TAs Like Me: Racial Interactions between Graduate Teaching Assistants and Undergraduates*

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Abstract

Over the past 40 years, institutions of higher education in the U.S. have experienced a dramatic shift in the racial composition of students enrolled in both undergraduate and graduate programs. Using administrative data from a large, diverse university in California, we identify the extent to which the academic outcomes of undergraduates are affected by the race/ethnicity of their graduate student teaching assistants (TAs). To overcome selection in course taking, we exploit the timing of TA assignments, which occur after students enroll in a course, and use within class and within student variation in TA-student race/ethnicity composition. Results show a positive and significant increase in course grades when students are assigned TAs of a similar race/ethnicity. These effects are largest in classes where TAs were given advanced copies of exams and when exams were not multiple choice. We also find that assignment to similar race TAs positively affects student attendance to TA office hours and discussion sections. Overall, our evidence is consistent with TA-student match quality gains, role model effects, and potential discrimination in grading.

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1 Introduction

From 1995 to 2012, the United States has steadily fallen relative to other developed countries in college completion rates. Over this short period of time, the US went from having the highest young-adult college completion rate among OECD countries to nineteenth.[1] Especially alarming is the fact that US college completion rates have stagnated *despite* increases in overall college attendance (Turner, 2004; Pew Research Center 2014) and large increases in the returns to a college education in the US (Oreopoulos and Petronijevic, 2013). Educational mobility in the US also trails the majority of other OECD countries. For example, in the US approximately 29% of men and 17% of women have less education than their parents, compared to the OECD averages of 19% and 13% of men and women, respectively (Weston, 2014). Underlining these college completion rates are prominent racial gaps (Fry, 2002; Arcidiacono et al., 2011). In 2009, over 50% of Asian adults aged 25 and older held a bachelor's degree or higher compared to less than 20% of African-Americans and Hispanics (Current Population Survey 2009). Such differences in postsecondary educational attainment could lead to persistent income inequality across racial groups (Altonji and Blank, 1999; Card, 1999; Jencks and Phillips, 1998).

A natural question to ask is, once students enter college, what factors determine the likelihood they succeed and graduate? Several prior studies have presented causal evidence on various university inputs that influence undergraduate success, including capacity constraints and resources (Bound et al., 2010; Bound et al., 2012), professor quality, gender, and race (Hoffmann and Oreopoulos, 2009b; Carrell and West, 2010; Hoffmann and Oreopoulos, 2009a; Carrell et al., 2010; Fairlie et al., 2014), coaching and advising (Bettinger and Baker, 2014; Angrist et al., 2009), and academic probation (Lindo et al., 2010).

One glaring omission from this literature centers on teaching assistants (TAs), who account for nearly 15% of the total employment of postsecondary teachers in the US annually (Bureau of Labor Statistics, OES). TAs are graduate students employed by a university who perform various duties in the course while under the supervision of a professor or lecturer. Many of these duties impact student success in the course, including 1) hosting small weekly discussion sections, 2) holding office hours, 3) tutoring, 4) proctoring exams, 5) grading assignments and exams, and 6) arranging meetings with students. TA-student relationships are unique in that they are more likely to be a peer-based interaction, since the typical age gap between undergraduates and TAs is relatively small.[2] Additionally, with class sizes

[1] OECD (2014), Education at a Glance 2014, Chart A3.2. Twenty-eight member countries in 2012 were considered for the study.

[2] Several studies have focused on the potential benefits of peer-based mentoring and tutoring. For example, Castleman and Page (2014) find that near-aged peer mentors in college who sent text messages during the summer to college-intending high school graduates substantially increased subsequent college enrollment.

and student-professor ratios increasing in the US (Cuseo, 2007; Kokkelenberg et al., 2008; Schanzenbach, 2014), TAs are likely to play an increasingly important role in the US post-secondary education system.

In this paper, we begin to shed light on the importance of TAs in the education production function. To do so, we focus on the role of TA race. Understanding how TA race influences student outcomes is particularly important given recent trends in the US. For the past 40 years, undergraduate and graduate programs have been experiencing a dramatic shift in student racial composition. In 1976, 82% of students enrolled in undergraduate programs in the US were White, compared to only 57% in 2013. A similar pattern can be observed in post-baccalaureate programs, where the fraction of non-White students grew by 180% from 1976 to 2013 (NCES 2014).

Why might students be influenced by TA race? Role model effects are often mentioned as an important determinant affecting educational outcomes. Another factor might include racial differences in the academic expectation of the student. Research from psychology and sociology suggests that equally skilled students of different races may perform differently due to the students' self-belief about their ability to succeed, and these gaps may be muted (or exacerbated) by the TA's race (Spencer et al., 1999). Another channel is a match quality effect, where TAs of different races may have, on average, particular teaching styles or capabilities which are better suited to students of similar race.[3] Finally, TAs may exhibit bias with respect to how they treat, consciously or unconsciously, students of a similar race.

Numerous studies have investigated the importance of student-teacher interactions at the postsecondary level, with a majority focusing on the role of professor gender. Early studies found mixed results, though these studies likely suffer from potential selection biases (e.g. Rothstein, 1994; Canes and Rosen, 1995; Neumark and Gardecki, 1998). More recent studies, which have exploited within class and within student variation to overcome selection issues, have found positive same-gender effects on course grades, choice of major, course credits, and course dropping (Bettinger and Long, 2005; Hoffmann and Oreopoulos, 2009a; Hoffmann and Oreopoulos, 2009b). Likewise, using random assignment to courses, Carrell et al. (2010) find that professor gender has a significant impact on female students' performance in STEM courses. Finally, most closely related to our study, Fairlie et al. (2014) focus on student-instructor race interactions at a community college and find that race plays a large role in student outcomes.

To our knowledge, this is the first study to investigate the importance of TA race.[4] Our

[3]This channel includes language matching where all else equal, a student learns more if particular material can be taught in the student's native language, and students who share the same race as their TAs are more likely to share the same native language.

[4]One exception is a study by Borjas (2000) who examined selection into course sections with foreign-born

primary analyses utilize over 600,000 student-class observations across an eight year period from a public university in California, coupled with TA assignment data from the university's Department of Economics. The institution we study is large and racially-diverse. In 2014, of the over 34,000 students enrolled, 39% were Asian or Pacific Islander, 19% were Hispanic, and 29% were White. Our data also include a survey that was offered to all professors who taught an economics class during the period of our study, which asked about exam structure (multiple choice vs. essay) and whether exams were shared with TAs prior to the exam date. Lastly, our data include an audit study which recorded student attendance during optional TA discussion sections and office hours.

We consider several empirical strategies to causally identify the effects of TA-student racial interactions and to overcome concerns of potential selection bias. Our primary analyses focus on models with class fixed effects, where we estimate differences in outcome variables between students across different races when assigned to the same TAs within the same class.[5] Since the explanatory variable varies both within class, across students, and within student, across classes, the data also allow us to control for sorting that occurs across classes by simultaneously including student fixed effects with class fixed effects. Furthermore, we find no evidence of endogenous sorting into classes by student race when predicting the race of the class' TAs with a full set of controls, including professor race and gender, student gender, high school GPA, age, class standing, and major. The lack of evidence of endogenous sorting is unsurprising for several reasons. First, the primary course registration period for undergraduates occurs before TA assignments are generated by the department. Secondly, once generated, the department only privately reveals the TA assignments to the corresponding professors and TAs.[6]

Our results show that students perform better in classes taken with TAs who are of a similar race. We predict a 7.7% of a standard deviation increase in course grade for students who are assigned to TAs of similar race, relative to being assigned to TAs of dissimilar race. This result is robust across various specifications, racial categorizations, and subsamples. Race interactions have no impact on course withdrawal rates or likelihood of enrolling in subsequent related courses. As a falsification test, we also find that course grades are uninfluenced by the racial composition of a student's TAs in future courses.

TAs across three introductory economics courses.

[5] We define class as a combination of a course (e.g. Introductory Microeconomics), term (e.g. Fall 2010), and lecture. For popular courses, several lectures may be offered within the same term such that each lecture constitutes a different class. TAs are never assigned to more than one class within a term.

[6] In other words, TAs and professors themselves do not know which classes TAs are assigned to by the time most undergraduates enroll. While undergraduates still have the ability to register for courses after the end of the primary registration period, the majority of classes fill up by the time this period is over, leaving little capacity for students to be selective with their courses.

Finally, we use the audit study and professor survey to offer evidence for the mechanisms potentially driving the results. Results show that students are more likely to attend their TAs' optional discussion sections and office hours when the TA is of a similar race, providing direct evidence of students responding to similarly-raced TAs. We also see that racial interaction effects are especially prominent in classes where TAs had been given a copy of the exam prior to the exam date. We interpret this result as evidence of "teaching to the exam", where TAs, perhaps unconsciously, divulge information that is pertinent to the exams. Students who attend the TAs' discussion sections and office hours are the beneficiaries of teaching to the test, and attending students tend to be of similar race as the TAs.

