_5, \boldsymbol{t}, \epsilon_{Black,gfc}$ are all as previously defined. Parallel equations for Hispanic, Asian, and White students achievement are all examined, with the equation for White students including $\beta_4(p_{White,gfc} - p_{White,gfc\text{-}1})$ instead of $\beta_4(p_{other,gfc} - p_{other,gfc\text{-}1})$. I add a non-linear model to address the potential different effects his may have on student achievement in the following section.

3.3 Non-Linear Model

The Non-Linear Model examines the same dependent variable while excluding school level variables, however includes the squared percentage of student race (Black, Hispanic, Asian, and other). Which gives the following equation:

$$Eq\ 3\text{:}\ A_{Black,gfc} - A_{Black,gfc\text{-}1} = \beta_0 + \beta_1(p_{Black,gfc} - p_{Black,gfc\text{-}1}) + \beta_2(p_{Black,gfc} - p_{Black,gfc\text{-}1})^2 + \beta_3(p_{Asian,gfc} - p_{Asian,gfc\text{-}1}) + \beta_4(p_{Asian,gfc} - p_{Asian,gfc\text{-}1})^2 + \beta_5(p_{Hipsanic,gfc} - p_{Hispanic,gfc\text{-}1}) + \beta_6(p_{Hipsanic,gfc} - p_{Hispanic,gfc\text{-}1})^2 + \beta_7(p_{other,gfc} - p_{other,gfc\text{-}1}) + \beta_8(p_{other,gfc} - p_{other,gfc\text{-}1})^2 + \boldsymbol{t} + (\epsilon_{Black,gfc} - \epsilon_{Black,gfc\text{-}1})$$

$A_{Black,gfc}, \beta_1, \beta_3, \beta_5, \beta_7, t, \epsilon_{Black,gfc}$ *are as previously defined.* $\beta_2, \beta_4, \beta_6, and \beta_8$ are the additional coefficients of interest, that examine the potential non-linear effects of racial composition changes in a classroom. The final model I have included integrates the two previous and has both the school level controls and the non-linear variables.

3.4 School level controls with Non-linear

The school level controls with Non-linear controls will allow for the examination of important school level variables along with controlling for the potential non-linear aspect of racial composition and the effect on student achievement. This model is likely the strongest in its ability to account for as many relevant factors as possible. It not only controls for non-linearity in the results but also the previously defined additional controls, therefore this is likely the most valid model. By including both of these aspects, the following model is generated:

$$Eq\ 4: A_{Black,,gfc} - A_{\text{Black},gfc\text{-}1} = \beta_0 + \beta_1\left(p_{Black,gfc} - p_{Black,gfc\text{-}1}\right) + \beta_2\left(p_{Black,gfc} - p_{Black,gfc\text{-}1}\right)^2 + \beta_3\left(p_{Asian,gfc} - p_{Asian,gfc\text{-}1}\right) + \beta_4\left(p_{Asian,gfc} - p_{Asian,gfc\text{-}1}\right)^2 + \beta_5\left(p_{Hipsanic,gfc} - p_{Hispanic,gfc\text{-}1}\right) + \beta_6\left(p_{Hipsanic,gfc} - p_{Hispanic,gfc\text{-}1}\right)^2 + \beta_7\left(p_{other,gfc} - p_{other,gfc\text{-}1}\right) + \beta_8\left(p_{other,gfc} - p_{other,gfc\text{-}1}\right)^2 + \boldsymbol{\delta_1}\left(\boldsymbol{X'_f} - \boldsymbol{X'_{f\text{-}1}}\right) + (\boldsymbol{t}) + (\epsilon_{Black,gfc} - \epsilon_{Black,gfc\text{-}1})$$

$A_{Black,gfc}, \beta_1, \beta_2, \beta_3, \beta_4, \beta_5, \beta_6, \beta_7 \beta_8 \beta_9. t, \epsilon_{Black,gfc}$ are as previously defined. $\boldsymbol{\delta_1}$ is the same school level variables as defined in the Linear School Level Controls model. The next section will provide more specific information into the data set in its entirety.

4. Data

The data set was obtained from individual files that are all retrievable from the California Department of Education. Mean Scaled Scores of aggregate student level data by race in adjacent cohorts for the California Standards Tests-Math (CST-M) and the California Standards Tests-English (CST-E) are the dependent variables in all the models examined. Both the CST-M and CST-E have a score range of 150-600. The panel begins in 2002-03 school year, ends in 2011-12 school year, and consists of all California public schools. Years as early as 1998-99 school year are available; however, necessary school identifying information was not publically accessible. In the current paper, the only grade that has been examined is 4th to ensure that the students are in elementary school. Future research should look to extend these methods to different education levels.

