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ABSTRACT

A Community College Instructor Like Me: Race and Ethnicity Interactions in the Classroom*

This paper uses detailed administrative data from one of the largest community colleges in the United States to quantify the extent to which academic performance depends on students being of similar race or ethnicity to their instructors. To address the concern of endogenous sorting, we use both student and classroom fixed effects and focus on those with limited course enrolment options. We also compare sensitivity in the results from using within versus across section instructor type variation. Given the computational complexity of the 2-way fixed effects model with a large set of fixed effects we rely on numerical algorithms that exploit the particular structure of the model's normal equations. We find that the performance gap in terms of class dropout and pass rates between white and minority students falls by roughly half when taught by a minority instructor. In models that allow for a full set of ethnic and racial interactions between students and instructors, we find African-American students perform particularly better when taught by African-American instructors.

JEL Classification: I23, I24

Keywords: race, education, minorities, college

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1. Introduction

The achievement gap between historically underrepresented minority students and non-minority students is one of the most persistent and vexing problems of the educational system in the United States. African-American, Latino and Native-American students have substantially lower test scores, grades, high school completion rates, college attendance rates, and college graduation rates than non-minority students (U.S. Department of Education 2010). In particular, less than one-fifth of African-Americans and less than one-eighth of Latinos who are between 25 and 29 years old have a college degree. The levels of college completion for Non-Latino Whites are two to three times higher. With large returns to college education, these disparities in educational attainment have important implications for income and wealth inequality across racial and ethnic groups (Altonji and Blank 1999, Card 1999, Jencks and Phillips 1998).

Many social researchers and public policy makers argue that the college achievement gap may be partly explained by the general lack of minority teachers at the post-secondary level. Only 9.6 percent of all full-time instructional faculty at U.S. colleges are black, Latino or Native American (U.S. Department of Education 2010). In contrast, these groups comprise one-third of the college-age population and an even higher percentage of children. Many social scientists hypothesize that the lack of minority instructors limits the availability of role models, increases the likelihood of "stereotype threats" and discrimination against minority students, and limits exposure to instructors with similar cultures and languages.

Using a new administrative dataset with detailed demographic information on instructors as well as students from one of the largest and most ethnically diverse community colleges in the United States, this study is the first to test whether minority instructors have a positive effect on the academic achievement of minority students at the college level. The need to address this question is growing in importance. Community colleges enroll more than half of all minority students attending public universities and nearly half of all students attending public universities. Since community colleges, in addition to providing workforce training, serve as an important gateway to 4-year colleges, they can be seen as a crucial part of the post-secondary educational system in the United States. In some states with large community college systems, such as California, nearly half of all students attending a 4-year college previously attended a community college (California Community Colleges Chancellor's Office 2009). With recent calls for major expansions in enrollments and provision of 4-year transfer courses, one can expect that they will gain further importance.[1] The achievement gap is also large in community colleges with underrepresented students having lower grades, retention rates, and transfer rates (U.S. Department of Education 2010; CCCCO 2010; Sengupta and Jepsen 2006). Policy interventions targeting community colleges are therefore likely to have major effects on the educational system has a whole.

Random assignment of students to professors does not occur at a typical college. We therefore rely on a different and novel identification strategy together with previously used identification strategies to estimate student-instructor minority interactions at the classroom level. First, we take advantage of the registration priority system established at our community college and focus on students with the lowest course enrollment status.

[1] For example, President Obama has proposed an unprecedented funding increase for community colleges that aims to boost graduates by 5 million students by 2020. In California, transfers from community colleges to the California State University (CSU) system are projected to increase by 25 percent over the next decade (California Postsecondary Education Commission 2010).

Given the intense competition for classes created by negligible tuition and the absence of admissions requirements, this system is strictly enforced and has an enormous effect on course choice. Students with the lowest registration priority status have severely restricted choices in which classes to take, and they are thus close to exogenously assigned. Several tests for non-random sorting using a rich set of student and instructor characteristics support this conclusion.

Second, we explore the robustness of our results using variation in instructor race and ethnicity across rather than within sections, thus ruling out the possibility of sorting within an academic session across sections of the same course. Third, our main results focus on the differential effect between minority and non-minority students of being assigned to a minority-instructor in the same class. This answers the question whether the minority achievement gap is smaller in classes that are taught by minority instructors. As a consequence, the explanatory variable of interest varies both within student and within a class, allowing us to estimate models that simultaneously include student and classroom fixed effects. This eliminates biases coming from student specific differences common across courses and classroom specific differences common across classmates. It also leads to standardized grade outcomes, since we are only using within-class differences among students facing the same grading standards. Given the sample size – we observe over 30,000 students in nearly 21,000 classes – estimation of this model by conventional algorithms is computationally infeasible. We thus rely on an algorithm that has been applied to the estimation of firm and worker fixed effects in large administrative data.[2]

We find that the minority achievement gap is smaller in classes taken with underrepresented minority instructors with respect to various course outcomes. While

[2] See for example Abowd, Kramarz, and Margolis (1999) and Abowd, Creecy, and Kramarz (2002).

minority students are overall more likely to drop a course, less likely to pass a course, and less likely to have a grade of at least a B, these gaps decrease by 2.9 percentage points, 2.8 percentage points, and 3.2 percentage points respectively when assigned to an instructor of similar minority type. These effects are large, representing roughly half of the total gaps in the outcomes between non-minority and minority students in our data. Blacks particularly benefit from being taught by Black instructors.

We conclude that these results likely occur from students reacting to teachers rather than the other way around. First, teacher minority status strongly affects students' early dropout decisions, even before teachers have had the opportunity to grade. Second, our results are almost entirely driven by younger, not older students. If instructors react to student's minority status, we would expect to see effects for both young and old. This suggests that young students are particularly susceptible to role-model effects.

Our paper is related to a small, but growing literature that focuses on student-instructor interactions in college by gender rather than by race or ethnicity. These studies tend to conclude that female students perform relatively better when matched to female instructors (e.g. Bettinger and Long 2005; Hoffmann and Oreopoulos 2009).[3] One of these studies, by Carell, Page, and West (2010), takes advantage of random assignment of students to classrooms at the U.S. Air Force Academy. They find that female students perform better in math and science courses with female instructors. The results might differ, however, for community college students and large state college students. None

[3] There is considerably more research that studies gender interactions on the primary or secondary school level. Results have been mixed (for example, Nixon and Robinson 1999, Ehrenberg, Goldhaber, and Brewer 1995, Dee 2007, Holmlund and Sund 2005, Carrington and Tymms 2005, 2007, Lahelma 2000, and Lavy and Schlosser 2007). Dee (2004, 2005, 2007)) and Ehrenberg, Goldhaber and Brewer (1995) find some evidence of positive student-teacher interactions by gender and race at the elementary and 8th grade levels.

of these previous studies at the college level examine the impact of instructor's minority status, race, or ethnicity because of data limitations or lack of ethnic diversity. However, the effects of minority faculty on minority students may be larger because of the sizeable racial achievement gap and similarities in culture, language and economic backgrounds. By sharing these characteristics, minority instructors may be able to better communicate subject matter in their courses, provide one-on-one help, and advise minority students. Additionally, the nature and extent of racial inequality is very different than gender inequality in education, income and other outcomes.

The rest of this paper proceeds as follows: In section 2 we start with providing some institutional background and then describe and summarize the data. We also document the results from tests for non-random sorting of students across course-sections. In the next section we introduce our econometric framework. We then move on to the results-section of the paper. We finish with a conclusion.

2. Data

2.1 Institutional Background

Our analysis is based on administrative data from De Anza College, a large community college which is part of the California Community College system and which is located in the San Francisco Bay area.[4] With an average total enrolment of 22,000 students per year, De Anza College is one of the largest community colleges in the United States. It has a larger share of minority students than the nationally representative community college, reflecting the diversity of Northern California. All courses at De

[4] The California Community College system is the largest higher educational system in the United States. It includes 110 colleges and educates 2.6 million students per year.

Anza College are one quarter long, and the majority of courses are restricted to 50 or fewer students. The tuition at De Anza College is $17 per unit (roughly $850 per year in tuition and fees) with a large percentage of students receiving fee waivers because of financial need. Similar to all community colleges in California it has open enrolment – anyone with a high school diploma or equivalent is automatically admitted.

Registration Priority System

Open enrolment, very low tuition costs, mandated small class sizes, and its location in the San Francisco Bay Area create intense competition for courses at De Anza College. Because of the general excess demand for courses, the College has established a strictly enforced registration priority system which determines on which day students are allowed to register over an eight day period. Registration priority is determined by whether the student is new, returning or continuing, the number of cumulative units earned at De Anza College, and enrolment in special programs. Incoming students and students who have taken a break away from the college have the lowest priority status. Priority status improves for continuing students by cumulative unit blocks. For example, continuing students with less than 11 cumulative units register on day 7 and continuing students with 11-29.5 cumulative units register on Day 6.