Lastly, racial interaction effects are strongest in classes which had no multiple choice questions on the exams. For these classes, we predict a 0.217 standard deviation increase in course grade for students who are assigned to TAs of similar race. This result could stem from several possible explanations. First, critical thinking is typically a key component to success on essay-based questions, and critical thinking skills may be fostered in settings where students discuss and ask questions about the course material, such as in TA discussion sections and office hours. Another explanation suggests that TAs are responding to students of similar race through grading.[7] Classes with no multiple choice exams are classes where TAs exercise subjective judgment when grading, and students of specific races may be more likely to answer non-multiple choice questions in a manner which TAs of similar race favor.

The remainder of this paper proceeds as follows. Section 2 introduces the data. Section 3 discusses our identification strategies and econometric specifications. Section 4 presents our results, and section 5 concludes.

2 Data

2.1 Data Sources and Institutional Background

Our paper centers on detailed student administrative data from a large, public university in California with a highly diversified student community. In 2014, over 34,000 students enrolled at the university, where 39% of the enrolled students were Asian or Pacific Islander, 19% were Hispanic, and 29% were White. U.S. News & World Report (2015) classifies the university admissions as "most selective" and ranks the university as one of the best public university in the United States. Our primary analyses link the student administrative data to graduate teaching assistant (TA) assignment data from the university's Economics Department. The B.A. in Economics is the second largest major at the university, accounting for over 6% of degrees conferred annually. These data cover the academic school years from

[7] Other studies have found gender biases in teacher grading at the secondary school level (Lavy and Sand, 2015).

2003 to 2011 for the three primary quarters of enrollment: Fall, Winter, and Spring.[8]

Each observation in our data set pertains to a student who enrolls in a class. We define a class as a combination of a course (e.g. ECN100), a term (e.g. Fall 2010), and a lecture. For popular courses, multiple lectures are often offered within the same term, with different TAs assigned to each lecture (and quite often, different professors). We have a series of student-level characteristics, including term admitted, major(s), admission basis (freshman vs. transfer), gender, race, nationality, parental education, and high school GPA. Student-by-term level variables include academic standing (Freshman/Sophomore/Junior/Senior) and age. Finally, class-level controls include professor gender and race. We match each student by class observation to TAs assigned to the class. Since a single class may contain up to three TAs, we do not necessarily analyze one-to-one matches between a student and a TA.[9] Consequently, as described in further detail in section 3, we link the race of a student enrolled in a class to the racial composition of the TAs assigned to the class.

Lastly, our paper utilizes two supplemental sets of data. First, in the Fall of 2014, a survey was offered to all professors who taught a class during our 2003 to 2011 time frame. For each class a professor taught, the survey recorded 1) whether the professor shared a copy of the class' exams with the TAs prior to the exam date and 2) the structure of the exams (multiple choice vs. short/long answer).[10] Approximately 58% of our total student-by-class observations are covered by professor survey responses. Secondly, in the Spring 2015 quarter, an audit study was conducted where student attendance by gender and race at TA discussion sections and office hours was recorded by an undergraduate research assistant who audited the class. TA discussion sections and office hours are hosted weekly throughout the quarter, and attendance in this setting is optional for enrolled students. Auditors visited the TA discussion sections during the third and fourth weeks of the term and the office hours during the fifth and sixth weeks. The audit study covers 124 discussion sections and 102 office hours.

2.2 Summary Statistics

The main outcome variable of interest is the grade each student received in each class, conditional on staying enrolled. Following the classical American letter grading system, at the end of the term, each professor assigns a letter grade (with +/- modifiers) to each student

[8] Hence, we do not focus on any special quarters, such as summer sessions.

[9] In economics courses, a student is technically assigned to a single TA, but often has the liberty to choose any of the TAs in their class to attend discussion sections, visit office hours, etc. Furthermore, it is the joint responsibility of all TAs within a class to assist with lectures, grade assignments and exams, etc.

[10] Valid responses to the question of sharing exams with the TAs included "Yes", "No", "Sometimes", and "I don't remember". When using this question for analyses, we only focus on the sample of responses that were either "Yes" or "No".

in his/her classes based on the student's performance on class assignments and exams. Each letter grade then gets translated by the university into a numerical grade point average (GPA) value (e.g. $A = \frac{12}{3} = 4.0$, $A- = \frac{11}{3} \approx 3.7$, $F = 0$). For each class, professors are asked to attain an average GPA around 2.7, though professors are given discretion to deviate from this average. For our primary analyses, we standardize each student-by-class grade to a mean of zero and a standard deviation of one by class, and call this variable "Standardized grade". As a robustness check to the standardization, later analyses consider ordered logit and ordered probit specifications using the letter grades. Another student-by-class outcome variable of interest includes an indicator for whether the student withdrew from the class ("Dropped class"). Other outcomes we save for the appendix include indicators for whether the student passed the class and whether the student enrolled in a class in the same subject in a subsequent term.

Table 1 presents summary statistics for our main sample of interest. We have 60,642 student-by-class observations, 19,522 students, 614 classes, and 286 teaching assistants. From Panel A, over 50% of students were male, and nearly 4% of students are identified as international, while the average high school (weighted) GPA for students was 3.64. Panel B reveals that on average, over 117 students enrolled in each class, over 70% of instructors were White, and nearly 14% of instructors were Asian. Consistent with the notion that classes are difficult to get into, Panel C shows that under 2% of students drop the class once they successfully enroll. Grade Point Average in Panel C corresponds to the numerical grade the student received in the class, which ranges between 0 (for F) and 4.0 (for A). White students received an average class grade around 2.55, in between a C+ and B-, while Asian students received an average grade slightly above a B-. The standard deviation of GPA is around one grade point unit, so the distance between two letter grades (e.g. C vs. B) is roughly one standard deviation. A student is flagged as passing the class if they received a C- ($\frac{5}{3}$ in GPA units) or higher, or a "Pass" in the class.[11] Over 80% of students passed their classes. From Panel D, we find that almost half of the students were Asian, while nearly a third were White. Meanwhile, for TAs, roughly 38% were White and 44% were Asian.[12]

Given these summary statistics, we can also turn to the Integrated Postsecondary Education Data System (IPEDS) to consider how generalizable our findings may be to other universities. The fraction of White students in our sample compares similarly to that of

[11] In certain classes, students can opt to receive a grade of either "Pass" or "No Pass", which do not translate into GPA units. Typically, to determine whether a student deserves a "Pass", a professor submits letter grades to the university, and then the university assigns a grade of "Pass" if the student received a C- or higher.

[12] A student/TA/professor is classified as of Asian race if their primary race is recorded as Chinese, Japanese, Korean, Filippino, South-East Asian, Vietnamese, Thai, or "Other Asian".

all other California universities, where 27.1% and 36.9% of undergraduate and graduate students were White, respectively. On the other hand, our sample has a smaller share of minorities and a larger share of Asian students, as roughly 22% of California undergraduates were Asian and 50% were from a minority background. For other observable characteristics, undergraduates in our sample appear similar to the average undergraduate attending a US research university.[13] For instance, the 25^{th} (75^{th}) percentile SAT Math score for undergraduates at research universities was 558 (667), compared to 560 (680) for our sample. Our sample contains 47% female students, compared to 51% of undergraduates at research universities. Approximately 5% of students from research universities come from a foreign country, and the age profile of undergraduates also looks broadly similar.

3 Econometric Specifications

Our first specification estimates the impact of TA race for Asian and non-Asian student subsamples separately, using the following specification:[14]

$$y_{ikt} = \gamma SameRaceTA_{ikt} + \beta X_{ikt} + \lambda_k + \alpha_t + u_{ikt} \tag{1}$$

where y_{ikt} is an outcome for student i taking course k in school term t, X_{ikt} is a vector of student by class controls, λ_k and α_t are fixed effects for course and term, respectively, and u_{ikt} is the error term. $SameRaceTA_{ikt}$ is the fraction of student i's TAs for course k in school term t that are of similar race to the student. In other words, if student i is (non-)Asian, then $SameRaceTA_{ikt}$ is the fraction of the student's TAs in course k and term t that are (non-)Asian. Since the number of TAs assigned to a class ranges from one to three, $SameRaceTA_{ikt}$ carries a value of either 0, $\frac{1}{3}$, $\frac{1}{2}$, $\frac{2}{3}$, or 1. The estimated γ coefficients measure the average effect from taking a class in which all TAs are of a similar race versus all TAs of a different race, and captures both the racial interaction effect and a TA quality effect (if Asian TAs teach differently than non-Asian TAs, for example). The summation of the γ coefficients for the subsamples captures the interaction effect of a student being of similar race as their TAs (see Appendix).

The data also allow us to estimate the following specification, which includes class fixed effects:

$$y_{ikt} = \psi(A_i * AsianTA_{ikt}) + \beta X_{it} + \lambda_{kt} + \alpha_{kA} + \delta_{tA} + u_{ikt} \tag{2}$$

[13] IPEDS uses the basic Carnegie Classification of Institutions of Higher Education (2010) to determine the list of research universities.

[14] Our primary analysis divides by Asian and non-Asian subsamples since this parses the data most evenly. We discuss alternative racial categorizations and subgroups in the results and appendix sections, and the overall findings remain unchanged.

where y_{ikt} is a class-specific outcome for student i, A_i is an indicator variable for whether student i is Asian, $AsianTA_{ikt}$ is the Asian composition of student i's TAs for class kt, X_{it} is a vector of student by term controls, and λ_{kt}, α_{kA}, and δ_{tA} are class, course-by-race, and term-by-race fixed effects, respectively.