As seen in Table 1 there are substantially more test scores for Hispanic students (41,887 English scores and 41,935 math scores) than there are for the other races. Hispanic students had an average English score of 343.055 and an average Math score of 355.237, both of which demonstrate an increasing trend over time. Whereas there are the fewest Black scores available, 6,899 English scores and 6,921 math scores. Black students have and average English score of 335.326 and an average Math score of 336.135, both of which also demonstrate an increasing trend over time. Test scores in both Math and English for Asian and White students also have a similar increasing time trend. The number of observations of each racial group is representative of the population of California as a whole. The number of observations for each racial group would seem to be enough to capture any effects that may be present within the model. Given all the models implemented use first differencing to look at adjacent cohort-to-cohort comparison, it is important that there is enough variation in our factors so if there is an effect it can be detected. Looking once again at Table 1, the lowest standard deviation of any variable is the Mean Scaled Score English of Hispanic Difference, which is 14.285. The variation of the dependent variables seems to be acceptable for a first differencing approach and now I will address the variation of the controls in the implemented models. The time trend being positive in all tests is accounted for with the time dummy; this should minimize the time variant effects of the test.

Table 2 shows that the percentage of students that are Hispanic and Asian both appear to have an increasing time trend, 0.95 percent and 0.027 percent, respectively. While the percentage of Black and White students have a decreasing time trend, 0.178 percent and 0.993 percent, respectively. The percentage of Asian Students Differenced has the lowest standard deviation of 4.843. Although there is no standard for the proper amount of variation needed for first differencing, I proceed with the understanding that if there is not enough variation within the data set I may fail to find statistical significance in some of the variables of interest. I examine the results of the paper in the following section.

5. Results

The following section outlines the results by subject, first looking at the effects of class racial composition on English for each racial group. I then outline the effects of class racial composition on math in each racial group. Table 3 contains the results for achievement in both English and math for Black students. Each separate column corresponds with a different model, the baseline, the non-linear, the school level controls with non-linear, and the school level controls, respectively. Table 4 follows the same format, however, reports the results for Hispanic students. Table 5 and Table 6 also follow the aforementioned format while reporting Asian and White students' results.

5.1 English Results

All results discussed in the current section are illustrated in Table 3. I fail to find evidence that an increase of the percentage of any racial group and a decrease in the percentage of White students influences English test scores of Black students in three of the four models examined. However, in the school level controls model I find that an increase in percentage of Asian students increases Black students' English scores. Given there were a 10-percentage point increase in Asian students and a 10-percentage point decrease in White students I would expect Black English scores to increase by 1.56 points, holding all else constant. This result is significant at the 10 percent level.

All results discussed in the current section are illustrated in Table 4. I find that in both of the linear models an increase in the percentage Black students and a decrease in the percentage White students leads to a decrease in Hispanic English scores. In the baseline model, I find that a 10-percentage point increase of Black students and a 10-percentage point decrease in White students would lead to a 1.23-point decrease of Hispanic English scores, holding all else constant. Similarly, the school level controls suggest that a 10 percentage point increase in Black students would lead to a 1.14-point decrease in Hispanic English scores, holding all else constant. Both of these results are significant at the one percent level. Similar results are found in the non-linear models as well.

Testing the joint significance of the percentage of Black students and the percentage of Black students squared, I find that an increase in the percentage of a class that is Black compared to a decrease in the percentage of White students will have a decreasing effect on Hispanic English scores until more than 93 percent of the class is Black, at which point I fail to find evidence that an increase in the percentage of Black students any longer has an effect on Hispanic English scores, holding all else constant.

The effect each additional percentage of Black students has a smaller effect on Hispanic test score than the previous percentage increase. When examining the school level non-linear model, I find that for all percentages of Black students up until 68 percent, there is a decreasing effect on Hispanic test scores, however, this effect changes to increasing once a class has eclipsed 68 percent Black students. The joint significance shows that for all percentages from one to 71 are statistically significant. Therefore, as the percentage of Black students increases and White students decrease, Hispanic English scores will decrease. This effect will diminish as the percentage of the class that is Black approaches 68 percent, and an increase in Black students after this value will have a positive effect on Hispanic English scores until 71 percent of the class is Black, holding all else constant.