A student's registration priority has a large impact on his or her choice of classes.[5] Conversations with college administrators revealed that students with a low ranking on course-priority lists have severely limited choices in instructors. As a consequence, for a particular course that offers multiple course-sections, they have little

[5] In personal conversations with college administrators we have learned that students often register for classes as soon as they are allowed to and that they use other methods to improve their registration priority.

control over which teacher they are matched to. We corroborate this anecdotal evidence by performing numerous tests for non-random sorting, all of which reject the hypothesis that students systematically sort into sections taught by an instructor who shares their race or ethnicity.[6]

2.2 Data Set and Summary Statistics

Our data record course grades, course credits, course dropout behaviour, and detailed demographic characteristics for all students enrolled at any point in time between the third quarter of 2002 and the second quarter of 2007. We are also able to match these course data to detailed data on instructor characteristics, such as race, age, gender, and part-time status. To our knowledge, this is the first dataset providing detailed data on instructor's race for a diverse faculty. We also observe at the beginning of each quarter students' registration priority and whether they are an entering student. One further major advantage of this dataset is that it allows us to match students to courses that students enrolled in before their first day of class, regardless of whether they completed the course or not. We exclude recreational courses, such as cooking, sports and photography, and orientation courses from our analysis. To minimize computation without losing identification power we also exclude courses that have an average enrolment per session of less than 15 students. Since educational policy interventions are usually targeted at younger individuals, we focus our study on students who are at most 35 years old, although we explore age-heterogeneity in one specification.

[6] We remove students enrolled in special and often minority-student programs, such as SLAM, STARS, and SSRC. These students receive special registration priority status even if they are new or returning students.

We consider four outcome variables: an indicator for whether a student drops out of a course at any time during the session, an indicator variable for whether the course was passed, a numerical grade variable, and an indicator variable for whether the course grade was a B or higher. The last variable is interesting because a letter grade of B is the cutoff for admission at the University of California. In the regression analysis below we standardize the numerical grade variable to have zero mean and unit variance within each course.

The first panel of Table 1 (Unrestricted Sample) provides summary statistics of interest for the sample before dropping small courses, small departments, and students who are older than 35 years. This sample consists of 506,280 student-course observations. Only 2.4 percent of the student-course observations are for small courses, and 1.2 percent for courses from a small academic department. 9.2 percent of the observations are for the oldest students. The median age of the students who are at most 35 years old is 21.5 years. Since student who are between 21.5 and 35 years old comprise less than 50 percent of the student-course observations, it is clear that the youngest students take on average more courses. Dropping small courses, small departments, and the older student from the sample leaves us with 446,239 student-course observations. Ten percent of students are entering students, and 29 percent have low registration priority status when they enrolled in courses in the data. In terms of types of courses in the main sample, we find that only 3 percent of student/course observations are in language courses. We exclude these later in sensitivity analyses. We find that 26 percent of student/courses are taught by one instructor within the quarter. Sixty-one percent of student/course observations have no variation in underrepresented minority status within quarters and 52 percent of student/course observations have no variation in underrepresented minority status within academic-years. In these cases, underrepresented minority students have much less choice in courses they take.

Panel B of Table 1 shows differences in mean student outcomes across students of different races and ethnicities. Sample sizes vary by outcome. Since course grades are available only for students who finish a course while we can observe all courses a student enrolled in at the beginning of the semester, the sample size is the largest for the "Dropped Course" outcome. Furthermore, some courses only assign a passed/failed outcome, so that the sample size for the variable "Passed Course" is larger than the sample sizes for the two remaining grade outcomes.

The fact that we observe grade outcomes only for those who do not drop a course generates a sample selection problem. We address this issue by computation non-parametric bounds below. However, given that students who are induced to not drop a course because it is taught by an instructor of the same minority group are likely to be from the lower end of the ability distribution, we interpret our point estimates as lower bounds for the true minority interactions and focus our analysis on them.

There are important differences in student outcomes across groups. White and Asian students have the highest average outcomes. Hispanics, African-American, and Native American, Pacific Islander and other non-white students are more likely to drop courses, are less likely to pass courses, receive lower average grades, and are less likely to receive a good grade (B or higher). For most outcomes, these differences are large and statistically significant. Aggregating up these statistics (not shown in table) yields a dropout rate of 26 percent. The aggregated average grade is 2.9 (where 4.0 is equivalent to an A), and 66 percent of courses taken by students for letter grades receive a grade of B or higher. Of all students who finish courses, the total pass rate is 88 percent. These courses include non-letter grades (pass/no pass) as well as letter grades.

Panel C of table 1 displays the racial composition of the student body. There are 31,961 students in the panel. White students comprise 28 percent of all students and Asians comprise 51 percent of students. Hispanic students represent the largest underrepresented minority group with 14 percent of all students. African-American students comprise 4 percent of students and Native American, Pacific Islanders, and other non-white students comprise 3 percent of students. Underrepresented minorities, which are commonly defined by these latter groups in California public higher education, comprise 21 percent of the total student body. Half of all students are female.

The racial distribution of the 942 instructors in the sample (reported in Panel D) differs substantially from the student distribution. Nearly 70 percent of instructors are white. In contrast, only 14 percent of instructors are Asian and 6 percent of instructors are Hispanic. Interestingly, the percentage of African-American instructors and Native American, Pacific Islander and other non-white instructors are slightly higher than their representation in the student body. The lack of minority instructors at De Anza College does not differ from the national pattern for all colleges. Roughly 10 percent of all college instructors are from underrepresented minority groups (U.S. Department of Education 2010). At De Anza College, 16 percent of instructors are from underrepresented minority groups. The lack of minority instructors is perhaps even more surprising given the diversity of the workforce in Northern California.

2.3 Evidence Against Sorting

The concern regarding the validity of our results comes from the possibility that students sort into class-sections in a systematic way. If for example high-ability minority students are more likely than non-minority students to sort into course-sections taught by minority instructors, our results might be biased. Although we use several strategies to rule out our results to be driven by this type of student behavior, we first exploit the richness of our data and the student characteristics contained therein to investigate if there is evidence for non-random sorting on observables. We start with regressing the fraction of underrepresented minority students in a classroom on a dummy variable that is equal to one if the teacher belongs to the group of underrepresented minorities. These regressions are based on data that are aggregated up to the classroom level. To allow for correlations across classrooms, we cluster standard errors on the course-time level. Results are displayed in table 2. We investigate the robustness of the results with respect to the regression specification, the sample, and the type of variation in instructor minority status across different section of a course.

Column 1 shows robust evidence for sorting. In the full sample, the fraction of minority students in a class taught by a minority instructor is, on average, 0.8 percentage points higher, a small but statistically significant effect. These results are robust to the sample of students used, although the estimates become insignificant when only upper-year students who have a low ranking on enrolment priority lists are kept. Since the regression model in column 1 includes course and time fixed effects, it utilizes some variation across courses within the same year-quarter to identify the sorting parameter. In column 2 we modify the regression specification by including a set of course-time fixed effects instead, thus only allowing for variation in instructor minority status across different sections of a course offered in the same year. With point estimates decreasing and standard errors increasing, the estimates in all but the full sample become at most marginally significant. In columns 3 and 4 we repeat the exercise for a sample that drops course-time combinations that have variation in teacher minority status across sections. As a consequence, the sorting parameter is identified from variation across different classrooms of the same course, but taught in different semesters. By construction of the resulting sample, student sorting across sections in the same course-time is absorbed by the fixed effects. Any sorting uncovered by the regressions takes place across different year-quarters. The results suggest no changes to course selection across semesters due to instructor ethnicity or race. In the last column we further restrict the sample to rule out any course-specific variation in teacher minority status within an academic year, so that the relationship between instructor and student characteristics for a given course is measured across years. As expected, we find no evidence of student sorting, though the standard errors have increased.

Although the evidence for sorting presented above is weak, a deeper exploration of sorting patterns is worthwhile. In fact, since we are using within-classroom and within-student variation only to identify the parameter of interest in our regression models below, the validity of our results will be unaffected by the sorting patterns on the classroom-level displayed in table 2. Remaining selection could still occur if better able minority students sort into sections taught by minority instructors relative to better able non-minority students in the same class and after conditioning on the student's performance in other classes. We investigate whether there is evidence for this type of differential sorting using observable measures of ability and other background characteristics contained. We calculate ***minority-specific*** classroom averages of these variables and regress them on a dummy variable that is equal to one if the observation is associated with the underrepresented minority student group, a dummy that is equal to one if the section is taught by an underrepresented minority instructor, and the interaction between these two dummy variables. The interaction measures the extent to which the minority-gap in the outcomes varies across classes taught by minority and non-minority instructors. It is thus an estimate of differential sorting, the type of sorting that is of concern for our main results. Estimates for the interaction term are presented in Appendix Table 1, panels A to E. Each panel is associated with a different student background variable, and we follow the structure of Table 2 in exploring the robustness of findings. Panel A shows the results with student age as the outcome variable. The interaction effect is used to test whether the difference in average student age in a classroom across student minority groups depends on the minority status of the instructor. As is evident from Panel A, there is virtually no evidence for this type of differential sorting across classrooms. We repeat the analysis for the outcomes (in order of the panels) “gender”, “student holds a higher degree”, “cumulated number of courses before taking the course”, “GPA prior to enrolment”, corroborating the conclusion drawn from Panel A that there is no evidence for differential sorting.

