Tenure-Track Appointment for Teaching-Oriented Faculty?

HOW TEACHING AND RESEARCH FACULTY AFFECT STUDENT OUTCOMES

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JUNE 2020

AMERICAN ENTERPRISE INSTITUTE

Executive Summary

Even before the COVID-19 pandemic, almost three-quarters of instructors in America's higher education system were contingent faculty. Colleges and universities have increasingly relied on them as a flexible and cost-saving way to provide instructional services.

But the rapid growth of contingent faculty has created new challenges for higher education institutions. Concerns over poor working conditions, low wages, and lack of job security have led to ongoing discussions about whether colleges should provide tenure appointments to contingent faculty, which could stabilize the teaching workforce. Others worry that contingent faculty might be less equipped to teach certain subjects, hurting student outcomes. If contingent faculty lower achievement levels, is providing them with tenure opportunities the right policy solution?

This report presents new evidence on the effectiveness of contingent faculty with tenure-track appointment—a group we refer to as "teaching faculty." Using a unique administrative dataset that includes six cohorts of students enrolled at a selective public research university, we examine how the type of instructor affects a student's current and subsequent academic outcomes. Overall, the results indicate that the three types of faculty in our data—tenure-track research faculty, tenure-track teaching faculty, and contingent lecturers—produce fairly equivalent student outcomes.

There are a few notable exceptions. We find that students on the margin of passing an introductory course are more likely to fail if the course is taught by tenure-track teaching faculty, rather than research faculty or lecturers. With subsequent outcomes, students who take their initial course outside their intended major with tenure-track teaching faculty are more likely to enroll in subsequent courses in that field.

Results from our study serve as a first step toward understanding the promise of a dual-tenure-track model in creating a stabilized teaching force in research universities. Compared with their tenure-track research colleagues and lecturers, tenure-track teaching faculty in our sample assume a substantially larger teaching load yet produce comparable student outcomes. The dual-tenure-track model could limit institutional expenses while leading contingent faculty to stable employment, increased compensation and benefits, and better working conditions.

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Faculty at higher education institutions assume a multitude of responsibilities, including research, teaching, and service. This is particularly true at research universities, where professors are expected to publish academic research and regularly teach throughout the year. But changing enrollment trends have led to an imbalance. When student enrollment is above anticipated levels, institutions often make up the difference by hiring short-term adjuncts or lecturers.[1] Increasingly, colleges have hired contingent faculty—part- or full-time lecturers or adjuncts—as a flexible and cost-saving way to provide instructional services.

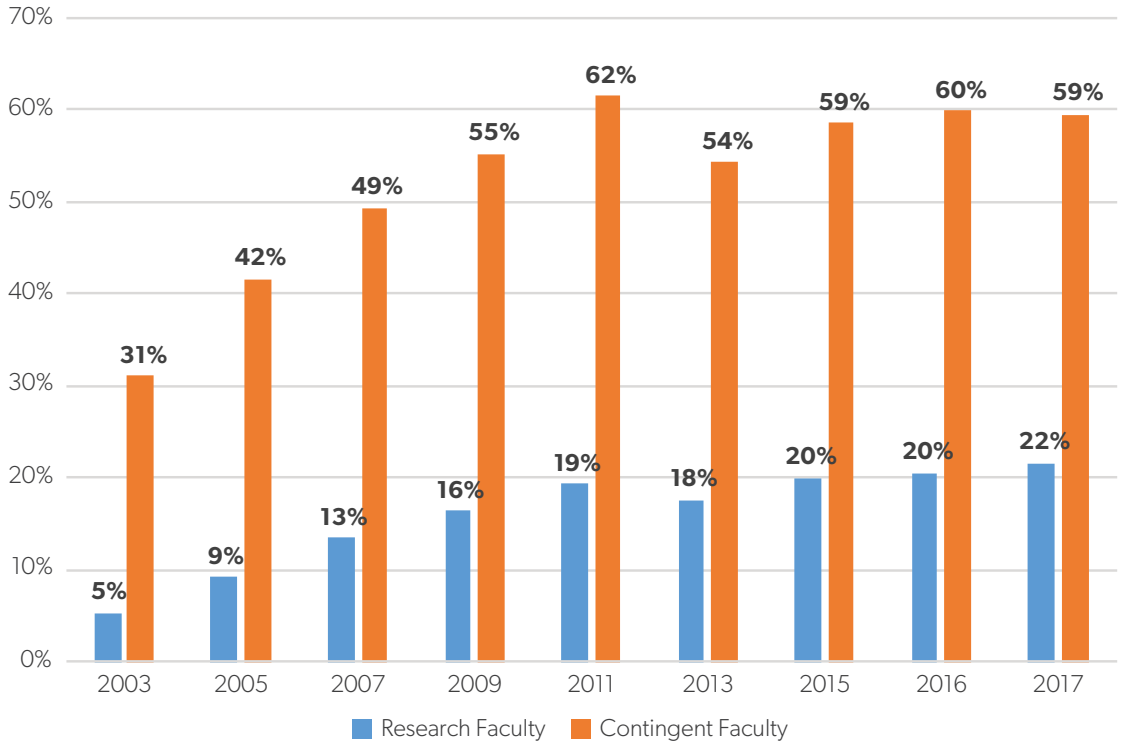
Even before the COVID-19 pandemic, almost three-quarters of all instructors in America's higher education system were contingent faculty, and they are the fastest-growing group of all faculty employed at colleges. (See Figure 1.)[2] This practice has created a bit of a debate in the higher education community. Some observers raise concerns regarding contingent faculty's employment conditions—relatively low compensation, minimal benefits, exclusion from departmental decisions, and lack of job security. Startling media accounts reveal that these lecturers are commonly referred to as "invisible faculty." Often, contingent faculty learn only days beforehand which courses they will be teaching that semester. They sometimes lack office space and rarely receive guidance or administrative support.[3]