All results discussed in the current section are illustrated in Table 6. In the linear models, there is only evidence that an increase in the percentage of Asian students will affect Asian English scores. In the baseline model a 10-percentage point increase in Asian students compared to a 10-percentage point decrease of White students, will lead to a 1.24-point increase of Asian English scores, holding all else constant. This result is significant at the one percent level.

When I examine the joint significance of percentage of Asian students and the percentage of Asian students squared, I find that a percentage increase of Asian students would have a positive effect on Asian English test scores until 59.25 percent of the class is Asian. As the class exceeds 59.25 percent Asian, additional increases to the percentage of Asian students would lead to a decreasing effect of Asian English scores. The joint test reaches significance at levels of one percent to 93 percent. As the percentage of the class that is Asian increases each additional percentage point increase has a smaller increasing effect than the previous percentage point increase up until the 59.25 threshold is reached. For all percentage point increases beyond 59.25 percent the decreasing effect is smaller than the previous percentage point increase until 93 percent of the class is Asian, beyond this I fail to find evidence of an effect on English scores.

All results discussed in the current section are illustrated in Table 5. In both of the linear models examined I find evidence that a percentage point increase of Black students and a percentage point decrease to the reference group (other race students) will have a decreasing effect on White English scores. In the baseline model, a 10-percentage point increase in Black students and a 10-percentage point decrease to the reference group would lead to a 0.74-point decrease of White English scores, holding all else constant. While the school level controls showed the same change would have a 0.68 decrease in White English scores, holding all else constant. These results reach significance at the five percent and 10 percent levels, respectively.

Examining the joint significance of the percentage of a class that is Black and the percentage of a class that is Black squared, I find that an increase in Black students has a negative effect on White English scores until 53.5 percent of the class is Black. However, I only find evidence of joint significance from classes that are one percent Black to 31 percent Black. Each additional percentage point increase has a smaller negative effect than the previous percentage point increase until the 31 percent threshold is reached.

Percentage of White students and percentage of White students squared also has an effect on White English scores when I test the joint significance. I find that for all percentages of White students beyond 8.023 percent there is a decreasing effect on White English scores, however, this effect only reaches significance for levels from 61 percent White students to 80 percent White students. Therefore, any percentage point increase in White students that would make a class more than 61 percent White but less than 80 percent White would lead to a decrease in White English scores. Each additional percentage point increase would have a larger effect than the previous percentage point change.

5.2 Math results

All results discussed in the current section are illustrated in Table 3. For Black students I fail to find evidence that a percentage increase of any of the races examined and a decrease in the percentage of White students would lead to a significant difference in either of the linear models that were examined. There are results that reach significance in the non-linear models after testing the joint significance of the race and race squared variables.

For the non-linear model the results indicate an increase in the percentage of Black students has an increasing effect on Black Math scores until 25 percent of the class is Black, and a decreasing effect at all percentages beyond 25. I fail to find evidence of there being joint significance until the percentage of Black students reaches 82 percent, therefore, all percentage point increases that surpass 82 would lead to a decreasing effect on Black Math scores, holding all else constant. The magnitude of the decreasing effect increases as the percentage continues to surpass 82. I find joint significance for the percentage of Hispanic students and the percentage of Hispanic students squared at percentages from one to 81. An increase in the percentage of Hispanic students and a decrease in the reference group has an increasing effect on Black Math scores until the percentage of the class that is Hispanic surpasses 81, holding all else constant. Each additional percentage point of Hispanic students in a class has a smaller increasing effect than the previous percentage point increase.

The percentage of other race students and other race students squared reaches significance when tested jointly. An increase in the percentage of other students and decrease in the percentage of White students has a decreasing effect until the percentage of a class that is other race students reaches 57.5 percent, after which an increase in the percentage of other race students has an increasing effect. These variables reach significance at all percentages from one to 75, holding all else constant. In the school level controls with non-linear model I find that the percentage of Black students and the percentage of Black students squared reaches joint significance from one to seven percent. At all values that reach significance an additional percentage point of Black students has a positive effect on Black Students Math scores, however, each additional percentage increase leads to a smaller increase than the previous percentage point increase.