3. Statistical Methodology

3.1 Basic Model

We now turn to the description of the econometric models of the following four student outcomes: a dummy variable for whether a student drops the course at some time during the academic session, a dummy variable for whether a student passes the course conditional on finishing it, a course-grade variable that is normalized to have mean zero and unit standard deviation within a course, and a dummy variable for whether the student has a grade above a B-. In the following we index students by i, teachers by j, and classrooms by c. A classroom is defined by those in the same course subject, the same section, and the same year-quarter, rather than by a physical location. We estimate the following two-way fixed effect model of student outcomes y_{ijc} :

(1) $$y_{ijc} = \alpha_1 * min\_stud_i * min\_inst_j + \gamma_i + \phi_c + u_{ijc}$$

where min_stud and min_inst are indicator variables that are equal to one if the student or teacher belong to the group of disadvantaged minorities, respectively, and γ_i and ϕ_c are student and classroom fixed effects. The parameter of interest is α_1, measuring the differential effect between minority and non-minority students of being taught by a minority instructor. It measures the extent to which minority gaps in the outcome variables depend on whether the students are assigned to a minority or a non-minority instructor. This specification allows us to include student and classroom fixed effects, and consequently the coefficients on the variables min_stud and min_inst are not identified.

We also estimate models in which we include a full set of indicator variables for the four main ethnic groups in the sample – Whites, African-Americans, Hispanics, and Asians. In this case there are 16 racial interactions, 9 of which are identified.

Student fixed effects are included to address the concern that individuals with higher unobserved academic abilities sort into classes taught by a teacher that share their underrepresented minority status. Classroom fixed effects in turn are necessary to account for the possibility that students who sit in the same class are subject to the same shocks. An example of such a "shock" is the grading and testing philosophy of the instructor. The inclusion of classroom fixed effects avoids the need to rely on data with standardized testing procedure across classrooms since within the same classroom students are writing exactly the same tests.

Estimation of two-way fixed effects models with unbalanced Panel Data becomes computationally infeasible with large data sets. With more than 30,000 students and over 20,000 classrooms in our data, model parameters cannot be estimated directly by OLS. Since our data set is a non-balanced panel, conventional within transformations are not possible, either. We thus rely on recent advances in the estimation of firm-and worker fixed effects from administrative data. The computational algorithms used to estimate two-way fixed effects models with high-dimensional sets of dummy variables generally rely on the fact that each individual only contributes to the identification of a subset of the fixed effects.[7] In our example, each individual only contributes to the identification of the classrooms she or he visits at one point. This implies that normal equations involve block-diagonal ("sparse") matrices whose inversion is much less problematic than the inversion of non-sparse matrices. In practice, one performs a within-transformation in a first step to eliminate individual fixed effects, and then solves the remaining normal

[7] The seminal paper in this literature is Abowd, Kramarz and Margolis (1999). Refinements have been developed by Abowd, Creezy and Kramarz (2002) and Andrews et al (2008). Cornelissen (2008) has written a Stata-routine based on these algorithms.

equations using matrix-inversion schemes that exploit the block-diagonal structure of the remaining matrices.[8] All standard errors are clustered on the classroom-level.[9]

3.2 Bounds

Estimation of the econometric models of grade outcomes is possible only for the sample of students who write the final exam. The propensity to finish a course might be affected by the variable of interest – the minority-status interactions between students and instructors within classrooms - as well. This creates a potential sample selection problem, formally described by the following set of equations:

$$(2) \qquad grade_{ijc} = \alpha_1^{grade} * min\_stud_i * min\_inst_j + \gamma_i^{grade} + \phi_c^{grade} + u_{ijc}^{grade}$$

$$(3) \qquad dropped_{ijc} = \alpha_1^{dropped} * min\_stud_i * min\_inst_j + \gamma_i^{dropped} + \phi_c^{dropped} + u_{ijc}^{dropped}$$

$$(4) \qquad grade_{ijc} = (1 - dropped_{ijc}) * grade_{ijc}^{*}.$$

Equations (2) and (3) replicate equation (1) for the grade-outcome and the dropout-variable, while equation (4) accounts for the potential selection bias. OLS-estimates of the parameter of interest, α_1^{grade}, is biased conditionally on individual fixed effects if $\alpha_1^{dropped}$ is significantly different from zero. Correcting for sample selection is difficult in our case since any variable affecting dropout behavior arguably also affects potential grades. Without exclusion restrictions, identification in a standard Heckman-selection model is solely based on the non-linearity of the correction term. Furthermore, with the

[8] The literature estimating firm-and worker fixed effects also utilize the fact that many workers never change firms, thus not contributing to identification of any of the firm fixed effects. In our example, this does not apply since the majority of individuals take at least one class and thus contribute to the identification of at least some classroom fixed effects.

[9] We have also clustered standard errors by classroom-minority. As expected, in this case the precision our estimates increases somewhat. The main conclusions remain unaltered.

inclusion of classroom- and student fixed effects, estimates from reduced-form Probit equations required for a Heckit-procedure are biased. We thus estimate non-parametric bounds of α_1^{grade} using a procedure similar to the ones described by Krueger and Whitmore (2002) and Lee (2010) and applied by Hoffmann and Oreopoulos (2009). In general, OLS-estimates are biased downward if minority students are less likely to drop the course when the instructor belongs to the minority group as well, and if the marginal students induced to stay come from the left tail of the grade distribution. It is biased upward if the marginal students come from the right tail of the grade distribution. We can therefore estimate an upper (lower) bound of α_1^{grade} when applying OLS to a sample without the ($\alpha_1^{dropped}$ *100)-percent worst (best) minority students in classes taught by a minority instructor.

We therefore apply the following procedure: In the first step we estimate equation (1) for the dropout-variable. This provides us with an estimate of $\alpha_1^{dropped}$, the "minority gap" in dropout behavior when the class is taught by a minority instructor. We then calculate the ($\alpha_1^{dropped}$ *100) percentile ($\left(1-\alpha_1^{dropped}\right)$*100 percentile) of the minority-student grade distribution for every class taught by a minority teacher and drop all minority students with a final grade lower (higher) than this percentile. Since we are focusing on selection due to the ***relative*** difference from having a minority instructor between minority and non-minority students, we do not need to trim marginal non-minority students. In the second step we use this restricted sample to estimate the same equation as in the first step, but with final grade replacing the dropout variable as outcome. We also perform this algorithm by running the dropout-regressions course-by-course, therefore providing us with course-specific estimates of the $\alpha_1^{dropped}$. As Lee (2010) shows, this procedure yields the tightest bounds on the parameter of interest if the outcome variable is continuous. We thus compute the bounds only for the grade variable, which is our only continuous outcome variable, while leaving the results for the discrete outcome “Passed Course” uncorrected.[10]

We interpret the results from this part as a robustness check rather than as the main part of our analysis. By the logic of role-model effects it is reasonable to assume that it is the lower-achieving minority students rather than the best students who are at the margin of dropping a course and are induced not to do so because they share the minority status with their instructor. We therefore interpret our uncorrected estimates as lower bounds of minority-interactions.

4. Results

4.1 Main Results

Estimates of the minority interactions between students and instructors for all four outcome variables using the full sample and a sub-sample of students who are low on the course-enrolment priority lists are shown in table 3. We also explore the sensitivity of results with respect to the set of fixed effects included in the econometric models. Results from our preferred specification described in equation (1) are displayed in column (6) of the table. We highlight three main results: First, there is a significant minority interaction effect on student dropout behaviour that is robust with respect to the sample used and the

[10] Strictly speaking, this variable is not continuous, either. For our application, this can be problematic because the grade distribution has mass-points at the lower and upper tail. Hence, if we trim the distribution at the x%-percentile, we might drop more than x% of the students. We solve this problem by randomizing among the students at the mass-points in such a way that we are trimming exactly x% of the distribution.

set of fixed effects included. Our main estimates indicate a reduction of the minority gap in course dropout behaviour when taught by a minority instructor by 2 to 3 percentage points. Second, when using the remaining three outcome variables, minority interaction effects are robust with respect to the set of fixed effects used only when relying on the sample of low-priority students (below we bound these effects by whether minority instructors cause better or worse performing minority students to stay). This is our preferred sample since students included in it are severely restricted in their choice of course and instructor. For this group of students, the minority gap in the probability of passing a course decreases by up to 4 percentage points, a sizable effect. Furthermore, we estimate a robust reduction of the minority gap in grades of 5 percent of a standard deviation. However, for this outcome the standard errors are too high to yield a definite conclusion. There is however no robust effect with respect to the probability of having a good grade. Thus, the grade adjustment takes place mostly at the lower end of the grade distribution. Third, when including both, student and classroom fixed effects, minority-interaction effects are statistically significant for all outcome variables, and they are robust with respect to the sample of students utilized in the estimation. One possibility for the large impact of including classroom fixed effects on the estimates is that instructors who are assigned to different sections of the same course apply different grading and evaluation procedures. Inclusion of classroom fixed effects acts as a way of "standardizing" tests and classroom conditions across the student observations used to identify the interaction effect. Our results suggest that it stabilizes our estimates considerably, although we estimate an additional set of over 20,000 parameters.