The core of our identification strategy centers on class fixed effects, which control for unobserved factors that vary at the class level and affect student performance. Note that class fixed effects also control for professor fixed effects since each class is taught by exactly one professor. These, in turn, control for the possibility that students of a particular race take classes with professors who are systematically different from other professors. Class fixed effects also avoid the need to rely on settings with standardized grading or testing procedures across classes since students within a class are completing the exact same assignments and tests. Thus, we are solely comparing the academic performances of Asian and non-Asian students within the same class and subjecting the students to the same class-level shocks, such as the professor's and TAs' characteristics (e.g. ability/experience) or the time/size of the class.

Course-by-race fixed effects allow for racial differences in the outcome variable to vary across courses. These are necessary to account for the possibility that the courses in which non-Asians and Asians tend to perform differently are also the courses in which TAs tend to be non-Asian or Asian, respectively.[15] Term-by-race fixed effects account for the possibility that the academic capabilities of Asian or non-Asian students are changing over time. The coefficient ψ measures the average outcome gain for Asian students, relative to non-Asian students, from assignment to Asian TAs. Conversely, ψ measures the average outcome loss for non-Asian students, relative to Asian students, from assignment to Asian TAs versus non-Asian TAs.

Finally, to measure student attendance by race to TA discussion sections and office hours from the audit study, we consider the following specification:

$$fracStudentAsian_s = \rho AsianTA_s + \beta X_s + u_s \tag{3}$$

where each observation corresponds to TAs' discussion sections or office hours. X_s comprises of indicators for the weekday, the time, and the individual auditor for the discussion section or office hour.[16] Observations are weighted by total attendance of students to the discussion section or office hour. The coefficient ρ is the expected increase in the fraction of

[15]For example, Asian students may be more likely to enroll in an international studies course and Asian TAs may be more likely to be assigned to international studies. Indeed, when evaluating student grades, our estimated magnitude of ψ slightly increases when we exclude course–by-race fixed effects (see Appendix Table A.3).

[16]There were 23 separate auditors who attended the discussion sections and office hours.

attendees who are Asian in response to the discussion section or office hour being hosted by an Asian TA.

3.1 Identification

The primary threat to our identification strategy is self-selection into courses by TA race, which could result in a correlation between unobserved variables in the error term u_{ikt} and the interaction term $A_i * AsianTA_{ikt}$. For example, our estimates would be biased if high ability Asian students systemically select into classes assigned Asian TAs and high ability non-Asian students systematically select into classes assigned non-Asian TAs. Prior work looking at professor-student relationships potentially suffer from such selection biases, where students of a particular gender/race, and different academic capabilities, select into classes based on the teacher gender/race.[17]

To mitigate selection biases, previous studies have often focused on a sub-sample of students or classes where selection was arguably less of an issue.[18] Fortunately, in our setting, it is nearly impossible for undergraduates to identify which TAs are assigned to classes prior to enrollment. Importantly, the primary registration period for undergraduate classes occurs well before the economics department generates TA assignments for classes.[19] While undergraduates (technically) have the ability to register for courses after the end of the primary registration period, the majority of classes fill up by the time this period is over, leaving little capacity for students to be selective with course registration.

To formally test for endogenous enrollment by race, we regress $AsianTA_{ikt}$ on observable characteristics and term and course fixed effects. The first column of Table 2 presents results from our main sample of interest, while the next two columns consider Asian and non-Asian student subsamples. The final three columns consider the subsample of classes taught by professors who completed our survey. Results show that our regressors are generally small and weak predictors of Asian TA composition, and the race of the student is a weak predictor of TA race. For each regression, we test the hypothesis that all covariates are jointly equal to zero, conditional on term and course fixed effects, and report the p-values. Across all samples, we fail to reject the hypothesis that all covariates have no power in predicting TA race.[20] Results from this analysis, coupled with practical knowledge of the registration

[17] Perhaps exacerbating selection biases in prior studies are services such as *ratemyprofessor.com*, which provide students with extensive information about their instructors.

[18] For instance, Fairlie et al. (2014) focus on students with relatively low standing on registration priority lists since these students have little ability to be selective with their courses.

[19] For example, for the Spring 2014 term, which started in March, the primary undergraduate registration period started on February 3 and ended on February 14. The department of economics generated and privately revealed TA assignments on February 27 to TAs and professors.

[20] We also consider the "sorting regressions" of Fairlie et al. (2014) in Appendix Table A.1, and find no evidence of endogenous sorting. The primary benefit of the Fairlie et al. (2014) specification is the ability

process for students into classes, indicate that our primary regressor of interest is likely free from selection bias.

As an additional validity check of our identification strategy, we examine whether student performance in current courses responds to TA race in *future* courses. In other words, under the assumption that there are no across-term correlations of selection into courses by TA race, the race of a student's TAs in future courses should have no influence on a student's current term performance. Panel A of Table 4 presents these results. Across all specifications, we find that the race of future TAs has no impact on current term performance.[21]

4 Results

4.1 Main Results

Table 3 presents our main results. The first two rows from Table 3 report estimates for γ from specification (1), where we regress our dependent variables on the fraction of TAs who are Asian and non-Asian for Asian and non-Asian student subsamples, respectively. Focusing on the first column, which includes term and course fixed effects, Asian students receive a statistically significant 2.3% of a standard deviation boost in course grade when the racial composition of the TAs is entirely Asian, relative to being entirely non-Asian. Similarly, we estimate a 3.7% of a standard deviation increase in course grade for non-Asian students when enrolled in a class with all non-Asian TAs.

The summation of these two estimates is the expected relative change in performance between Asian and non-Asian students when the student has all Asian TAs instead of all non-Asian TAs. To test whether this summation is significant, we estimate the model on the entire sample while including an interaction between the Asian TA composition variable and an Asian student dummy variable.[22] Results are presented in the row labeled, "Effect of Similar Race" and show the summation is statistically significant. These results suggest that students perform relatively better when taking classes with TAs who are of a similar race.

For the remaining columns of Table 3 under "Standardized grade", we consider the sensitivity of the results to the inclusion of different fixed effects and controls. The second column includes a full set of controls, while the third column replaces course and term fixed effects with class fixed effects.[23] Column four replaces student-level controls with student fixed

to condition on class fixed effects. A drawback is that one cannot simultaneously test the importance of observables X_{ikt} in predicting TA race.

[21] Note that this analysis drops all students who only enrolled in one term of classes, and the last term for which students enrolled in classes.

[22] We also allow for Asian-specific coefficients for each regressor.

[23] Note that specification (1) is not estimable with class fixed effects since class fixed effects absorb the racial composition of the class' TAs.

effects.[24] Across specifications, we estimate statistically significant gains for students when assigned TAs of similar race. From our fully-specified model with both class and student fixed effects, we predict a 0.077 standard deviation increase in course grade when students are matched to TAs who are all of a similar race as themselves.[25] Given the standard deviation of course grades is slightly over one grade point unit, and the value of a grade modifier (+/-) is a third of a grade point unit, this effect is roughly equivalent to an increase of a fourth of a grade modifier. Standard errors are clustered by professor for all specifications.[26] Panel B presents the results for classes where the professor responded to our survey.

One hypothesis is that the similar race effects we find could simply reflect a systematic change in student composition that occurs after students enroll in the class. That is, after students observe the race of their TAs, they decide whether to drop the course. This would be a concern, for instance, if high ability non-Asian students systematically drop classes once they observe that the TAs are Asian. While this effect is likely to be small, since overall drop rates are under 2% (Table 1), we formally test for this possibility using "Dropped class" as an outcome variable. From columns five through eight of Table 3, we find no evidence that Asian and non-Asian students differ in their choice to drop a course based on the racial composition of the TAs.[27]

4.2 Specifications Using Letter Grades

In order to further test the robustness of our results, and to understand how the distribution of grades shifts in response to TA race, we consider alternative specifications utilizing the raw letter grades students received in their classes. Students who enrolled in a class for a letter grade received either an A(-), B(+/-), C(+/-), D(+/-), or F. Similar to specification (1), we first consider the impact of TA race for Asian and non-Asian student subsamples separately. Then, similar to specification (2), we estimate models where we interact student race with TA

[24] Since student fixed effects rely on within student, across class variation, our primary regressors of interest are only identified with students who enrolled in more than one class.

[25] When the data are parsed by White and non-White students and TAs, this coefficient drops slightly to 0.076 standard deviations, and maintains statistical significance at the 1% level (see Appendix Table A.5). Racial interactions remain statistically significant when we consider specifications (1) and (2) with finer race categorizations (see Appendix Table A.6 and Table A.7).

[26] With fewer professor clusters than class clusters, we conservatively cluster at the professor level instead of the class level. Ideally, we would cluster at the TA level, but since a single class may contain up to three TAs, a single observation may belong to up to three TA clusters. There are fewer professors than TAs in our setting. As a robustness check, we consider the subsample of classes which had only one TA and cluster at the TA level. Both estimated magnitudes and standard errors slightly increase, with the results remaining largely statistically significant (see Appendix Table A.3, Panel C). The standard errors decrease when we cluster at the class level instead of professor level.