All results discussed in the current section are illustrated in Table 4. In both linear models I find evidence that a percentage increase of Black students and a percentage decrease of White students has a decreasing effect on Hispanic Students Math scores. In the baseline model, a 10 percentage point increase in Black students and a 10 percentage point decrease of White students would lead to a 1.38-point decrease of Hispanic math scores, holding all else constant. The school level controls model finds similar results, with the point change being a 1.33-point decrease to Hispanic math scores, holding all else constant. These results reach significance at the five percent and one percent levels, respectively. I find that in the non-linear models the joint significance of the percentage of Black students and percentage of Black students also has an effect on Hispanic math scores.

In the non-linear model I find that an increase in the percentage of Black students has a decreasing effect on Hispanic math scores and this reaches significance for all percentages of Black students, holding all else constant. This decreasing effect increases in magnitude with each additional percentage point increase. When examining the school level controls with non-linear component I find that increasing the percentage of Black students while decreasing the percentage of White students also has a decreasing effect on Hispanic Math scores for all percentage levels from one to 73, holding all else constant. The negative effect decreases in magnitude for each additional percentage point added. I will now examine the changes of racial composition has on Asian math scores.

All results discussed in the current section are illustrated in Table 5. In the baseline model I find that changing the percentage of students that are Black and Hispanic both have decreasing effects on Asian Math scores. I find that a 10 percentage point increase in Black students and a 10 percentage point decrease of White students leads to a 1.84-point decrease of Asian math scores, holding all else constant. In addition, I find that a 10 percentage point increase in Hispanic students leads to a 1.17-point decrease of Asian math scores, holding all else constant. Both of the previous results reach significance at the 10 percent level. I now look at the nonlinear models

Testing the joint significance of the race variables and the race variables squared in the non-linear model I find increasing the percentage of Asian students has an increasing effect on Asian math scores. For all percentage levels from one to 37 a percentage, increase of Asian students and a decrease in White students will have an increasing effect on Asian math scores. This increasing effect decreases in magnitude with each percentage point increase. In the school level controls with non-linear model I find that an increase in the percentage of Hispanic students has a decreasing effect on Asian math scores for all percentages 63 and greater of Hispanic students, holding all else constant. For each additional percentage point increase beyond 63 the decreasing effect increases in magnitude. I now will examine the effects racial composition has on White math scores.

All results discussed in the current section are illustrated in Table 6. In both linear models I find that an increase in the percentage of White students and a decrease in the percentage the reference group leads to an increase in White math scores. For the baseline model, a 10 percentage point increase in White students would lead to an increase of .79-points for White math scores, holding all else constant. This result is significant at the one percent level. For the school level control model, a 10 percentage point increase in White students leads to a 1.09-point increase in White test scores, holding all else constant. The following section will examine the effects that the school level controls had on test scores.

5.3 School level controls effects on Math and English scores

For both Black and Hispanic students an increase in the percentage of students who are free and reduced lunch eligible (FRE) has a decreasing effect on their Math and English scores. A 10-percentage point increase in students that are FRE and a 10 percentage point decrease to students that are not FRE eligible leads to a 0.68-point decrease in Black English scores, holding all else constant. This same change had a 1.19-point decrease in Black Math scores, holding all else constant. Although the magnitude of the effect was smaller Hispanic students scores are also negatively affected. A 10 percentage point increase in students that are FRE leads to a 0.33-point decrease in Hispanic English scores and a .58-point decrease in Hispanic Math scores, holding all else constant. For Asian students I only find enough evidence to claim an effect for their English scores. A 10 percentage point increase in students that are FRE leads to a 0.73-point decrease to Asian English scores, holding all else constant. Whereas there is only enough evidence for White students to claim that a 10 percentage point increase in students that are FRE leads to a 0.47-point decrease in White Math scores.

Both Hispanic and White students' English scores are increased with an increase in the percentage of teachers and administrators that are female. For Hispanic students, a 10 percentage point increase in teachers and administrators that are female leads to a 36.27-point increase in English scores, holding all else constant. For White students, a 10 percentage point increase in teacher and administrators that are female leads to a 51.99-point increase to English scores, holding all else constant. I will now examine the effects student-teacher racial matching has on student achievement.