4.2 Robustness Checks

In table 4 we use several subsets of our data to explore the robustness of our estimates. We only present the estimates from our preferred model. The first two rows show results from a regression in which the minority interaction effect is allowed to vary by student gender. There is no evidence that these effects are gender specific. To further rule out that our conclusions will be influenced by selection biases, we restrict the variation in instructor minority status within course-time and across classrooms in the next three specifications. In the first of these specifications we drop course-time combinations with different instructors teaching different sections. Hence, we only keep courses that are taught by the same instructor in an academic session, no matter how many sections are offered simultaneously. In the second specification we allow different instructors to be observed for a course-time, but we drop observations for which some sections are taught by minority teachers and others by non-minority teachers. Identification of minority student-instructor interactions therefore comes only from across quarter variation in instructor ethnicity or race. In the third of this set of regressions we further restrict the sample in such a way that there is no variation in instructor minority status within an academic year and a course. Other than for the first specification applied to a sample of low-priority students, we obtain substantial, robust and often significant estimates of the minority interactions. Insignificance of estimates is largely driven by an increase of standard errors, which is to be expected since we are using significantly smaller samples.

The rest of table 4 can be summarized as follows: First, point estimates remain remarkably robust when using a sample of entering students who are automatically set low on the course enrolment priority lists. Second, minority interaction effects are by far the biggest for students who are younger than the median student.[11] Indeed, our estimates suggest that our results are largely driven by this group of students. Third, the exclusion of language courses, for which particular types of interactions between students and their instructors might exist, does not significantly alter our estimates.

Table 5 displays lower and upper bounds of the minority interaction effects when using standardized grade outcomes as the dependent variable. When using the full sample, estimates are bounded by 3.9 percent and 7.9 percent of the variables' standard deviation. The estimated lower and upper bounds are all statistically significant on conventional levels. When using the sample of low-priority students instead, the sample sizes decrease and the bounds widen. They are given by 2.9 percent and 9.3 percent of the grade's standard deviation. Standard errors increase by a factor 2.5, but the upper bounds are statistically significant. Taken together, this table presents further evidence for a robust and quite substantial minority interaction effect on grades, in addition to a substantial effect on the probability for dropping the class.

4.3 Race and Ethnicity Interactions

In table 6 we break down our minority interaction estimates by different ethnicities and race. We focus on four groups, Whites, African-Americans, Hispanics, and Asians. While student fixed effects absorb the interaction for one of the student groups – in our case "Whites" - the classroom fixed effects absorb the interaction for one of the instructor groups – again "Whites". Thus, only 9 of the 16 race and ethnicity

[11] Since we are estimating the heterogeneity of results with respect to age in this specification, we also include the older students who were dropped from the main sample. We do this to help argue that the presence of age-heterogeneity rules out our results to be entirely driven by discrimination against students.

interactions are identified and all estimated interaction effects are relative to outcomes for white students with alternative instructor types. We present the P-value from F-tests for two hypotheses of major interest, namely for the presence of an own-race interaction and for the presence of any race interaction. We find strong and robust evidence for own-race interactions. African-American students experience particularly large and robust relative gains from being taught by a same-race instructor. This is particularly noteworthy given that African-American students and teachers account for only 4 percent and 6 percent of the sample respectively.

4.4 Are Students Reacting to Instructors or Vice Versa?

Two pieces of evidence presented so far point toward students adjusting their academic behaviour depending on the minority status of the instructor rather than instructors adjusting to status of the student. First, we find dropout effects from instructor race and ethnicity prior to receiving grades. This outcome is entirely determined by the student rather than the instructor. Second, as shown in table 4, it is the young students who are most affected by the instructor's minority status. There are no significant effects for old students. However, if results were driven by instructors discriminating against certain student groups, one would expect minority effects not to vary across age groups. Discrimination would affect all students of a certain minority or non-minority group irrespective of the age. We thus conclude that young students are likely to be susceptible to role-model effects, while older students are not. To obtain further evidence, we investigate whether there are minority-interactions with respect to the probability of a student taking another course in the same subject in the following semester.[12] Results are shown in Appendix Table 2. In Panel A, we use observations only for which the student has taken exactly one course in a semester in a certain subject. This avoids the need to aggregate up to the student-subject-time level and allows us to use the same regression specification used in table 3. In panel B we relax this restriction, but we need to aggregate up to the student-subject-time level and exclude classroom fixed effects. As shown in Panel A, the minority gap in the probability of continuing a subject in the following semester is significantly affected by the minority status of the instructor. These results are quite robust across specifications and the group of students used and corroborate our hypothesis that minority interactions are, at least to some extent, driven by the student reacting to the instructor.[13]

5. Conclusion

In this paper we estimate for the first time the importance of race and ethnicity interactions between teachers and students at the community college level to explain academic performance and dropout behavior. Using within class variation for students taking multiple courses with limited enrolment options (and no evidence of sorting), we find that minority students perform relatively better in classes when instructors are of the same race or ethnicity. Blacks, Hispanics, Asians, and Native Americans are 2.9

[12] Another option to increase sample size is to consider the probability of taking a same-subject-course in any of the following semesters, rather than the semester directly afterward. This however introduces the problem that we cannot rule out that the results are driven by effects that accumulate over time. We thus restrict our analysis on the probability that a student takes another course in the same subject exactly one semester later.

[13] Hoffmann and Oreopoulos (2009) draw similar conclusions for gender interactions within classrooms at a large Canadian University. In contrast to our study, they focus on large courses in which exams are not graded by the instructor.

percentage points more likely to pass courses with instructors of similar background and 2.8 percentage points more likely to pass courses with underrepresented instructors. These effects represent roughly half of the total gaps in classroom outcomes between white and underrepresented minority students at the college. The effects are particularly large for Blacks. The class dropout rate relative to Whites is 6 percentage points lower for Black students when taught by a Black instructor. Conditional on completing the course, the relative fraction attaining a B-average or greater is 13 percentage points higher.

We estimate relative grade score effects ranging from 4 to 8 percent of a standard deviation from being assigned an instructor of similar minority status. Taken together with the large class dropout interaction effects, these impacts are notably larger than those found for gender interactions between students and instructors at all levels of schooling. They are likely due to students behaving differently based on minority status of instructors rather than the other way around. We find dropout effects before receiving a grade, effects for younger students but not older, and effects on subsequent course choices – all evidence pointing more to students reacting to instructors.

Our results suggest that the academic achievement gap between White and underrepresented minority college students would decrease by hiring more minority instructors. However, the desirability of this policy is complicated by the finding that students appear to react positively when matched to instructors of a similar race or ethnicity but negatively when not. Hiring more instructors of one type may also lead to greater student sorting and changes to classroom composition, which may also impact academic achievement. A more detailed understanding of heterogeneous effects from instructor assignment, therefore, is needed before drawing recommendations for improving overall outcomes. The topic is ripe for further research.

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TABLE 1 - DESCRIPTIVE STATISTICS

PANEL A: Student-Course Level

	Mean	Std. Dev.	*Total Number of Observations*
Unrestricted Sample			
Small Course	0.024	0.023	*506,280*
Small Department	0.012	0.012	
Student younger than 21.5 years	0.536	0.249	
Student between 21.5 and 35 years	0.372	0.234	
Students older than 35 years	0.092	0.084	
Main Sample			
Age of Student	22.2	4.1	*446,205*
Entering Student	0.10	0.30	*446,239*
Low Registration Priority Student	0.29	0.46	
Language Course	0.03	0.16	
Course is taught by one instructor within quarter	0.26	0.44	
Course has no variation in instructor underrepresented-minority status within quarter	0.61	0.238	
Course has no variation in instructor underrepresented-minority status within academic Year	0.52	0.250	
Age of instructor	52.52	10.75	*446,235*
Instructor teaches part-time	0.41	0.49	*446,239*

PANEL B: Student Outcome -, Student-Course Level, by Race/Ethnicity, Main Sample

	Student Race/Ethnicity				
	White	*Asian*	*Hispanic*	*African American*	*Nat. American, Pacific Isl., other non-White*
Dropped Course	0.24	0.26	0.28	0.30	0.28
Total Nr of Obs: 444,239	*(0.43)*	*(0.44)*	*(0.45)*	*(0.46)*	*(0.45)*
Passed Course	0.89	0.89	0.84	0.82	0.86
Total Nr of Obs: 319,641	*(0.31)*	*(0.32)*	*(0.37)*	*(0.39)*	*(0.35)*
Grade	2.90	2.91	2.58	2.51	2.71
Total Nr of Obs: 277,889	*(1.14)*	*(1.14)*	*(1.19)*	*(1.21)*	*(1.19)*
Good Grade (B or higher)	0.68	0.68	0.57	0.53	0.61
Total Nr of Obs: 277,889	*(0.47)*	*(0.47)*	*(0.50)*	*(0.50)*	*(0.49)*

PANEL C: Student Level

	Mean	S.D.	*Sample Size*
Main Sample			
Female Student	0.50	0.50	*31,894*
Underrepresented Minority Student	0.21	0.41	*31,961*
White Student	0.28	0.20	
Asian Student	0.51	0.25	
Hispanic Student	0.14	0.12	
African-American Student	0.04	0.04	
Native American, Pacific Islanders, Other non-White Student	0.03	0.03	

PANEL D: Instructor Level

	Mean	S.D.	*Sample Size*
Main Sample			
Female Instructor	0.49	0.50	*942*
Underrepresented Minority Instructor	0.16	0.36	
White Instructor	0.70	0.21	
Asian Instructor	0.14	0.12	
Hispanic Instructor	0.06	0.06	
African-American Instructor	0.06	0.05	
Native American, Pacific Islanders, Other non-White Instructor	0.04	0.03	

NOTES: Courses are defined to be "small" if their average enrolment per session falls below the 2-percentile of the course enrolment distribution. Departments are defined to be "small" if the total number of students in the sample associated with a department is smaller than the 1-percentile of the departmental size distribution. In our main analysis we focus on students who are at most 35 years old. The median age of the resulting sub-sample is 21.5 years. This motivates the choice of student-age groups listed in Panel A of this table. Students and instructors belong to the group of "Underrepresented Minorities" if their race/ethnicity is reported to be Hispanic, African-American, or Native American, Pacific Islanders, or other non-Whites.