[27] Appendix Table A.2 presents results with additional outcome variables. We find significant positive racial interactions effects on students passing their classes, with no result on students' subsequent enrollment in classes.

racial composition. Figure 1 displays the marginal effects from ordered logit regressions of having TAs of similar race (or for "Effect of Similar Race", $A_i{*}AsianTA_{ikt}$) on the probability of attaining each possible letter grade.[28] We find that students are significantly more likely to attain grades of B or higher when matched to TAs of similar race. Correspondingly, students are also less likely to attain grades of C+ or lower when matched to TAs of similar race. The largest marginal effects come from increases in the probability of receiving an A, followed by decreases in the probability of receiving a C, in response to having TAs of similar race.

4.3 Mechanisms

An important question to address for welfare and potential policy implications centers on the mechanisms that are driving our results. TA race could influence student outcomes in several manners. Role model effects are often mentioned as a determinant affecting educational outcomes. In our setting, students may be inspired by their TAs, or be more comfortable approaching and learning from their TAs due to the TA sharing a similar race.

Another channel is a match quality effect, where TAs of different race/ethnicity have particular teaching styles which are better suited to students of similar race/ethnicity. Included in this channel is a language matching effect, where students learn more if course material can be explained in the student's native language, which is more likely to occur when students share the same race/ethnicity as their TAs. Thus, with a match quality effect, students and TAs are not directly responding to the other's race, but instead students are reacting to a characteristic that is, on average, associated with their TAs' race/ethnicity.

Finally, TAs could exhibit bias with respect to how they treat students of a similar race. Discrimination could happen on an unconscious level where, for example, TAs of particular races may be more lenient when grading certain types of errors on exams that are more likely to be made by students of similar race.

To identify the potential mechanisms driving our results, we first test for student response to TA race by examining student attendance at optional TA discussion sections and office hours. Results in Table 5 show that across all specification and outcomes, TA race is positively related to the race of the attending students. From column (3), we predict an 8.4 percentage point increase in the fraction of attending students who are Asian in response to the discussion section being taught by an Asian TA. For office hours, we estimate a 20 percentage point increase in fraction of Asian attendees in response to the office hour being

[28]Appendix Table A.8 reports the estimated coefficients and marginal effects from these regressions, as well as estimates from ordered probit models. Estimates across ordered logit and ordered probit specifications are nearly identical and exhibit similar patterns.

hosted by an Asian TA.[29] These results provide evidence of students directly responding to TAs of similar race. Furthermore, the underlying motive for the students' attendance may be driven by a match quality effect, where a student is learning more from their TAs due to the TAs' teaching styles or capabilities.

Next we examine whether our effects differ across exam type by utilizing responses to the professor survey. Results in Table 6 indicate that our same-race effects are largest in classes with non-multiple choice exams. The estimated racial interaction effect in these courses is 0.217 standard deviations for the specification with both student and class fixed effects. We observe smaller, statistically insignificant interaction effects when focusing on classes that had exams with multiple choice. One interpretation of this finding is a match-quality effect. That is, classes without multiple choice exams may require more critical thinking skills, which are gained in TA discussion sections and office hours. Another explanation, suggesting discrimination, stems from TA grading behavior. Classes with non-multiple choice exams allow TAs to exercise more subjective judgments when grading. Students of specific races may be more likely to answer non-multiple choice questions in a manner which TAs of a similar race favor.

Table 6 also suggests that the observed racial interaction effects are especially driven by classes where TAs were given advanced copies of the exam. From column (6), we predict an 11.6% of a standard deviation increase in course grade for Asian students when taking a class with all Asian TAs versus non-Asian TAs. Similarly, non-Asian students see a boost of 3.9% of a standard deviation in course grade in response to taking a class with all non-Asian TAs instead of Asian TAs. Estimated racial interaction effects are statistically significant at the 10% level across all considered specifications. We interpret these results as TAs "teaching to the test", where when a TA is given a copy of the exam, the TA adjusts his/her discussion section and office hour lessons to better suit the material that will appear on the exam. Teaching to the test would benefit students who attend discussion sections and office hours, and as evidenced from the audit study, attending students tend to be of similar race as the TA.[30]

Finally, one may hypothesize that if material across courses had significant overlap and there were significant increase in learning in response to TA race, then the racial composition of a student's *past* TAs would influence their *current* grades. To test for this possibility, we

[29] The total number of (non-)Asian students who attend discussion sections increases when the TA is (non-) Asian. On the other hand, the total number of office hour attendees decreases, irrespective of student race, in response to office hours being hosted by an Asian TA; the decrease in Asian student attendees is smaller than the decrease from non-Asian student attendees.

[30] The racial interaction effects are strongest in classes that had both shared exams with TAs and no multiple choice (see Appendix Table A.4).

again consider specification (2) where we additionally include an interaction term between the indicator for student race A_i and the proportion of student i's TAs who were Asian in the term prior to the class being taken ($A_i \times AsianTA_{i(t-1)}$). Panel B of Table 4 presents results from this analysis. We find no evidence that the racial composition of a student's prior TAs influences current grades. These results suggest that either there is little overlap in the material taught across courses, or that any learning gains that stem from racial interactions do not carry over across terms.

5 Conclusions

In spite of increases in overall attendance, college completion rates have stagnated in the US. A natural question to ask is, once the student enters college, what factors determine student success? The goal of this paper is to shed light on the importance of TAs in determining student outcomes, focusing on the role of TA race. Understanding how TA race influences student outcomes is particularly important given recent trends in the US, where the fraction of non-White undergraduate and graduate students has nearly tripled over the past 40 years. Prominent racial gaps, in turn, lead to persistent income inequality across racial groups.

Our primary analyses come from detailed student administrative data from a large public university in California. We consider several empirical strategies to overcome concerns of potential selection bias. We first focus on models with class fixed effects, where we compare differences in outcomes between students across different races when assigned to the same TAs within the same class. Furthermore, we simultaneously control for sorting that occurs across classes by including student fixed effects. We find no evidence of endogenous sorting into classes by student race when predicting the race of the class' TAs with a full set of controls. The lack of sorting is unsurprising since students have very little ability identifying which classes TAs are assigned to, and TA assignments are generated after the undergraduates' primary registration period ends.

We find that students perform better when taking a class with TAs who are of a similar race. Race interactions have no impact on course withdrawal rates or likelihood of enrolling in subsequent courses in the same field. Students are more likely to attend their TA's optional office hours and discussion sections when the TA is of a similar race. Racial interactions are strongest in classes where TAs had been given a copy of the exam prior to the exam date, and when the exams for the class had no multiple choice. The body of evidence suggests that TA-student match quality, role model effects, and potential discrimination effects influence undergraduate student success.

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Main Tables and Figures

Table 1: Descriptive Statistics

	Mean	SD	Obsevations
Panel A. Sample characteristics, student level			19522
Male	0.528	0.499	
High school Grade Point Average (GPA)	3.641	0.360	
Admitted as transfer	0.201	0.400	
International student	0.039	0.192	
First generation college student	0.388	0.487	
Double major	0.039	0.193	
Panel B. Sample characteristics, class level			614
Number of students registered	117.417	83.147	
Professor White	0.713	0.453	
Professor Asian	0.138	0.346	
	White	Asian	Other/ Minority
Panel C. Student outcomes, student-class level			
Dropped class	0.010	0.010	0.019
Observations: 60,642	(0.100)	(0.100)	(0.135)
Grade Point Average (GPA)	2.552	2.756	2.348
Observations: 57,718	(1.015)	(0.988)	(1.074)
Passed class	0.840	0.877	0.780
Observations: 59,121	(0.367)	(0.329)	(0.414)
Enroll in subsequent class, same field	0.643	0.605	0.608
Observations: 60,642	(0.479)	(0.489)	(0.488)

	Students			Teaching Assistants		
	Mean	SD	Obs.	Mean	SD	Obs.
Panel D. Student and TA shares by race						
White	0.332	0.471		0.378	0.486	
Asian	0.449	0.497	19,522	0.441	0.597	286
Other/Minority	0.219	0.414		0.182	0.386	

Notes: Panel A corresponds to student-level, Panel B to class-level, and Panel C to student-class level descriptive statistics. In Panel D, reports under "Students" are student-level and reports under "Teaching Assistants" are TA-level. In Panel C, standard deviations are presented in parentheses. The student outcome variable "Grade" corresponds to the standard numerical American grading system with +/- modifiers (e.g. $A = \frac{12}{3} = 4.0$, $A- = \frac{11}{3} \approx 3.7$, $F = 0$). The student outcome variable "Enroll in subsequent class, same field" is an indicator for whether the student decided to enroll in another course within Economics.