I only find evidence that a change in the percentage of teachers and administrators that are Black Effects Black Students' Math scores. A 10 percentage point increase in teachers that are Black leads to a 117.76-point increase to Black math scores, holding all else constant. Black students are also the only group that enough evidence is found to claim changing the percentage of teachers and administrators that are Hispanic has an effect on achievement. For Black students'English scores, a 10 percentage point increase in teachers and administrators that are Hispanic leads to a 113.07-point decrease, holding all else constant. Hispanic students are affected by a change in the percentage of teachers and administrators that are White. For both Hispanic English and Math scores an increase in the percentage of White teachers and administrators has an increasing effect. A 10 percentage point increase of White teachers and administrators leads to a 28.32-point increase in English, and a 36.64-point increase in Math, holding all else constant.

6. Conclusion

The current paper attempts to analyze the effect class racial composition has on student achievement as measured by math and English test scores. I utilize adjacent cohort-to-cohort comparison to attempt to eliminate factors that may vary between schools and allow for the randomness of births to lead to variation between years. As mentioned previously, randomness of births may be a sounder argument for gender than it would be for racial composition, therefore, I add three additional models that attempt to eliminate factors one would expect to affect the achievement of students.

My results suggest that racial composition does have an effect on student achievement. More specifically, classes with higher percentage Black students negatively affect Hispanic Students Math and English scores and White students English scores. Whereas higher percentage Black students increases the Math scores of other Black students. In the baseline model, a higher percentage of White students was beneficial for other White students in both Math and English. In all models other than the school level control with nonlinear, a class with a higher percentage of students that are Asian would be expected lead to higher scores in English for other Asian students. For all outcomes other than White students English scores and Asian Math scores, a higher percentage of students that were FRE had a negative effect on student achievement.

Overall, the current results may suggest a benefit from the segregation of certain racial groups would be optimal for overall student achievement. However, the magnitude of the coefficients suggests that there may be no practical significance in doing so. The largest negative effect that I find is the effect the percentage of Black students has on Hispanic English scores (-0.136). Meaning a 99-percentage point increase in Black students would lead to a 13.46-point decrease in Hispanic students' English scores, which is less than half of a standard deviation. The largest positive coefficient being the effect an increase of the percentage Black students has on Black Math scores and that is 0.288. If this class were to be completely segregated, it would appear to have an increase of 28.8 points. This effect is roughly 90 percent of a standard deviation increase. One could argue that classes of 100 percent Black students would be the most beneficial for Black students and given the only other effect detected is a negative one on Hispanic Math scores, other students would not be harmed. Two other results should be noted. First, the effect of the percentage of teachers/administrators that are Hispanic on Black students English scores, and second, the effect the percentage of Black teachers/administrators has on Black Math scores. Both of these effects are very large -11.321 and 12.66, respectively. This would suggest it is greatly beneficial for Black students English scores to have a very low percentage of teachers/administrators that are Hispanic while also greatly beneficial for Black Students Math scores to have a large percentage of Black teachers/administrators. Ultimately, policies that invest in the proper racial composition of classes may only be effective at large levels of segregation, and resources should be invested into other efforts first.

Table 1. **Descriptive Statistics (Dependent Variables and Change in Dependent Variables)**				
		Obs	Mean	S.D.
Mean Scaled Score Black English		9,608	335.326	23.446
Mean Scaled Score Black Math		9,632	336.135	32.762
Mean Scaled Score Hispanic English		41,887	343.055	23.395
Mean Scaled Score Hispanic Math		41,935	355.237	31.593
Mean Scaled Score White English		31,489	378.116	27.866
Mean Scaled Score White Math		31,550	387.626	36.789
Mean Scaled Score Asian English		10,196	390.318	36.504
Mean Scaled Score Asian Math		10,219	424.169	44.684
Mean Scaled Score Black English Difference		6,899	2.96	17.47
Mean Scaled Score Black Math Difference		6,921	4.933	24.005
Mean Scaled Score Hispanic English Difference		35,371	3.738	14.285
Mean Scaled Score Hispanic Math Difference		35,414	5.421	20.987
Mean Scaled Score White English Difference		25,820	3.616	15.947
Mean Scaled Score White Math Difference		25,875	5.093	22.879
Mean Scaled Score Asian English Difference		7,558	4.271	17.817
Mean Scaled Score Asian Math Difference		7,583	6.3	25.33