TABLE 2 - SORTING REGRESSIONS

	LEVEL OF VARIATION IN INSTRUCTOR UNDERREPRESENTED-MINORITY STATUS ACROSS CLASSROOMS OF SAME COURSE				
	UNRESTRICTED		*NO VARIATION IN SAME YEAR-QUARTER*		*NO VARIATION IN SAME YEAR*
OUTCOME - FRACTION OF UNDERREPRESENTED MINORITY STUDENTS WITHIN CLASSROOM					
All Students	0.008 ***	0.008 **	0.016 **	0.009	0.031
	(0.003)	(0.004)	(0.008)	(0.012)	(0.023)
All Low Registration Priority Students	0.009 **	0.007	0.026 *	0.024	0.041
	(0.004)	(0.006)	(0.015)	(0.026)	(0.042)
Entering Students (==> Low Registration Priority)	0.015 **	0.013	0.088 **	0.011	0.181
	(0.008)	(0.011)	(0.044)	(0.097)	(0.111)
Continuing Students, Low Registration Priority	0.009	0.008	0.030	0.062	-0.025
	(0.008)	(0.010)	(0.030)	(0.057)	(0.056)
Continuing Students, Not Low Registration Priority	0.008 **	0.009 *	0.007	0.001	0.015
	(0.003)	(0.005)	(0.008)	(0.013)	(0.018)
FIXED EFFECTS:					
Course and Year	No	No	Yes	No	Yes
Course and Year-Quarter	Yes	No	No	No	No
Course-Year	No	No	No	Yes	No
Course-Year-Quarter	No	Yes	No	No	No

NOTES: This table displays results from regressing the fraction of underrepresented minority students within a classroom on an indicator equal to one if the instructor belongs to an underrepresented minority group, and a set of fixed effects. We only report the estimated coefficient on the former. Each cell is associated with a different regression. A classroom is defined by course, course section, and academic session. Students and instructors belong to the group of "Underrepresented Minorities" if their race/ethnicity is reported to be Hispanic, African-American, or Native American, Pacific Islanders, or other non-Whites. Rows are defined by the subsample of students we consider. Low registration priority students are those students who have the lowest standing on course enrolment lists. Columns explore sensitivity of results with respect to different sets of fixed effects and different sources of variation used to identify the parameters. When using courses without variation in teacher underrepresented minority status in the same academic year, only one of the specifications can be estimated. *** Significant on 1%-level; ** Significant on 5%-level; * Significant on 10%-level. Standard errors are clustered on the level of the fixed effect.

TABLE 3 - ESTIMATED ROLE OF INSTRUCTOR MINORITY STATUS FOR STUDENT OUTCOMES

	(1)		(2)		(3)		(4)		(5)		(6)	
OUTCOME: STUDENT DROPPED COURSE												
Number of Observations:	***444,584***											
All Students	-0.004		-0.020	***	-0.021	***	-0.018	***	-0.013	***	-0.020	***
	(0.006)		(0.006)		(0.007)		(0.006)		(0.005)		(0.005)	
All Low Registration Priority Students	-0.006		-0.025	***	-0.030	***	-0.021	*	-0.020	**	-0.029	***
	(0.009)		(0.010)		(0.011)		(0.011)		(0.010)		(0.011)	
OUTCOME: STUDENT PASSED COURSE, CONDITIONAL ON FINISHING THE COURSE												
Number of Observations:	***319,641***											
All Students	0.002		0.003		0.001		0.004		0.003		0.012	***
	(0.005)		(0.006)		(0.007)		(0.006)		(0.005)		(0.005)	
All Low Registration Priority Students	0.018	*	0.036	***	0.040	***	0.037	***	0.014		0.028	**
	(0.010)		(0.011)		(0.013)		(0.012)		(0.010)		(0.012)	
OUTCOME: STANDARDIZED STUDENT COURSE GRADE, CONDITIONAL ON FINISHING THE COURSE												
Number of Observations:	***277,889***											
All Students	0.013		-0.018		-0.007		-0.006		0.010		0.054	***
	(0.017)		(0.019)		(0.020)		(0.016)		(0.015)		(0.013)	
All Low Registration Priority Students	0.052	*	0.056	*	0.056		0.023		0.017		0.050	
	(0.030)		(0.033)		(0.037)		(0.034)		(0.031)		(0.033)	
OUTCOME: GOOD GRADE (B OR HIGHER), CONDITIONAL ON FINISHING THE COURSE												
Number of Observations:	***277,889***											
All Students	-0.002		-0.007		-0.005		0.004		0.006		0.024	***
	(0.008)		(0.009)		(0.009)		(0.008)		(0.007)		(0.006)	
All Low Registration Priority Students	0.000		0.006		0.000		0.015		0.003		0.032	**
	(0.014)		(0.015)		(0.017)		(0.016)		(0.014)		(0.016)	
FIXED EFFECTS:												
Year-Quarter-Minority	**Yes**		**Yes**		No		No		No		No	
Course-Minority	No		**Yes**		No		**Yes**		No		No	
Course-Minority-Year-Quarter	No		No		**Yes**		No		No		No	
Student	No		No		No		**Yes**		No		**Yes**	
Classroom	No		No		No		No		**Yes**		**Yes**	
CONTROLS:												
Instructor Controls	**Yes**		**Yes**		**Yes**		**Yes**		No		No	
Student Controls	**Yes**		**Yes**		**Yes**		No		**Yes**		No	

NOTES: This table displays results from our main outcome regressions. We report the coefficient of the interaction between student's and instructor's underrepresented minority status. Each cell is associated with a different regression. A classroom is defined by course, course section, and academic session. Students and instructors belong to the group of "Underrepresented Minorities" if their race/ethnicity is reported to be Hispanic, African-American, or Native American, Pacific Islanders, or other non-Whites. We consider 4 student outcomes: In panel A an indicator variation equal to one if the student drops the course; in panel B an indicator variable equal to one if the student passes the course; in panel C the student's **standardized** course grades; in panel D an indicator variable equal to one if the student has a grade of at least B. We explore the sensitivity with respect to the regression specification, i.e. the set of fixed effects and controls included in the regressions. Student controls include age and gender; instructor controls include age, gender, and a part-time indicator. We also compute the regression coefficients for a sample of all students and a sample of low-priority students.
*** Significant on 1%-level; ** Significant on 5%-level; * Significant on 10%-level. Standard errors are clustered by classroom.