Others worry that the increasing reliance on contingent faculty may lower the quality of instruction students receive. For example, some think excellent academic scholars could be excellent teachers, grounding their instruction in advanced research-led knowledge.[4] Bringing in large proportions of contingent faculty, then, might inadvertently hinder students' academic achievement.

Meanwhile, others argue that using contingent faculty could *increase* student performance. These observers believe that an outstanding researcher's attributes are distinct from an effective teacher's, especially in entry-level courses that aim to create a strong foundation in a discipline.[5] And since tenure criteria usually emphasize research excellence rather than teaching excellence, traditional research faculty may lack the time and motivation needed to improve their instructional quality.[6] Thus, contingent faculty may employ better techniques that enhance student engagement, interest, and achievement.

This conversation has led to discussions about whether colleges should provide tenure appointments to contingent faculty to improve the teaching workforce in higher education. For example, in their 2015 book, *The Humanities, Higher Education, and Academic Freedom*, Michael Bérubé and Jennifer Ruth advocate for forming a separate tenure track for faculty to prioritize teaching instead of research. This group of faculty would be responsible

Figure 1. Percentage Increase in Research and Contingent Faculty at Higher Education Institutions Relative to 1998 Employment Levels



Note: "Research Faculty" includes professors, associate professors, and assistant professors. "Contingent Faculty" includes lecturers and instructors. Other faculty are excluded. Data are available for only the given years.
Source: Authors' calculations using Digest of Education Statistics, "Full-Time Faculty in Degree-Granting Postsecondary Institutions, by Race/Ethnicity, Sex, and Academic Rank," National Center for Education Statistics, Table 315.20, https://nces.ed.gov/programs/digest/d18/tables/dt18_315.20.asp?current=yes.

for shouldering a significant teaching load (similar to that of contingent faculty) while being entitled to the same working conditions and job security that tenure-track professors experience.[7]

The University of California (UC) system has adopted such a model, which it refers to as a dual-tenure-track system.[8] Under this model, course instructors can be divided into one of three broad categories: nontenure-track contingent faculty (referred to as "contingent lecturers"), tenure-track/tenured research faculty (referred to as "research faculty"), and tenure-track/tenured teaching faculty (referred to as "teaching faculty"). In the 2016–17 academic year, the UC system employed 1,954 contingent lectures, 7,724 research faculty, and 274 teaching faculty across 10 campuses.

Relatively little is known about whether teaching faculty are more effective instructors than research faculty or contingent lecturers. Previous research has linked student transcripts and instructor profiles to compare the effectiveness of adjunct faculty and traditional professors, and the findings are generally mixed.[9]

The only research specifically about teaching faculty comes from two recent descriptive studies. The first study by Ashley Harlow and colleagues surveyed teaching faculty members in the UC system and found that teaching faculty, on average, were satisfied, felt valued, and experienced a sense of belonging in their departments.[10] The second study by Viet Quoc Vu examined the instructional practices used in 259 large introductory STEM courses at the University

of California, Irvine.[11] Using observational classroom data, the author found that teaching faculty used more "promising practices" (such as formative assessment, active learning, and collaborative group activities) than research faculty or contingent lecturers did. Although the study provides encouraging evidence about the possible benefits of teaching faculty on student learning, it does not link instructor type to student academic outcomes.

We address this research gap by examining whether students perform similarly well in courses taught by research faculty, teaching faculty, and contingent lecturers. To our knowledge, this is the first analysis of how teaching faculty relative to traditional research faculty and contingent lecturers affect students' academic outcomes.

This builds on the existing literature on instructor effectiveness in two important ways. First, our analysis includes a new instructor category that has not been previously examined—*teaching faculty*. Second, the mixed findings of previous research point to substantial variations in contractual forms, working conditions, departmental characteristics, and quality of contingent faculty across different institutional contexts. Our report adds to this line of research by estimating the impact of contingent faculty at a selective public research institution.[12]

Overall, our results indicate that the three types of faculty are fairly comparable in student outcomes—although there are a few important exceptions. Specifically, we find that students on the margin of passing an introductory course are more likely to fail if the course is taught by tenure-track teaching faculty, rather than research faculty or lecturers. With subsequent outcomes, although the patterns of results are generally null, we do find that students who take their initial course outside their intended major with tenure-track teaching faculty, instead of with either research faculty or lecturers, are more likely to enroll in subsequent courses in that field.