Table 2: Tests for Endogenous Sorting – Regression of TA Race on Observables

	Full Sample			Prof. Survey Sample		
	All students	Asian	Non-Asian	All	Asian	Non-Asian
Outcome: Fraction TAs Asian						
Asian Student	0.001	—	—	0.002	—	—
	(0.004)	—	—	(0.004)	—	—
Female Student	0.001	0.003	-0.003	-0.001	0.005	-0.006
	(0.003)	(0.005)	(0.004)	(0.004)	(0.005)	(0.005)
Admit as Transfer	0.016**	0.023*	0.013	0.011	0.023	0.004
	(0.008)	(0.012)	(0.011)	(0.010)	(0.015)	(0.013)
Age	-0.001	-0.002	0.001	0.001	-0.002	0.002
	(0.001)	(0.002)	(0.001)	(0.001)	(0.002)	(0.001)
International Student	-0.011	-0.009	-0.014	-0.014	-0.009	-0.030
	(0.010)	(0.010)	(0.018)	(0.010)	(0.011)	(0.021)
First Generation	-0.003	-0.002	-0.004	-0.005	-0.004	-0.006
	(0.003)	(0.004)	(0.004)	(0.003)	(0.005)	(0.005)
High School GPA	0.004	-0.006	0.013**	0.003	-0.001	0.008
	(0.005)	(0.008)	(0.006)	(0.007)	(0.009)	(0.008)
Admission Year	-0.005	-0.004	-0.007	-0.001	-0.003	-0.001
	(0.003)	(0.004)	(0.004)	(0.004)	(0.005)	(0.005)
Same Major as Class	0.001	0.002	-0.003	0.001	-0.001	-0.001
	(0.006)	(0.007)	(0.007)	(0.007)	(0.008)	(0.008)
Double Major	0.001	0.001	0.001	0.007	0.005	0.010
	(0.007)	(0.010)	(0.009)	(0.009)	(0.011)	(0.011)
Freshman	0.002	-0.010	0.012	-0.001	-0.015	0.012
	(0.010)	(0.014)	(0.012)	(0.013)	(0.016)	(0.015)
Sophomore	0.008	0.005	0.009	0.002	-0.001	0.007
	(0.007)	(0.010)	(0.010)	(0.010)	(0.012)	(0.012)
Junior	0.001	0.001	0.003	-0.002	-0.010	0.007
	(0.006)	(0.008)	(0.007)	(0.008)	(0.010)	(0.008)
Female Professor	-0.056	-0.057	-0.056	-0.031	-0.047	-0.016
	(0.042)	(0.041)	(0.044)	(0.059)	(0.058)	(0.061)
Asian Professor	0.054	0.046	0.061	0.093	0.081	0.107
	(0.047)	(0.047)	(0.049)	(0.071)	(0.073)	(0.071)
Course & Term FE	Yes	Yes	Yes	Yes	Yes	Yes
P-value: Joint Significance	0.706	0.421	0.389	0.891	0.540	0.592
R-squared	0.220	0.235	0.209	0.306	0.311	0.306
Observations	60642	29391	31251	35023	17448	17575

Notes: Each specification presents results for a regression where the dependent variable is the fraction of the student's TAs in the class that were Asian. Coefficients for term and course FE are not shown. P-value for joint significance of all individual covariates, conditional on term and course FE, included. The first column is our full sample. The next two columns consider Asian and non-Asian student subsamples. The final three columns pertain to the sample of classes taught by professors who participated in our survey. Standard errors in parentheses, clustered by class. One, two, and three asterisks indicate statistical significance at the 10, 5, and 1 percent levels, respectively.

Table 3: Main Results

	Standardized grade				Dropped class			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Panel A: Full Sample								
Asian Students								
w/ Asian TAs	0.023*	0.031**	—	—	0.002	0.001	—	—
	(0.014)	(0.014)	—	—	(0.002)	(0.002)	—	—
Non-Asian Students								
w/ Non-Asian TAs	0.037***	0.045***	—	—	0.001	0.001	—	—
	(0.013)	(0.013)	—	—	(0.002)	(0.002)	—	—
Effect of Similar Race	0.061**	0.076***	0.078***	0.077***	0.002	0.002	0.002	0.003
	(0.025)	(0.024)	(0.025)	(0.021)	(0.002)	(0.002)	(0.003)	(0.003)
Observations	57718	57718	57718	49177	60642	60642	60642	51653
Panel B: Professor Survey Sample								
Asian Students								
w/ Asian TAs	0.036**	0.039**	—	—	0.001	0.001	—	—
	(0.018)	(0.018)	—	—	(0.002)	(0.002)	—	—
Non-Asian Students								
w/ Non-Asian TAs	0.030	0.040**	—	—	0.001	0.001	—	—
	(0.019)	(0.020)	—	—	(0.003)	(0.003)	—	—
Effect of Similar Race	0.066*	0.079**	0.080**	0.086**	0.003	0.003	0.003	0.005
	(0.034)	(0.033)	(0.034)	(0.034)	(0.003)	(0.003)	(0.003)	(0.005)
Observations	33997	33997	33997	29262	35649	35649	35649	30670
Term FE	X	X			X	X		
Course FE	X	X			X	X		
Class FE			X	X			X	X
Student FE				X				X
Controls:								
Professor		X				X		
Student		X	X			X	X	
Student X Term		X	X	X		X	X	X

Notes: Each cell reports the coefficient for similar race graduate TA composition, or in the case of "Effect of Similar Race", Asian graduate TA composition interacted with an Asian student dummy. Standardized grade has a mean of zero and a standard deviation of one by class. Controls include age when class began, high school GPA, and admission year, as well as indicators for student gender, international vs. domestic, whether parents attended college, admittance (transfer vs. freshman), whether the student is majoring in the subject of the course, double major, class standing (Freshman/Sophomore/Junior/Senior), and professor gender and race. All "Effect of Similar Race" specifications include course-by-race and term-by-race fixed effects. Standard errors in parentheses, clustered by professor. One, two, and three asterisks indicate statistical significance at the 10, 5, and 1 percent levels, respectively.

Table 4: Specifications with Past/Future TA Race

	Standardized Grade						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Panel A: Future TAs							
$A_i \times AsianTA_{ikt}$	0.062*	0.114***	0.086***	0.116***	0.122***	0.078***	0.128***
	(0.034)	(0.028)	(0.030)	(0.028)	(0.027)	(0.024)	(0.025)
$A_i \times AsianTA_{i(t+1)}$	-0.006	0.017	0.015	0.010	0.030	0.019	0.020
	(0.030)	(0.027)	(0.027)	(0.027)	(0.027)	(0.027)	(0.027)
Observations	36294	36294	36294	36294	36294	36294	36294
Panel B: Past TAs							
$A_i \times AsianTA_{ikt}$	0.116***	0.141***	0.122***	0.139***	0.123***	0.097***	0.122***
	(0.026)	(0.025)	(0.026)	(0.025)	(0.025)	(0.022)	(0.023)
$A_i \times AsianTA_{i(t-1)}$	-0.012	-0.014	-0.005	-0.020	-0.005	0.005	0.006
	(0.029)	(0.026)	(0.028)	(0.027)	(0.030)	(0.031)	(0.030)
Observations	37214	37214	37214	37214	37214	37214	37214
Term FE	X		X			X	
Course FE	X		X			X	
Class FE				X			X
Student FE					X	X	X
Controls:							
Professor		X	X				
Student		X	X	X			
Student X Term		X	X	X			

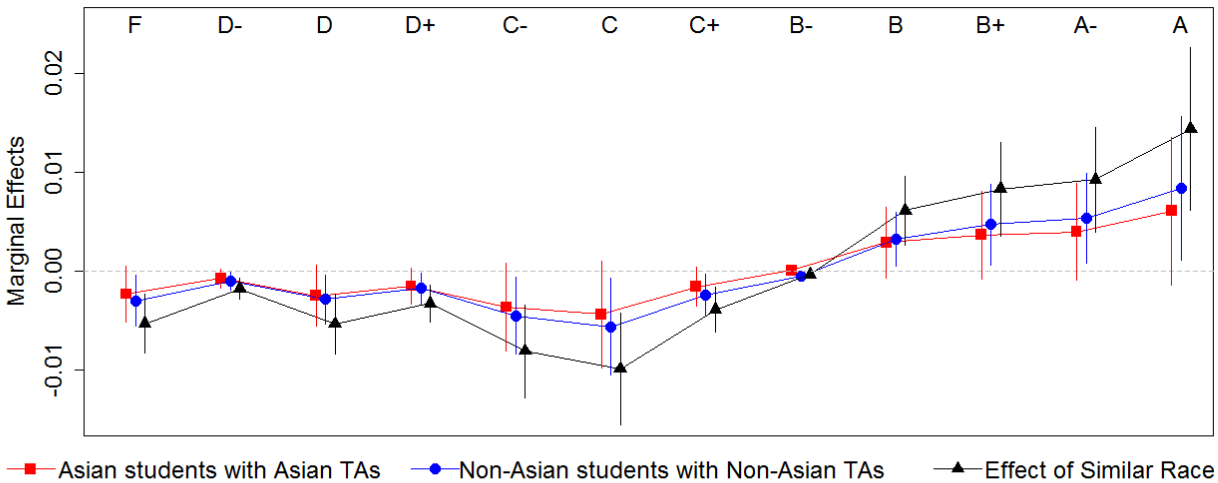
Notes: Each column within each panel presents results from a single regression where we estimate specification (2) but additionally include an interaction term between an indicator for the student being Asian and the fraction of the student's TAs who were Asian in the next (Panel A) or prior (Panel B) term. Controls include age when class began, high school GPA, and admission year, as well as indicators for student gender, international vs. domestic, whether parents attended college, admittance (transfer vs. freshman), whether the student is majoring in the subject of the course, double major, class standing (Freshman/Sophomore/Junior/Senior), and professor gender and race. Standard errors in parentheses, clustered by professor. One, two, and three asterisks indicate statistical significance at the 10, 5, and 1 percent levels, respectively.