TABLE 4 - ESTIMATED ROLE OF INSTRUCTOR MINORITY STATUS FOR STUDENT OUTCOMES: SUB-GROUP ANALYSIS

	ALL STUDENTS				LOW-PRIORITY STUDENTS			
	Dropped Course	Passed Course	Grade (Standar-dized)	Good Grade (B or higher)	Dropped Course	Passed Course	Grade (Standar-dized)	Good Grade (B or higher)
Male vs. Female Students								
Minority Interaction	-0.021 ***	0.012 *	0.029 *	0.021 **	-0.019	0.038 **	0.021	0.031
	(0.007)	(0.007)	(0.018)	(0.009)	(0.015)	(0.018)	(0.047)	(0.023)
Minority Interaction*Female Students	0.002	-0.001	0.044 **	0.005	-0.019	-0.019	0.054	0.003
	(0.009)	(0.009)	(0.024)	(0.012)	(0.019)	(0.022)	(0.060)	(0.029)
Course-Quarters that are taught by one Instructor								
Minority Interaction	0.001	0.008	0.035	0.022	0.048	-0.024	-0.250	-0.025
	(0.012)	(0.010)	(0.039)	(0.018)	(0.035)	(0.046)	(0.226)	(0.087)
Course-Quarters without Variation in Instructor Underrepresented Minority Status								
Minority Interaction	-0.014	0.023 ***	0.097 ***	0.045 ***	-0.010	0.041	0.073	0.042
	(0.010)	(0.008)	(0.028)	(0.013)	(0.024)	(0.028)	(0.111)	(0.048)
Course-Years without Variation in Instructor Underrepresented Minority Status								
Minority Interaction	-0.021 *	0.012	0.065 *	0.042 ***	-0.007	0.059	0.089	0.067
	(0.013)	(0.010)	(0.036)	(0.016)	(0.033)	(0.041)	(0.175)	(0.074)
Entering Students (==> Low Registration Priority)								
Minority Interaction	-	-	-	-	-0.027	0.029	0.050	0.038
					(0.025)	(0.029)	(0.090)	(0.048)
Different Age Groups of Students								
Minority Interaction*Student younger than 21.5 years	-0.018 ***	0.007	0.039 **	0.017 **	-0.028 **	0.039 ***	0.077 *	0.042 **
	(0.007)	(0.007)	(0.016)	(0.008)	(0.013)	(0.016)	(0.041)	(0.020)
Minority Interaction*Student between 21.5 and 35 years	-0.001	0.011	0.038	0.015	0.011	-0.022	-0.067	-0.023
	(0.009)	(0.009)	(0.023)	(0.011)	(0.020)	(0.022)	(0.070)	(0.033)
Minority Interaction*Student older than 35 years	-0.017	-0.005	-0.050	-0.020	-0.033	-0.061 *	-0.125	-0.046
	(0.016)	(0.013)	(0.044)	(0.020)	(0.034)	(0.036)	(0.135)	(0.057)
No Language Courses								
Minority Interaction	-0.018 ***	0.008	0.039 ***	0.019 ***	-0.027 **	0.022 *	0.021	0.025
	(0.005)	(0.005)	(0.013)	(0.007)	(0.011)	(0.013)	(0.034)	(0.017)
FIXED EFFECTS:								
Student	Yes				Yes			
Classroom	Yes				Yes			

NOTES: This table explores the heterogeneity of our results across different student groups and types of courses considered. We report the coefficient of the interaction between student's and instructor's underrepresented minority status - referred to as "Minority Interaction". In cases where we allow minority effects to vary across student groups we also report the interaction between the main variable of interest and indicator variables that are equal to one if a student belongs to a certain subgroup. We only report results for our preferred specification, including student and classroom fixed effects. A classroom is defined by course, course section, and academic session. Students and instructors belong to the group of "Underrepresented Minorities" if their race/ethnicity is reported to be Hispanic, African-American, or Native American, Pacific Islanders, or other non-Whites. We consider 4 student outcomes: an indicator variation equal to one if the student drops the course; an indicator variable equal to one if the student passes the course; standardized course grades; and an indicator variable equal to one if the student has a grade of at least B. We also compute the regression coefficients for a sample of all students and a sample of low-priority students. *** Significant on 1%-level; ** Significant on 5%-level; * Significant on 10%-level. Standard errors are clustered by classroom.

TABLE 5 - UPPER AND LOWER BOUNDS FOR ESTIMATED ROLE OF INSTRUCTOR MINORITY STATUS FOR STUDENT GRADE

	TRUNCATION BY OVERALL DROPOUT BEHAVIOUR		TRUNCATION BY COURSE-SPECIFIC DROPOUT BEHAVIOUR	
	All Students	Low Registration Priority Students	All Students	Low Registration Priority Students
Lower Bound	0.039 ***	0.029	0.042 ***	0.033
	(0.013)	(0.034)	(0.013)	(0.033)
Uncorrected Estimate	0.054 ***	0.050	0.054 ***	0.050
	(0.013)	(0.033)	(0.013)	(0.033)
Upper Bound	0.079 ***	0.093 ***	0.072 ***	0.063 *
	(0.013)	(0.033)	(0.013)	(0.034)
Student FE	Yes		Yes	
Classroom FE	Yes		Yes	

NOTES: This table shows uncorrected and sample-selection corrected estimates for the minority interaction when grade is used as the outcome variable. We first estimate the minority interaction in dropout regressions (not shown in table). The estimate provides us with the x-percentage difference of the propensity to drop the course between minority and non-minority students when the class is taught by a minority instructor. We then calculate the x-percent and (100-x)-percent quantiles of the minority grade distribution in classes taught by minority instructors. To compute the upper bound on the interaction we drop minority students with grades below the x-percent quantile. To compute the lower bound we drop the students with grades above the (100-x) quantile. We report the coefficient of the minority interaction with standardized grade as outcome variable. We compute the regression coefficients for a sample of all students and a sample of low-priority students. The first two columns report results when the trimming procedure relies on estimate of the minority interaction in dropout regressions that use the full sample; the last two columns report results when the trimming procedure relies on estimate of the minority interaction in dropout regressions we run for each course separately; in the latter case we need to replace student fixed effects by student controls to achieve identification. A classroom is defined by course, course section, and academic session. Students and instructors belong to the group of "Underrepresented Minorities" if their race/ethnicity is reported to be Hispanic, African-American, or Native American, Pacific Islanders, or other non-Whites. *** Significant on 1%-level; ** Significant on 5%-level; * Significant on 10%-level. Standard errors are clustered by classroom.

TABLE 6 - ESTIMATED ROLE OF INSTRUCTOR RACE/ETHNICITY FOR STUDENT OUTCOMES, USING A SAMPLE WITH 4 RACE/ETHNICITY-GROUPS ONLY

	All Students				All Low Registration Priority Students			
	Instructor Race/Ethnicity				*Instructor Race/Ethnicity*			
	White	*African-American*	*Hispanic*	*Asian*	*White*	*African-American*	*Hispanic*	*Asian*
OUTCOME:STUDENT DROPPED COURSE								
Number of Observations:		***418,283***				***122,887***		
Student Race/Ethnicity								
White		NOT IDENTIFIED				NOT IDENTIFIED		
African-American		-0.078 ***	-0.018	0.011		-0.083 ***	-0.018	0.092 ***
		(0.016)	(0.017)	(0.015)		(0.034)	(0.038)	(0.030)
Hispanic	NOT IDENTIFIED	-0.019 *	-0.025 ***	0.022 ***	NOT IDENTIFIED	-0.007	-0.042 *	0.050 ***
		(0.011)	(0.010)	(0.009)		(0.023)	(0.022)	(0.019)
Asian		-0.016 **	-0.011	-0.014 **		0.008	-0.003	-0.003
		(0.008)	(0.008)	(0.006)		(0.017)	(0.018)	(0.014)
F-test: Own-Race/Ethnicity Effect (P-value)			***0.000***				***0.023***	
F-test: Race/Ethnicity-Effect (P-value)			***0.000***				***0.000***	
OUTCOME: STUDENT PASSED COURSE, CONDITIONAL ON FINISHING THE COURSE								
Number of Observations:		***300,503***				***89,031***		
White		NOT IDENTIFIED				NOT IDENTIFIED		
African-American		0.067 ***	-0.013	-0.009		0.094 ***	0.038	-0.010
		(0.015)	(0.016)	(0.014)		(0.034)	(0.046)	(0.032)
Hispanic	NOT IDENTIFIED	0.020 **	0.009	-0.026 ***	NOT IDENTIFIED	0.066 ***	0.023	-0.008
		(0.010)	(0.009)	(0.008)		(0.025)	(0.025)	(0.020)
Asian		0.007	0.000	0.004		0.010	0.017	0.015
		(0.007)	(0.006)	(0.005)		(0.018)	(0.017)	(0.014)
F-test: Own-Race/Ethnicity Effect (P-value)			***0.000***				***0.025***	
F-test: Race/Ethnicity-Effect (P-value)			***0.000***				***0.041***	
OUTCOME: STANDARDIZED STUDENT COURSE GRADE, CONDITIONAL ON FINISHING THE COURSE								
Number of Observations:		***260,466***				***70,871***		
White		NOT IDENTIFIED				NOT IDENTIFIED		
African-American		0.190 ***	0.015	0.012		0.157	0.068	0.045
		(0.040)	(0.046)	(0.033)		(0.107)	(0.154)	(0.085)
Hispanic	NOT IDENTIFIED	0.071 ***	0.096 ***	-0.026	NOT IDENTIFIED	0.105	0.089	-0.040
		(0.027)	(0.027)	(0.020)		(0.068)	(0.075)	(0.057)
Asian		0.054 ***	0.011	0.049 ***		0.067	0.074	0.021
		(0.020)	(0.019)	(0.014)		(0.054)	(0.052)	(0.040)
F-test: Own-Race/Ethnicity Effect (P-value)			***0.000***				***0.291***	
F-test: Race/Ethnicity-Effect (P-value)			***0.000***				***0.587***	
OUTCOME: GOOD GRADE (B OR HIGHER), CONDITIONAL ON FINISHING THE COURSE								
Number of Observations:		***260,707***				***70,925***		
White		NOT IDENTIFIED				NOT IDENTIFIED		
African-American		0.090 ***	0.025	0.007		0.129 ***	0.044	0.025
		(0.020)	(0.021)	(0.017)		(0.047)	(0.072)	(0.042)
Hispanic	NOT IDENTIFIED	0.029 **	0.039 ***	0.001	NOT IDENTIFIED	0.063 *	0.013	-0.010
		(0.014)	(0.013)	(0.011)		(0.033)	(0.037)	(0.029)
Asian		0.009	0.006	0.028 ***		0.035	0.003	0.006
		(0.010)	(0.009)	(0.007)		(0.026)	(0.025)	(0.020)
F-test: Own-Race/Ethnicity Effect (P-value)			***0.000***				***0.051***	
F-test: Race/Ethnicity-Effect (P-value)			***0.000***				***0.366***	
Fixed Effects:								
Student FE		Yes				Yes		
Classroom FE		Yes				Yes		

NOTES: This table displays results from outcome regressions in which we allow for interactions between all observed student and instructor races/ethnicities. We report the full set of 9 identified interactions for each regression. Same-Race/Ethnicity interactions are shown in red. We only show results for our preferred specification that includes student and classroom fixed effects. P-values for a F-test of the existence of same-race/ethnicity interactions and for the existence of any race/ethnicity-interactions are also listed. A classroom is defined by course, course section, and academic session. We consider 4 student outcomes: an indicator variation equal to one if the student drops the course; an indicator variable equal to one if the student passes the course;standardized course grades; and an indicator variable equal to one if the student has a grade of at least B. We also compute the regression coefficients for a sample of all students and a sample of low-priority students. *** Significant on 1%-level; ** Significant on 5%-level; * Significant on 10%-level. Standard errors are clustered by classroom.