Table 2. **Descriptive Statistics (Control Variables and Controlled Variables Differenced**				
		Obs	Mean	S.D.
% Students Free and Reduced Lunch Eligble		56,450	55.761	30.6
% Students Free and Reduced Lunch Eligble Differenced		48,972	1.028	9.298
% Black Students		57,200	7.582	12.88
% Black Students Differenced		49,701	-0.178	6.086
% Hispanic Students		57,200	45.044	31.068
% Hispanic Students Differenced		49,701	0.95	10.157
% White Students		57,200	32.615	28.932
% White Students Differenced		49,701	-0.993	11.294
% Asian Students		57,200	7.719	13.152
% Asian Students Differenced		49,701	0.027	4.843
% Black Teachers/Administrators		52,150	0.035	0.083
% Black Teachers/Administrators Differenced		45,418	-0.085	2.594
% Hispanic Teachers/Administrators		52,150	0.162	0.183
% Hispanic Teachers/Administrators Differenced		45,418	0.433	5.042
% White Teachers/Administrators		52,150	0.718	0.237
% White Teachers/Administrators Differenced		45,418	-0.823	8.396

Table 3 OLS estimation of Black Scores	Baseline	Non-linear	School level Controls With Non-Linear	School level controls	Baseline	Non-linear	School level Controls With non-linear	School level controls
VARIABLES	Mean Scaled Score Black English				Mean Scaled Score Black Math			
% change Black†	0.013	0.050	0.081	0.010	0.005	0.210*	0.288**	0.001
	(0.056)	(0.090)	(0.099)	(0.062)	(0.079)	(0.128)	(0.140)	(0.089)
% change Black Sq.		-0.001	-0.001			-0.003**	-0.004***	
		(0.001)	(0.001)			(0.001)	(0.001)	
% change Hispanic†	0.015	0.018	-3.80E-04	0.015	0.000	-0.086	-0.127	-0.008
	(0.055)	(0.102)	(0.112)	(0.061)	(0.073)	(0.135)	(0.152)	(0.082)
% change Hispanic Sq		-3.24E-05	1.66E-04			0.001	0.001	
		(0.001)	(0.001)			(0.001)	(0.002)	
% change Other†	-0.001	0.001	-0.029	-0.018	-0.043	-0.115	-0.104	-0.031
	(0.058)	(0.087)	(0.099)	(0.067)	(0.078)	(0.117)	(0.134)	(0.093)
% change Other Sq		-7.11E-06	1.70E-04			0.001	0.001	
		(0.001)	(0.001)			(0.002)	(0.002)	
% change Asian†	0.105	0.173	0.155	0.156*	0.070	0.104	-0.049	0.066
	(0.085)	(0.137)	(0.146)	(0.089)	(0.117)	(0.192)	(0.208)	(0.125)
% change Asain Sq		-0.002	-3.91E-05			-0.002	0.003	
		(0.003)	(0.003)			(0.005)	(0.005)	
% change in FRE			-0.068**	-0.067**			-0.119***	-0.114***
			(0.033)	(0.033)			(0.038)	(0.038)
Years of Teaching Experience			0.004	0.004			0.007	0.007
			(0.004)	(0.004)			(0.005)	(0.005)
% change of Female Teachers			-3.107	-3.022			4.403	4.741
			(4.847)	(4.850)			(6.434)	(6.463)
% change of Teachers with a Master's			1.058	1.072			4.589	4.707
			(3.418)	(3.416)			(4.689)	(4.699)
% change Black Teachers			6.709	6.894			11.776*	12.660*
			(5.051)	(4.946)			(7.002)	(7.021)
% change Hispanic Teachers			-11.307**	-11.321**			-2.853	-2.906
			(5.292)	(5.284)			(7.232)	(7.202)
% change White Teachers			-1.923	-1.874			-2.634	-2.509
			(2.298)	(2.291)			(3.276)	(3.254)
Observations	6,859	6,859	5,819	5,819	6,882	6,882	5,836	5,836
R-squared	0.039	0.039	0.046	0.046	0.020	0.021	0.029	0.027
Robust standard errors in parentheses	*** p<0.01, ** p<0.05, * p<0.1							
† the reference group is % White Students								