Table 5: Audit Study of TA Section and Office Hour Attendance

	Discussion Section			Office Hours			Pooled	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
% students Asian								
Asian TA	0.076**	0.085*	0.084*	0.330***	0.134	0.200*	0.081*	0.081**
	(0.034)	(0.044)	(0.045)	(0.120)	(0.124)	(0.103)	(0.045)	(0.038)
Observations		118			43		161	
Mean of outcome		0.576			0.622		0.588	
Controls		X	X		X	X	X	X
Weighted observations			X			X		X

Notes: Each cell reports the coefficient on an indicator for whether the TA for the discussion section or office hour was Asian. The outcome variable is the fraction of attended students who were Asian. Controls include indicators for day of the week, time slot, and auditor. Robust standard errors presented in parenthesis. One, two, and three asterisks indicate statistical significance at the 10, 5, and 1 percent levels, respectively.

Figure 1: Results from Ordered Logit Specification



Notes: Each of the three connected lines present marginal effects from an ordered logit regression of having TAs of similar race (or for "Effect of Similar Race", $A_i * AsianTA_{ikt}$) on the probability of attaining each possible letter grade. Coefficients reported in Appendix Table A.8. Controls include age when class began, high school GPA, and admission year, as well as indicators for student gender, international vs. domestic, whether parents attended college, admittance (transfer vs. freshman), whether the student is majoring in the subject of the course, double major, class standing (Freshman/Sophomore/Junior/Senior), and professor gender and race. Standard errors are clustered by professor. 95% confidence intervals plotted for each estimated marginal effect.

Table 6: Professor Survey Results

	No Multiple Choice Exams				Some/All Multiple Choice			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Outcome: Standardized Grade								
Asian Students								
w/ Asian TAs	0.064**	0.062	—	—	0.044	0.009	—	—
	(0.024)	(0.061)	—	—	(0.030)	(0.034)	—	—
Non-Asian Students								
w/ Non-Asian TAs	0.132***	0.139***	—	—	0.002	0.026	—	—
	(0.024)	(0.046)	—	—	(0.030)	(0.038)	—	—
Effect of Similar Race	0.196***	0.201***	0.199***	0.217***	0.046	0.035	0.046	0.040
	(0.041)	(0.065)	(0.042)	(0.070)	(0.055)	(0.044)	(0.056)	(0.048)
Observations	9185	8883	9185	8883	24290	19861	24290	19861
	Exams Withheld from TAs				Exams Shared with TAs			
Asian Students								
w/ Asian TAs	-0.000	-0.030	—	—	0.081***	0.116*	—	—
	(0.021)	(0.064)	—	—	(0.027)	(0.065)	—	—
Non-Asian Students								
w/ Non-Asian TAs	-0.000	0.105	—	—	0.045	0.039	—	—
	(0.032)	(0.103)	—	—	(0.035)	(0.051)	—	—
Effect of Similar Race	-0.000	0.075	-0.003	0.056	0.126**	0.155*	0.127**	0.172**
	(0.046)	(0.096)	(0.048)	(0.093)	(0.055)	(0.081)	(0.055)	(0.081)
Observations	9189	8296	9189	8296	19119	15503	19119	15503
Term FE	X	X			X	X		
Course FE	X	X			X	X		
Class FE			X	X			X	X
Student FE		X		X		X		X
Controls:								
Professor	X	X			X	X		
Student	X		X		X		X	
Student X Term	X	X	X	X	X	X	X	X

Notes: Each cell reports the coefficient for similar race graduate TA composition, or in the case of "Effect of Similar Race", Asian graduate TA composition interacted with an Asian student dummy. Standardized grade has a mean of zero and a standard deviation of one by class. Controls include age when class began, high school GPA, and admission year, as well as indicators for student gender, international vs. domestic, whether parents attended college, admittance (transfer vs. freshman), whether the student is majoring in the subject of the course, double major, class standing (Freshman/Sophomore/Junior/Senior), and professor gender and race. All "Effect of Similar Race" specifications include course-by-race and term-by-race fixed effects. Standard errors in parentheses, clustered by professor. One, two, and three asterisks indicate statistical significance at the 10, 5, and 1 percent levels, respectively.

Results Appendix

Claim: summation of γ coefficients from subsample regressions of equation (1) produces racial interaction effect. Consider the following three regressions:

For Asian students:

$$y_{ikt} = \gamma_1 AsianTA_{ikt} + \beta X_{ikt} + \lambda_k + \alpha_t + u_{ikt} \tag{4}$$

For non-Asian students:

$$y_{ikt} = \gamma_2 AsianTA_{ikt} + \beta X_{ikt} + \lambda_k + \alpha_t + u_{ikt} \tag{5}$$

For non-Asian students:

$$y_{ikt} = \gamma_3 nonAsianTA_{ikt} + \beta X_{ikt} + \lambda_k + \alpha_t + u_{ikt} \tag{6}$$

γ_1 captures both the racial interaction effect and an overall TA quality effect (if, for example, Asian TAs teach differently than non-Asian TAs, on average). The difference between γ_1 and γ_2 is the relative racial difference predicted from assignment to a class with all Asian TAs, and thus captures the interaction effect of a student being of similar race as their TAs. Note that $\gamma_3 = -\gamma_2$. Hence, the summation of γ_1 and γ_3 captures the racial interaction effect. Thus, the summation of the γ coefficients for the subsamples from equation (1) produces the racial interaction effect.

"Sorting Regressions" from Fairlie et al., 2014:

$$\bar{X}_{ac} = \delta_1 AsianTA_c + \delta_2 I_a + \delta_3 AsianTA_c * I_a + v_{ac} \tag{7}$$

Table A.1: Sorting Regressions – Fairlie et al., 2014 (AER)

	Female	High School GPA	Age	Admit as Transfer	# Prior Units	Double Major	Inter-national	Class Major
Full Sample	0.014	-0.018	-0.024	0.007	-1.537	-0.014	-0.000	0.003
	(0.018)	(0.014)	(0.061)	(0.015)	(1.924)	(0.018)	(0.012)	(0.017)
Professor Survey Subsample	0.013	-0.001	-0.065	0.008	-1.759	-0.008	0.009	-0.009
	(0.023)	(0.016)	(0.087)	(0.022)	(2.934)	(0.027)	(0.018)	(0.022)
Classes with one TA	0.005	-0.019	-0.060	-0.007	-1.390	-0.011	-0.003	0.002
	(0.024)	(0.019)	(0.071)	(0.020)	(2.424)	(0.024)	(0.016)	(0.021)
Class FE	X	X	X	X	X	X	X	X

Notes: Each cell displays results from a regression of the race-specific average student outcomes in a classroom on an indicator for whether the average is associated with Asian students, the fraction of the TAs assigned to the class who are Asian, the interaction between these two variables, and class fixed effects. This table reports the coefficient on the interaction term, which can be interpreted as the extent to which Asian students sort into classes assigned Asian TAs. Outcomes for each regression vary across columns. Rows are defined by the subsample of students we consider. Students and TAs are classified as Asian if their primary race is recorded as Chinese, Japanese, Korean, Filippino, South-East Asian, Vietnamese, Thai, or "Other Asian". Standard errors in parentheses, clustered by professor. One, two, and three asterisks indicate statistical significance at the 10, 5, and 1 percent levels, respectively.