APPENDIX TABLE 1 - SORTING REGRESSIONS

	LEVEL OF VARIATION IN INSTRUCTOR UNDERREPRESENTED-MINORITY STATUS ACROSS CLASSROOMS OF SAME COURSE				
	UNRESTRICTED		*NO VARIATION IN SAME YEAR-QUARTER*		*NO VARIATION IN SAME YEAR*
PANEL A: OUTCOME - STUDENT AGE					
All Students	-0.004	0.046	-0.205	0.091	-0.093
	(0.079)	(0.112)	(0.168)	(0.302)	(0.374)
All Low Registration Priority Students	0.052	0.083	-0.419	0.541	-0.814
	(0.123)	(0.174)	(0.328)	(0.651)	(0.685)
Entering Students (==> Low Registration Priority)	0.061	0.037	0.266	2.058	0.101
	(0.161)	(0.233)	(0.690)	(1.801)	(1.189)
Continuing Students, Low Registration Priority	-0.042	-0.050	-1.067 **	-1.849 *	-0.828
	(0.160)	(0.214)	(0.475)	(1.093)	(1.001)
Continuing Students, Not Low Registration Priority	-0.032	0.011	-0.099	-0.069	0.162
	(0.082)	(0.118)	(0.195)	(0.373)	(0.399)
FIXED EFFECTS (BY UNDERREPRESENTED MINORITY STATUS):					
Course and Year	No	No	Yes	No	Yes
Course and Year-Quarter	Yes	No	No	No	No
Course-Year	No	No	No	Yes	No
Course-Year-Quarter	No	Yes	No	No	No

NOTES: This table displays results from regressions of the minority-specific average student age in a classroom on an indicator equal to one if the average is associated with minority students, an indicator if the class is taught by a minority instructor, the interaction between these two variables, and a set of fixed effects. We only report the coefficient on the interaction term, to be interpreted as the extent to which minority students sort into classrooms taught by minority instructors. Each cell is associated with a different regression. A classroom is defined by course, course section, and academic session. Students and instructors belong to the group of "Underrepresented Minorities" if their race/ethnicity is reported to be Hispanic, African-American, or Native American, Pacific Islanders, or other non-Whites. Rows are defined by the subsample of students we consider. Low registration priority students are those students who have the lowest standing on course enrolment lists. Columns explore sensitivity of results with respect to different sets of fixed effects and different sources of variation used to identify the parameters. When using courses without variation in instructor underrepresented minority status in the same academic year, only one of the specifications can be estimated. *** Significant on 1%-level; ** Significant on 5%-level; * Significant on 10%-level. Standard errors are clustered on the level of the fixed effect.

	LEVEL OF VARIATION IN INSTRUCTOR UNDERREPRESENTED-MINORITY STATUS ACROSS CLASSROOMS OF SAME COURSE				
	UNRESTRICTED		***NO VARIATION IN SAME YEAR-QUARTER***		***NO VARIATION IN SAME YEAR***
PANEL B: OUTCOME - STUDENT GENDER					
All Students	0.009	0.014	-0.003	0.015	0.018
	(0.008)	(0.011)	(0.019)	(0.032)	(0.048)
All Low Registration Priority Students	0.018	0.013	-0.008	0.010	0.020
	(0.011)	(0.017)	(0.031)	(0.052)	(0.066)
Entering Students (==> Low Registration Priority)	0.006	-0.012	0.066	-0.127	0.209
	(0.022)	(0.034)	(0.061)	(0.152)	(0.129)
Continuing Students, Low Registration Priority	0.026	0.024	-0.041	-0.091	0.041
	(0.018)	(0.026)	(0.050)	(0.095)	(0.126)
Continuing Students, Not Low Registration Priority	0.006	0.012	0.002	0.019	0.008
	(0.009)	(0.013)	(0.023)	(0.040)	(0.061)
FIXED EFFECTS (BY MINORITY STATUS):					
Course and Year	No	No	Yes	No	Yes
Course and Year-Quarter	Yes	No	No	No	No
Course-Year	No	No	No	Yes	No
Course-Year-Quarter	No	Yes	No	No	No

NOTES: This table displays results from regressions of the minority-specific fraction of female students in a classroom on an indicator equal to one if the group fraction is associated with minority students, an indicator if the class is taught by a minority instructor, the interaction between these two variables, and a set of fixed effects. We only report the coefficient on the interaction term, to be interpreted as the extent to which minority students sort into classrooms taught by minority instructors. Each cell is associated with a different regression. A classroom is defined by course, course section, and academic session. Students and instructors belong to the group of "Underrepresented Minorities" if their race/ethnicity is reported to be Hispanic, African-American, or Native American, Pacific Islanders, or other non-Whites. Rows are defined by the subsample of students we consider. Low registration priority students are those students who have the lowest standing on course enrolment lists. Columns explore sensitivity of results with respect to different sets of fixed effects and different sources of variation used to identify the parameters. When using courses without variation in instructor underrepresented minority status in the same academic year, only one of the specifications can be estimated. *** Significant on 1%-level; ** Significant on 5%-level; * Significant on 10%-level. Standard errors are clustered on the level of the fixed effect.

	LEVEL OF VARIATION IN INSTRUCTOR UNDERREPRESENTED-MINORITY STATUS ACROSS CLASSROOMS OF SAME COURSE				
	UNRESTRICTED		*NO VARIATION IN SAME YEAR-QUARTER*		*NO VARIATION IN SAME YEAR*
PANEL C: OUTCOME - STUDENT HOLDS HIGHER DEGREE					
All Students	0.003	0.002	0.007	0.030	0.004
	(0.004)	(0.005)	(0.013)	(0.021)	(0.028)
All Low Registration Priority Students	0.000	-0.004	0.030	0.065	0.052
	(0.006)	(0.008)	(0.020)	(0.039)	(0.038)
Entering Students (==> Low Registration Priority)	0.013	0.002	0.073	0.079	0.024
	(0.009)	(0.012)	(0.048)	(0.120)	(0.068)
Continuing Students, Low Registration Priority	-0.004	-0.007	-0.007	-0.040	0.058
	(0.007)	(0.009)	(0.025)	(0.049)	(0.066)
Continuing Students, Not Low Registration Priority	0.005	0.006	0.004	0.031	-0.015
	(0.004)	(0.006)	(0.015)	(0.025)	(0.032)
FIXED EFFECTS (BY MINORITY STATUS):					
Course and Year	No	No	Yes	No	Yes
Course and Year-Quarter	Yes	No	No	No	No
Course-Year	No	No	No	Yes	No
Course-Year-Quarter	No	Yes	No	No	No

NOTES: This table displays results from regressions of the minority-specific fraction of students with a higher degree in a classroom on an indicator equal to one if the group fraction is associated with minority students, an indicator if the class is taught by a minority instructor, the interaction between these two variables, and a set of fixed effects. We only report the coefficient on the interaction term, to be interpreted as the extent to which minority students sort into classrooms taught by minority instructors. Each cell is associated with a different regression. A classroom is defined by course, course section, and academic session. Students and instructors belong to the group of "Underrepresented Minorities" if their race/ethnicity is reported to be Hispanic, African-American, or Native American, Pacific Islanders, or other non-Whites. Rows are defined by the subsample of students we consider. Low registration priority students are those students who have the lowest standing on course enrolment lists. Columns explore sensitivity of results with respect to different sets of fixed effects and different sources of variation used to identify the parameters. When using courses without variation in instructor underrepresented minority status in the same academic year, only one of the specifications can be estimated. *** Significant on 1%-level; ** Significant on 5%-level; * Significant on 10%-level. Standard errors are clustered on the level of the fixed effect.