Table 4 OLS estimation of Hispanic Scores	Baseline	Non-linear	School level Controls With Non-linear	School level controls	Baseline	Non-linear	School level Controls With Non-Linear	School level controls
VARIABLES	Mean Scaled Score Hispanic English				Mean Scaled Score Hispanic Math			
% change Black†	-0.123***	-0.125***	-0.136***	-0.114***	-0.153***	-0.138**	-0.133**	-0.133***
	(0.026)	(0.042)	(0.043)	(0.027)	(0.037)	(0.057)	(0.059)	(0.039)
% change Black Sq.		3.70E-06	0.001			-3.83E-04	3.15E-05	
		(0.001)	(0.001)			(0.001)	(0.001)	
% change Hispanic†	-0.017	-0.006	0.006	-0.016	-0.013	-0.034	-0.016	-0.010
	(0.015)	(0.038)	(0.039)	(0.016)	(0.022)	(0.055)	(0.057)	(0.023)
% change Hispanic Sq		-1.01E-04	-2.18E-04			2.05E-04	6.09E-05	
		(-3.19E-04)	(-3.24E-04)			(4.58E-04)	(7.26E-04)	
% change Other†	-0.007	-0.025	-0.039	-0.010	-0.021	-0.006	-0.018	-0.023
	(0.019)	(0.031)	(0.033)	(0.020)	(0.027)	(0.045)	(0.047)	(0.029)
% change Other Sq		3.33E-04	0.001			-0.000	-9.66E-05	
		(-4.84E-04)	(0.001)			(0.001)	(0.001)	
% change Asian†	0.006	-0.020	-0.014	0.011	0.018	0.006	0.009	0.022
	(0.029)	(0.044)	(0.045)	(0.030)	(0.041)	(0.062)	(0.064)	(0.043)
% change Asain Sq		0.001	0.001			3.28E-04	3.50E-04	
		(0.001)	(0.001)			(0.001)	(0.001)	
% change in FRE			-0.033***	-0.033***			-0.058***	-0.058***
			(0.011)	(0.011)			(0.016)	(0.016)
Years of Teaching Experience			5.88E-05	6.04E-05			0.001	0.001
			(0.001)	(0.001)			(0.002)	(0.002)
% change of Female Teachers			3.627*	3.596*			5.030	5.030
			(2.132)	(2.132)			(3.193)	(3.193)
% change of Teachers with a Master's			0.249	0.252			0.584	0.585
			(1.089)	(1.090)			(1.601)	(1.601)
% change Black Teachers			-1.979	-1.933			-2.206	-2.220
			(3.929)	(3.931)			(5.960)	(5.953)
% change Hispanic Teachers			-0.748	-0.712			1.483	1.471
			(1.777)	(1.774)			(2.551)	(2.549)
% change White Teachers			2.832**	2.869**			3.664*	3.654*
			(1.296)	(1.295)			(1.935)	(1.934)
Observations	35,263	35,263	33,087	33,087	35,305	35,305	33,129	33,129
R-squared	0.031	0.031	0.033	0.033	0.024	0.024	0.025	0.025
Robust standard errors in parentheses	*** p<0.01, ** p<0.05, * p<0.1			† the reference group is % White Students				

Table 5 OLS estimation of Asian Scores	Baseline	Non-linear	School level Controls With Non-linear	School level controls	Baseline	Non-linear	School level Controls With Non-Linear	School level controls
VARIABLES	Mean Scaled Score Asian English				Mean Scaled Score Asian Math			
% change Black†	-0.029	-0.033	-0.062	-0.016	-0.184*	-0.126	-0.045	-0.136
	(0.071)	(0.121)	(0.133)	(0.082)	(0.106)	(0.182)	(0.193)	(0.121)
% change Black Sq.		7.98E-05	0.002			-0.003	-0.004	
		(0.003)	(0.004)			(0.006)	(0.006)	
% change Hispanic†	-0.015	-0.010	-0.035	-0.043	-0.117*	-0.040	-0.025	-0.146*
	(0.048)	(0.081)	(0.086)	(0.052)	(0.070)	(0.120)	(0.128)	(0.075)
% change Hispanic Sq		-8.30E-05	-1.43E-04			-0.001	-0.002	
		(0.001)	(0.001)			(0.002)	(0.002)	
% change Other†	0.045	0.047	-0.009	-0.001	-0.048	-0.065	-0.111	-0.116*
	(0.050)	(0.069)	(0.075)	(0.058)	(0.064)	(0.101)	(0.109)	(0.069)
% change Other Sq		3.80E-05	1.93E-04			4.83E-04	9.92E-05	
		(0.001)	(0.001)			(0.001)	(0.002)	
% change Asian†	0.124***	0.237**	0.188*	0.072	0.060	0.307**	0.214	0.003
	(0.047)	(0.101)	(0.109)	(0.050)	(0.065)	(0.135)	(0.143)	(0.069)
% change Asain Sq		-0.002	-0.002			-0.003**	-0.003**	
		(0.001)	(0.001)			(0.001)	(0.001)	
% change in FRE			-0.073*	-0.073*			-0.098	-0.098
			(0.037)	(0.037)			(0.060)	(0.061)
Years of Teaching Experience			0.005	0.006			0.003	0.003
			(0.004)	(0.004)			(0.005)	(0.005)
% change of Female Teachers			3.065	2.926			10.888	10.726
			(6.427)	(6.456)			(9.459)	(9.501)
% change of Teachers with a Master's			3.642	3.643			6.662	6.908
			(3.140)	(3.140)			(4.641)	(4.628)
% change Black Teachers			4.870	5.770			3.987	4.919
			(13.380)	(13.301)			(19.337)	(19.291)
% change Hispanic Teachers			5.446	5.574			1.815	1.836
			(7.198)	(7.210)			(10.502)	(10.511)
% change White Teachers			-1.227	-1.417			-1.495	-1.878
			(3.891)	(3.910)			(5.983)	(5.975)
Observations	7,556	7,556	6,597	6,597	7,581	7,581	6,617	6,617
R-squared	0.050	0.051	0.053	0.052	0.035	0.036	0.038	0.036
Robust standard errors in parentheses	*** p<0.01, ** p<0.05, * p<0.1			† the reference group is % White Students				