Table A.2: Main Results – More Outcomes

	Passed Class				Enroll in Another Class			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Panel A: Full Sample								
Asian Students								
w/ Asian TAs	0.003	0.006	—	—	0.012	0.019	—	—
	(0.007)	(0.006)	—	—	(0.018)	(0.016)	—	—
Non-Asian Students								
w/ Non-Asian TAs	0.013*	0.014*	—	—	-0.003	-0.008	—	—
	(0.008)	(0.007)	—	—	(0.013)	(0.013)	—	—
Effect of Similar Race	0.017**	0.020***	0.017**	0.030***	0.009	0.011	0.017	0.004
	(0.007)	(0.007)	(0.007)	(0.008)	(0.016)	(0.015)	(0.017)	(0.025)
Observations	59121	59121	59121	50329	22288	22288	22288	16904
Panel B: Professor Survey Sample								
Asian Students								
w/ Asian TAs	0.012	0.012	—	—	0.039*	0.039*	—	—
	(0.009)	(0.009)	—	—	(0.022)	(0.022)	—	—
Non-Asian Students								
w/ Non-Asian TAs	-0.000	0.002	—	—	-0.007	-0.006	—	—
	(0.009)	(0.010)	—	—	(0.020)	(0.021)	—	—
Effect of Similar Race	0.012	0.014	0.014	0.025**	0.032	0.032	0.049**	0.002
	(0.011)	(0.011)	(0.011)	(0.010)	(0.020)	(0.019)	(0.023)	(0.046)
Observations	34751	34751	34751	29885	12622	12622	12622	9637
Term FE	X	X			X	X		
Course FE	X	X			X	X		
Class FE			X	X			X	X
Student FE				X				X
Controls:								
Professor		X				X		
Student		X	X			X	X	
Student X Term		X	X	X		X	X	X

Notes: Each cell reports the coefficient for similar race graduate TA composition, or in the case of "Effect of Similar Race", Asian graduate TA composition interacted with an Asian student dummy. Both outcome variables are indicators, one for whether the student passed the class and another for whether the student (Freshman or Sophomore) took another class in the same field in a subsequent term. Controls include age when class began, high school GPA, and admission year, as well as indicators for student gender, international vs. domestic, whether parents attended college, admittance (transfer vs. freshman), whether the student is majoring in the subject of the course, double major, class standing (Freshman/Sophomore/Junior/Senior), and professor gender and race. All "Effect of Similar Race" specifications include course-by-race and term-by-race fixed effects. Standard errors in parentheses, clustered by professor. One, two, and three asterisks indicate statistical significance at the 10, 5, and 1 percent levels, respectively.

Table A.3: Robustness Check – Additional Specifications

	Standardized Grade						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Panel A: Full Sample							
Asian Students							
w/ Asian TAs	0.023	0.020	0.031**	—	-0.019	0.034*	—
	(0.014)	(0.017)	(0.014)	—	(0.021)	(0.017)	—
Non-Asian Students							
w/ Non-Asian TAs	0.037**	0.079***	0.045***	—	0.132***	0.040**	—
	(0.014)	(0.015)	(0.014)	—	(0.019)	(0.017)	—
Effect of Similar Race	0.061**	0.098***	0.076***	0.096***	0.113***	0.074***	0.116***
	(0.026)	(0.023)	(0.024)	(0.024)	(0.021)	(0.020)	(0.020)
Observations	57718	57718	57718	57718	49177	49177	49177
Panel B: Professor Survey Sample							
Asian Students							
w/ Asian TAs	0.034*	0.011	0.037**	—	-0.038	0.018	—
	(0.019)	(0.020)	(0.018)	—	(0.029)	(0.024)	—
Non-Asian Students							
w/ Non-Asian TAs	0.030	0.072***	0.041*	—	0.159***	0.063**	—
	(0.023)	(0.020)	(0.023)	—	(0.024)	(0.026)	—
Effect of Similar Race	0.065*	0.083***	0.077**	0.079**	0.120***	0.081***	0.118***
	(0.038)	(0.031)	(0.036)	(0.031)	(0.027)	(0.026)	(0.025)
Observations	33399	33399	33399	33399	28683	28683	28683
Panel C: Single TA Class							
Asian Students							
w/ Asian TAs	0.039**	0.036	0.043**	—	0.031	0.063**	—
	(0.017)	(0.022)	(0.019)	—	(0.026)	(0.026)	—
Non-Asian Students							
w/ Non-Asian TAs	0.051***	0.070***	0.052***	—	0.077**	0.037	—
	(0.018)	(0.021)	(0.017)	—	(0.031)	(0.022)	—
Effect of Similar Race	0.090***	0.106***	0.096***	0.108***	0.109***	0.100***	0.113***
	(0.031)	(0.034)	(0.030)	(0.035)	(0.033)	(0.030)	(0.034)
Observations	17500	17500	17500	17500	16841	16841	16841
Term FE	X		X			X	
Course FE	X		X			X	
Class FE				X			X
Student FE					X	X	X
Controls:							
Professor		X	X				
Student		X	X	X			
Student X Term		X	X	X			

Notes: Each cell reports the coefficient for similar race graduate TA composition, or in the case of "Effect of Similar Race", Asian graduate TA composition interacted with an Asian student dummy. Controls include age when class began, high school GPA, and admission year, as well as indicators for student gender, international vs. domestic, whether parents attended college, admittance (transfer vs. freshman), whether the student is majoring in the subject of the course, double major, class standing (Freshman/Sophomore/Junior/Senior), and professor gender and race. Standard errors in parentheses, clustered by professor, except for in Panel C, where standard errors are clustered by teaching assistant. One, two, and three asterisks indicate statistical significance at the 10, 5, and 1 percent levels, respectively.

Table A.4: Additional Professor Survey Results

	Professor Survey Sample					
	All	(0)	(1)	(2)	(3)	(4)
Outcome: Standardized Grade						
Effect of Similar Race	0.080**	0.066	-0.067	0.167	0.179	0.235***
	(0.036)	(0.039)	(0.057)	(0.097)	(0.128)	(0.046)
Multiple Choice Exams	—	Yes & No	Yes	Yes	No	No
Share Exams with TAs	—	Yes & No	No	Yes	No	Yes
Class FE	X	X	X	X	X	X
Course X Race FE	X	X	X	X	X	X
Term X Race FE	X	X	X	X	X	X
Controls:						
Professor						
Student	X	X	X	X	X	X
Student X Term	X	X	X	X	X	X
Observations	33997	27837	7915	13643	897	5382

Notes: Each cell reports the coefficient on the interaction between a student identifier for Asian and fraction of TAs Asian. The first column reports estimates for the subsample of classes where professors completed the survey. Column (0) considers the subsample of classes where professors answered both questions of interest. The remaining columns consider further survey subsamples. Controls include age when class began, high school GPA, and admission year, as well as indicators for student gender, international vs. domestic, whether parents attended college, admittance (transfer vs. freshman), whether the student is majoring in the subject of the course, double major, and class standing (Freshman/Sophomore/Junior/Senior). Standard errors in parentheses, clustered by professor. One, two, and three asterisks indicate statistical significance at the 10, 5, and 1 percent levels, respectively.

Table A.5: Main Results by White vs. Non-White

	Standardized Grade				Dropped Class			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Panel A: Full Sample								
White Students								
w/ White TAs	0.081***	0.075***	—	—	0.001	0.001	—	—
	(0.017)	(0.016)	—	—	(0.002)	(0.002)	—	—
Non-White Students								
w/ Non-White TAs	0.031***	0.029**	—	—	0.002	0.002	—	—
	(0.010)	(0.011)	—	—	(0.001)	(0.001)	—	—
Effect of Similar Race	0.111***	0.104***	0.107***	0.076***	0.002	0.002	0.003	0.002
	(0.024)	(0.023)	(0.024)	(0.022)	(0.002)	(0.002)	(0.002)	(0.003)
Observations	57718	57718	57718	49177	60642	60642	60642	51653
Panel B: Professor Survey Sample								
White Students								
w/ White TAs	0.078***	0.071***	—	—	0.001	0.001	—	—
	(0.021)	(0.021)	—	—	(0.003)	(0.003)	—	—
Non-White Students								
w/ Non-White TAs	0.041***	0.038**	—	—	-0.000	-0.000	—	—
	(0.013)	(0.015)	—	—	(0.002)	(0.002)	—	—
Effect of Similar Race	0.119***	0.109***	0.114***	0.072**	0.001	0.001	0.002	0.001
	(0.030)	(0.030)	(0.030)	(0.030)	(0.003)	(0.003)	(0.003)	(0.005)
Observations	33997	33997	33997	29262	35649	35649	35649	30670
Term FE	X	X			X	X		
Course FE	X	X			X	X		
Class FE			X	X			X	X
Student FE				X				X
Controls:								
Professor		X				X		
Student		X	X			X	X	
Student X Term		X	X	X		X	X	X

Notes: Each cell reports the coefficient for White graduate TA composition, or in the case of Difference, White graduate TA composition interacted with a White student dummy. Standardized grade has a mean of zero and a standard deviation of one by class. Controls include age when class began, high school GPA, and admission year, as well as indicators for student gender, international vs. domestic, whether parents attended college, admittance (transfer vs. freshman), whether the student is majoring in the subject of the course, double major, class standing (Freshman/Sophomore/Junior/Senior), and professor gender and race. All "Difference" specifications include course-by-race and term-by-race fixed effects. Standard errors in parentheses, clustered by professor. One, two, and three asterisks indicate statistical significance at the 10, 5, and 1 percent levels, respectively.