	LEVEL OF VARIATION IN INSTRUCTOR UNDERREPRESENTED-MINORITY STATUS ACROSS CLASSROOMS OF SAME COURSE				
	UNRESTRICTED		***NO VARIATION IN SAME YEAR-QUARTER***		***NO VARIATION IN SAME YEAR***
PANEL D: OUTCOME - CUMULATED COURSES PRIOR TO ENROLMENT					
All Students	-0.016	0.077	-0.156	-0.012	-0.281
	(0.094)	(0.126)	(0.306)	(0.512)	(0.600)
All Low Registration Priority Students	-0.126	-0.073	-0.118	-0.682	0.724
	(0.080)	(0.101)	(0.270)	(0.511)	(0.601)
Entering Students (==> Low Registration Priority)	-0.025	-0.070	0.035	0.129	-0.245
	(0.057)	(0.081)	(0.268)	(0.511)	(0.337)
Continuing Students, Low Registration Priority	0.014	-0.024	0.364 **	0.367	0.147
	(0.055)	(0.076)	(0.187)	(0.443)	(0.394)
Continuing Students, Not Low Registration Priority	-0.073	0.034	-0.136	0.203	-0.812
	(0.093)	(0.122)	(0.327)	(0.589)	(0.636)
FIXED EFFECTS (BY MINORITY STATUS):					
Course and Year	No	No	Yes	No	Yes
Course and Year-Quarter	Yes	No	No	No	No
Course-Year	No	No	No	Yes	No
Course-Year-Quarter	No	Yes	No	No	No

NOTES: This table displays results from regressions of the minority-specific average number of courses taken prior to enrolment in a classroom on an indicator equal to one if the group average is associated with minority students, an indicator if the class is taught by a minority instructor, the interaction between these two variables, and a set of fixed effects. We only report the coefficient on the interaction term, to be interpreted as the extent to which minority students sort into classrooms taught by minority instructors. Each cell is associated with a different regression. A classroom is defined by course, course section, and academic session. Students and instructors belong to the group of "Underrepresented Minorities" if their race/ethnicity is reported to be Hispanic, African-American, or Native American, Pacific Islanders, or other non-Whites. Rows are defined by the subsample of students we consider. Low registration priority students are those students who have the lowest standing on course enrolment lists. Columns explore sensitivity of results with respect to different sets of fixed effects and different sources of variation used to identify the parameters. When using courses without variation in instructor underrepresented minority status in the same academic year, only one of the specifications can be estimated. *** Significant on 1%-level; ** Significant on 5%-level; * Significant on 10%-level. Standard errors are clustered on the level of the fixed effect.

	LEVEL OF VARIATION IN INSTRUCTOR UNDERREPRESENTED-MINORITY STATUS ACROSS CLASSROOMS OF SAME COURSE				
	UNRESTRICTED		***NO VARIATION IN SAME YEAR-QUARTER***		***NO VARIATION IN SAME YEAR***
PANEL E: OUTCOME - GPA PRIOR TO ENROLMENT					
All Students	0.013 (0.015)	0.017 (0.020)	-0.015 (0.037)	0.030 (0.061)	-0.042 (0.089)
All Low Registration Priority Students	0.025 (0.030)	0.026 (0.042)	0.000 (0.080)	0.071 (0.142)	0.017 (0.155)
Entering Students (==> Low Registration Priority)	0.008 (0.067)	-0.003 (0.106)	0.201 (0.217)	0.586 (0.498)	0.084 (0.526)
Continuing Students, Low Registration Priority	0.039 (0.051)	0.062 (0.073)	-0.072 (0.138)	-0.213 (0.342)	0.116 (0.202)
Continuing Students, Not Low Registration Priority	0.007 (0.015)	0.013 (0.021)	-0.036 (0.037)	0.015 (0.059)	-0.088 (0.101)
FIXED EFFECTS (BY MINORITY STATUS):					
Course and Year	No	No	Yes	No	Yes
Course and Year-Quarter	Yes	No	No	No	No
Course-Year	No	No	No	Yes	No
Course-Year-Quarter	No	Yes	No	No	No

NOTES: This table displays results from regressions of the minority-specific average cumulated GPA prior to enrolment in a classroom on an indicator equal to one if the group average is associated with minority students, an indicator if the class is taught by a minority instructor, the interaction between these two variables, and a set of fixed effects. We only report the coefficient on the interaction term, to be interpreted as the extent to which minority students sort into classrooms taught by minority instructors. Each cell is associated with a different regression. A classroom is defined by course, course section, and academic session. Students and instructors belong to the group of "Underrepresented Minorities" if their race/ethnicity is reported to be Hispanic, African-American, or Native American, Pacific Islanders, or other non-Whites. Rows are defined by the subsample of students we consider. Low registration priority students are those students who have the lowest standing on course enrolment lists. Columns explore sensitivity of results with respect to different sets of fixed effects and different sources of variation used to identify the parameters. When using courses without variation in instructor minority status in the same academic year, only one of the specifications can be estimated. *** Significant on 1%-level; ** Significant on 5%-level; * Significant on 10%-level. Standard errors are clustered on the level of the fixed effect.

APPENDIX TABLE 2 - ESTIMATED ROLE OF INSTRUCTOR MINORITY STATUS FOR THE PROPENSITY OF STUDENTS TO ENROL IN A SAME-SUBJECT COURSE IN THE FOLLOWING SEMESTER

PANEL A: INDIVIDUAL-LEVEL OUTCOMES, ONLY SUBJECT-TIME COMBINATIONS WITH ONE SUBJECT-COURSE

	(1)	(2)	(3)	(4)	(5)	(6)
NO FURTHER RESTRICTIONS						
Number of Observations:	***261,736***					
All Students	0.022 ***	0.020 ***	0.017 **	0.015 **	0.007	0.011 *
	(0.008)	(0.007)	(0.007)	(0.008)	(0.006)	(0.006)
All Low Registration Priority Students	0.014	0.033 ***	0.026 **	0.018	0.022 *	0.031 **
	(0.015)	(0.012)	(0.013)	(0.015)	(0.012)	(0.016)
STUDENT TAKES SUBJECT-COURSE FOR THE FIRST TIME						
Number of Observations:	***162,514***					
All Students	0.024 **	0.022 ***	0.015 *	0.022 ***	0.011	0.015 *
	(0.010)	(0.008)	(0.009)	(0.009)	(0.007)	(0.008)
All Low Registration Priority Students	0.007	0.026 **	0.016	0.029 *	0.022 *	0.045 *
	(0.016)	(0.013)	(0.015)	(0.017)	(0.013)	(0.019)
FIXED EFFECTS:						
Year-Quarter-Minority	**Yes**	**Yes**	No	No	No	No
Course-Minority	No	**Yes**	No	**Yes**	No	No
Course-Minority-Year-Quarter	No	No	**Yes**	No	No	No
Student	No	No	No	**Yes**	No	**Yes**
Classroom	No	No	No	No	**Yes**	**Yes**
CONTROLS:						
Instructor Controls	**Yes**	**Yes**	**Yes**	**Yes**	No	No
Student Controls	**Yes**	**Yes**	**Yes**	No	**Yes**	No

PANEL B: DATA AGGREGATED TO INDIVIDUAL-SUBJECT-TIME LEVEL

	(1)	(2)	(3)	(4)
NO FURTHER RESTRICTIONS				
Number of Observations:	***287,215***			
All Students	0.008	0.006	0.008	0.001
	(0.009)	(0.007)	(0.007)	(0.008)
All Low Registration Priority Students	-0.015	0.012	0.019	0.008
	(0.015)	(0.012)	(0.012)	(0.019)
STUDENT TAKES SUBJECT-COURSE FOR THE FIRST TIME				
Number of Observations:	***175,866***			
All Students	0.010	0.007	0.009	0.012
	(0.010)	(0.008)	(0.008)	(0.008)
All Low Registration Priority Students	-0.021	0.011	0.016	0.025 *
	(0.018)	(0.013)	(0.013)	(0.015)
FIXED EFFECTS:				
Year-Quarter-Minority	**Yes**	**Yes**	No	No
Subject-Minority	No	**Yes**	No	**Yes**
Subject-Minority-Year-Quarter	No	No	**Yes**	No
Student	No	No	No	**Yes**
CONTROLS:				
Instructor Controls	**Yes**	**Yes**	**Yes**	**Yes**
Student Controls	**Yes**	**Yes**	**Yes**	No

NOTES: This table displays results from regressions of an indicator variable for whether a student takes a course in the same subject in the subsequent semester. We report the coefficient of the interaction between student's and instructor's underrepresented minority status. Each cell is associated with a different regression. In the first panel we use observations for which the student has taken only one course in the same subject during a semester. In the second panel we aggregate up the data to the student-subject-time level. A classroom is defined by course, course section, and academic session. Students and instructors belong to the group of "Underrepresented Minorities" if their race/ethnicity is reported to be Hispanic, African-American, or Native American, Pacific Islanders, or other non-Whites. We explore the sensitivity with respect to the regression specification, i.e. the set of fixed effects and controls included in the regressions. Student controls include age and gender; instructor controls include age, gender, and a part-time indicator. We also compute the regression coefficients for a sample of all students and a sample of low-priority students. *** Significant on 1%-level; ** Significant on 5%-level; * Significant on 10%-level. Standard errors are clustered by classroom in Panel A and by subject-time in Panel B.