Table 6 OLS estimation of White Scores	Baseline	Non-linear	School level Controls	School level controls with Non-linear	Baseline	Non-linear	School level Controls	School level controls with Non-linear
VARIABLES	Mean Scaled Score White English				Mean Scaled Score White Math			
% change Black†	-0.074**	-0.107**	-0.077	-0.068*	-0.043	-0.092	-0.066	-0.015
	(0.035)	(0.054)	(0.058)	(0.038)	(0.048)	(0.074)	(0.081)	(0.052)
% change Black Sq.		0.001	2.30E-04			0.002	0.002	
		(0.002)	(0.002)			(0.002)	(0.002)	
% change Hispanic†	-0.032	-0.015	-0.004	-0.022	-0.023	0.015	0.069	0.009
	(0.021)	(0.041)	(0.044)	(0.023)	(0.030)	(0.058)	(0.062)	(0.032)
% change Hispanic Sq		-2.95E-04	-2.81E-04			-0.001	-0.001	
		(0.001)	(0.001)			(0.001)	(0.001)	
% change White†	0.029*	0.069	0.047	0.029	0.079***	0.077	0.074	0.105***
	(0.016)	(0.043)	(0.047)	(0.018)	(0.025)	(0.063)	(0.066)	(0.026)
% change White Sq		-4.27E-04	-1.95E-04			3.23E-05	3.30E-04	
		(4.17E-04)	(4.51E-04)			(0.001)	(0.001)	
% change Asian†	0.001	-0.063	-0.059	0.007	0.060	-0.050	-0.028	0.074
	(0.030)	(0.046)	(0.049)	(0.033)	(0.045)	(0.068)	(0.073)	(0.049)
% change Asain Sq		0.002	0.002*			0.003**	0.003*	
		(0.001)	(0.001)			(0.001)	(0.002)	
% change in FRE			-0.025	-0.025			-0.047**	-0.049**
			(0.017)	(0.017)			(0.020)	(0.020)
Years of Teaching Experience			-0.001	-0.001			0.001	0.001
			(0.002)	(0.002)			(0.002)	(0.002)
% change of Female Teachers			5.199*	5.264*			3.641	3.749
			(3.142)	(3.143)			(4.664)	(4.663)
% change of Teachers with a Master's			1.287	1.297			1.061	1.070
			(1.471)	(1.470)			(2.110)	(2.109)
% change Black Teachers			3.758	3.656			14.162	14.001
			(8.533)	(8.525)			(11.844)	(11.818)
% change Hispanic Teachers			1.773	1.690			1.969	1.926
			(3.626)	(3.621)			(5.433)	(5.431)
% change White Teachers			0.002	-0.038			3.659	3.614
			(1.704)	(1.705)			(2.598)	(2.600)
Observations	25,761	25,761	22,870	22,870	25,815	25,815	22,916	22,916
R-squared	0.038	0.038	0.038	0.038	0.025	0.026	0.026	0.026
Robust standard errors in parentheses	*** p<0.01, ** p<0.05, * p<0.1			† the refrence group is % Other race Students				

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