Table A.6: Estimated Role of TA Race for Student Outcomes - Group by Group Regressions

Panel A: Outcome - Dropped Class

	Full sample				**Professor Survey Subsample**			
	Racial Composition of TAs *(Comparison Group: Own Race TA)*				***Racial Composition of TAs*** *(Comparison Group: Own Race TA)*			
	White	*Non-East Asian*	*East Asian*	*Hispanic (Other)*	*White*	*Non-East Asian*	*East Asian*	*Hispanic (Other)*
White	—	0.003	-0.002	0.013**	—	0.004	-0.002	0.012
	—	(0.002)	(0.002)	(0.007)	—	(0.003)	(0.003)	(0.008)
Non-East Asian	-0.006	—	-0.002	-0.005	0.007	—	0.005	-0.008
	(0.006)	—	(0.010)	(0.005)	(0.008)	—	(0.008)	(0.014)
East Asian	0.000	0.002	—	-0.004	0.000	0.005	—	0.001
	(0.002)	(0.002)	—	(0.003)	(0.002)	(0.003)	—	(0.004)
Hispanic (Other)	-0.010	0.003	-0.005	—	-0.012	-0.001*	-0.007	—
	(0.009)	(0.008)	(0.009)	—	(0.013)	(0.006)	(0.011)	—

Panel B: Outcome - Standardized Grade

	White	*Non-East Asian*	*East Asian*	*Hispanic (Other)*	*White*	*Non-East Asian*	*East Asian*	*Hispanic (Other)*
White	—	-0.023	-0.082***	-0.068	—	-0.003	-0.073***	-0.127*
	—	(0.015)	(0.016)	(0.051)	—	(0.019)	(0.024)	(0.067)
Non-East Asian	-0.078**	—	-0.085**	-0.176**	-0.096*	—	-0.110**	-0.074
	(0.038)	—	(0.037)	(0.075)	(0.053)	—	(0.045)	(0.101)
East Asian	-0.061***	-0.020	—	-0.001	-0.088***	-0.0457**	—	0.023
	(0.017)	(0.015)	—	(0.053)	(0.020)	(0.020)	—	(0.078)
Hispanic (Other)	0.022	0.032	0.056	—	0.013	-0.012	0.055	—
	(0.085)	(0.060)	(0.082)	—	(0.166)	(0.095)	(0.156)	—

Panel C: Outcome - Take Another Class in Same Field

	White	*Non-East Asian*	*East Asian*	*Hispanic (Other)*	*White*	*Non-East Asian*	*East Asian*	*Hispanic (Other)*
White	—	0.012	0.015	-0.023	—	-0.022	0.012	-0.037
	—	(0.019)	(0.016)	(0.037)	—	(0.024)	(0.035)	(0.064)
Non-East Asian	-0.063*	—	-0.016	-0.120**	-0.100**	—	0.001	-0.043
	(0.032)	—	(0.021)	(0.060)	(0.040)	—	(0.033)	(0.062)
East Asian	0.004	-0.020	—	-0.064	0.030	-0.023	—	-0.002
	(0.018)	(0.015)	—	(0.055)	(0.023)	(0.018)	—	(0.057)
Hispanic (Other)	-0.610	-0.018	-0.071	—	-0.002	0.001	-0.024	—
	(0.090)	(0.054)	(0.083)	—	(0.122)	(0.056)	(0.117)	—

Notes: This table displays results from regressions that are run separately for each student race. Each cell reports the coefficient for TA racial composition. Standardized grade has a mean of zero and a standard deviation of one. The outcome in Panel C only considers Freshmen and Sophomores, and switches on for students who took another class in the same field in a subsequent term. Controls include age when class began, high school GPA, and admission year, as well as indicators for student gender, international vs. domestic, whether parents attended college, admittance (transfer vs. freshman), whether the student is majoring in the subject of the course, double major, class standing (Freshman/Sophomore/Junior/Senior), and professor gender and race. Course and term fixed effects included. Standard errors in parentheses, clustered by professor. One, two, and three asterisks indicate statistical significance at the 10, 5, and 1 percent levels, respectively.

Table A.7: Estimated Role of TA Race for Student Outcomes - Finer Race Groups

	Teaching Assistants Race			Teaching Assistants Race		
	East Asian	Non-East Asian	Hispanic (Other)	East Asian	Non-East Asian	Hispanic (Other)
Outcome variable		Dropped Class			Standardized Grade	
Observations		59,664			56,804	
Student Race:						
East Asian	**0.003**	0.000	-0.015**	**0.145*****	0.031	0.123
	(0.003)	(0.002)	(0.007)	**(0.030)**	(0.024)	(0.088)
Non-East Asian	0.005	**0.000**	-0.013	0.079**	**0.058**	-0.031
	(0.004)	**(0.004)**	(0.001)	(0.035)	**(0.030)**	(0.098)
Hispanic (Other)	0.009*	0.008	**0.002**	0.114***	0.035	**-0.006**
	(0.005)	(0.007)	**(0.013)**	(0.038)	(0.044)	**(0.107)**
F-test: Own-race effect (p-value)		0.854			0.000	
F-test: Race effect (p-value)		0.076			0.002	
Outcome variable		Passed Class			Take Another Class	
Observations		58,174			21,894	
East Asian	**0.025*****	0.007	0.021	**-0.015**	-0.041	-0.026
	(0.008)	(0.008)	(0.032)	**(0.023)**	(0.025)	(0.061)
Non-East Asian	0.010	**0.006**	-0.009	0.023	**-0.006**	-0.047
	(0.011)	**(0.011)**	(0.033)	(0.027)	**(0.032)**	(0.067)
Hispanic (Other)	0.027*	0.001	**0.062**	-0.021	0.016	**0.077**
	(0.016)	(0.014)	**(0.040)**	(0.031)	(0.043)	**(0.098)**
F-test: Own-race effect (p-value)		0.010			0.853	
F-test: Race effect (p-value)		0.143			0.158	

Notes: This table displays results from outcome regressions in which we allow for interactions between finer student and TA races. We only show results for our preferred specification, which includes student by term controls and class fixed effects. We report the full set of nine identified interactions for each regression. Since we include student race controls and class fixed effects, all interactions involving white students or TAs are unidentified. Same-race interactions are shown in bold. "Take Another Class" only considers the sample of Freshmen and Sophomores. p-values for an F-test of the existence of same-race interactions and for the existence of any race interactions are also listed. Standard errors in parentheses, clustered by professor. One, two, and three asterisks indicate statistical significance at the 10, 5, and 1 percent levels, respectively.

Table A.8: Alternative Specifications using Letter Grades

Panel A: Coefficients

	Ordered Logit	Ordered Probit
Asian Students		
w/ Asian TAs	0.067	0.034
	(0.042)	(0.024)
Non-Asian Students		
w/ Non-Asian TAs	0.087**	0.050**
	(0.038)	(0.022)
Effect of Similar Race	0.153***	0.083***
	(0.045)	(0.026)
N	57,718	57,718
log L	-131532.85	-131525.46
Pseudo R^2	0.0326	0.0327

Panel B: Marginal Effects

	F	D-	D	D+	C-	C	C+	B-	B	B+	A-	A
Ordered Logit												
Asian Students												
w/ Asian TAs	-0.002	-0.001	-0.002	-0.002	-0.004	-0.004	-0.002	0.001	0.003	0.004	0.004	0.006
	(0.001)	(0.001)	(0.002)	(0.001)	(0.002)	(0.003)	(0.001)	(0.001)	(0.002)	(0.002)	(0.002)	(0.004)
Non-Asian Students												
w/ Non-Asian TAs	−0.003**	−0.001**	−0.003**	−0.002**	−0.005**	−0.006**	−0.002**	0.001**	0.003**	0.005**	0.005**	0.008**
	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)	(0.002)	(0.001)	(0.001)	(0.001)	(0.002)	(0.002)	(0.004)
Effect of Similar Race	−0.005***	−0.002***	−0.005***	−0.003***	−0.008***	−0.010***	−0.004***	0.001***	0.006***	0.008***	0.009***	0.014***
	(0.002)	(0.001)	(0.002)	(0.001)	(0.002)	(0.003)	(0.001)	(0.001)	(0.002)	(0.002)	(0.003)	(0.004)
Ordered Probit												
Asian Students												
w/ Asian TAs	-0.003	-0.001	-0.002	-0.001	-0.003	-0.003	-0.001	0.001	0.002	0.003	0.003	0.006
	(0.002)	(0.001)	(0.002)	(0.001)	(0.002)	(0.002)	(0.001)	(0.001)	(0.001)	(0.002)	(0.002)	(0.004)
Non-Asian Students												
w/ Non-Asian TAs	−0.004**	−0.001**	−0.003**	−0.002**	−0.004**	−0.004**	−0.002**	0.001**	0.002**	0.004**	0.005**	0.010**
	(0.002)	(0.001)	(0.001)	(0.001)	(0.002)	(0.002)	(0.001)	(0.001)	(0.001)	(0.002)	(0.002)	(0.004)
Effect of Similar Race	−0.006***	−0.002***	−0.005***	−0.003***	−0.007***	−0.007***	−0.003***	0.001***	0.004***	0.006***	0.008***	0.015***
	(0.002)	(0.001)	(0.002)	(0.001)	(0.002)	(0.002)	(0.001)	(0.001)	(0.001)	(0.002)	(0.002)	(0.005)

Notes: Panel A shows the estimated coefficients from ordered logit and ordered probit models. Panel B displays the marginal effects for each possible letter grade, evaluated at the controls' means. Controls include age when class began, high school GPA, and admission year, as well as indicators for student gender, international vs. domestic, whether parents attended college, admittance (transfer vs. freshman), whether the student is majoring in the subject of the course, double major, class standing (Freshman/Sophomore/Junior/Senior), and professor gender and race. Standard errors in parentheses, clustered by professor. One, two, and three asterisks indicate statistical significance at the 10, 5, and 1 percent levels, respectively.