Given the long-standing debate about whether institutions should grant tenure to lecturers and adjuncts, knowing how instructor type could affect student academic outcomes relative to other types of faculty provides an empirical foundation for policymakers and college administrators to make informed staffing decisions.

Data and Institutional Context

Our analysis uses student transcript and administrative data that include six cohorts of students who initially enrolled at a large public institution in California, hereafter referred to as AUCC, between 2008–09 and 2013–14. The data were collected from the AUCC Office of Institutional Research and include student-level demographic information (gender, race, and age), academic preparation (SAT scores and high school GPA), and enrollment data, thus providing information about the types of courses each student takes during a particular quarter and the associated course instructor types and course grades.

Table 1 compares descriptive statistics for college students entering AUCC in fall 2008 and students entering public four-year colleges nationwide in the same year.[13] Compared to the national average, AUCC enrolls a much larger proportion of Asian students and other racially underrepresented student groups. In addition, AUCC is a relatively selective campus with SAT math and verbal scores above the national average by roughly 100 and 70 points, respectively.

AUCC classified faculty into 50 distinct titles. Of those titles, roughly half are positions with limited or no teaching responsibilities—such as visiting scholars, research specialists, and academic administrative officers. These positions are excluded from our analyses. Since the motivations of hiring teaching faculty and graduate student instructors differ, we also exclude courses that graduate students teach.[14] The remaining relevant faculty categories fall under three broad groups: research faculty, teaching faculty, and contingent lecturers. Appendix A details how we classified the job titles, and Appendix B describes the job responsibilities of the three categories.

Because this report aims to evaluate how instructor type during a student's *initial* exposure to a field of study affects the student's concurrent and subsequent academic outcomes, we limit the analysis to

Table 1. Descriptive Statistics

	National Sample	AUCC Sample, 2008 Cohort	AUCC Analytical Sample, All Cohorts
Female	0.547	0.545	0.549
White	0.632	0.244	0.203
Black	0.108	0.022	0.027
Hispanic	0.096	0.154	0.206
Asian	0.068	0.552	0.554
Other	0.010	0.028	0.011
Student Age	—	19.094	19.290
Low-Income Status	—	0.223	0.317
First-Generation Status	—	0.350	0.450
High School GPA	—	3.707	3.745
SAT Math Score	514	614.026	614.481
SAT Verbal Score	500	567.464	562.124
Entering Units	—	37.326	41.426

Note: National sample includes public degree-granting not-for-profit institutions and full-time undergraduate totals.
Source: Authors' calculations derived from the Integrated Postsecondary Education Data System Data Center. SAT information was retrieved from College Board, "2016 College-Bound Seniors Total Group Profile Report," 2016, https://reports.collegeboard.org/pdf/total-group-2016.pdf.

the first course a student takes in each field of study (referred to as "introductory course" hereafter). We further limit the sample to courses taken during a student's first quarter at AUCC to minimize the possibility of students systematically sorting into courses by faculty type, as this is when students are least likely to have existing knowledge about different types of faculty. (We discuss this in detail in the following section.) The final analytical sample includes 81,001 first-term introductory course enrollments for 36,965 students. These enrollments are in 1,075 courses taught by 1,082 distinct faculty members. Of these instructors, 592 were research faculty, 48 were teaching faculty, and 442 were contingent lecturers.

One of our outcome measures—a student's current course performance—is difficult to interpret without additional context about the student. For example, a significant positive effect from taking an introductory course with teaching faculty might be explained by either more effective instruction or simply different grading patterns. We use a few additional outcome measures to provide a more comprehensive understanding of how different types of instructors affect student achievement.

Specifically, we use subsequent course enrollment—whether students enroll in a second course in the same field of study as the introductory course—to measure student interest in a subject. Prior research has identified that subsequent performance is an important measure of student learning and can indicate whether instructional quality in introductory courses influences learning and engagement in the same field of study.[15] Accordingly, we also include students' performance in the second course in the same field of study as the introductory course as an outcome measure. To further supplement this analysis, we include the total number of credits a student ultimately earns in the same field of study and whether students declare a major in that field.

Table 2 summarizes statistics for our outcome measures: Panel A presents contemporaneous course outcomes, Panel B presents subsequent enrollment

Table 2. Summary Statistics for Outcome Measures by Faculty Type

	Teaching Faculty	Research Faculty	Lecturer
Panel A. Contemporaneous Course Outcomes			
Course Grade (Zero to Four Grading Scale)	2.712	2.824	2.948
Panel B. Subsequent Course Outcomes			
Enrolled in Subsequent Course in the Same Field	0.850	0.839	0.804
Grade in Subsequent Course (Zero to Four Grading Scale)	2.720	2.807	2.924
Panel C. Subsequent Academic Outcomes			
Course Grade (Zero to Four Grading Scale)	2.695	2.798	2.916
Total Credits Earned in the Same Field	24.76	26.25	17.77
Declared a Major in the Same Field	0.200	0.299	0.165

Note: Data include students who enrolled at AUCC between the 2008–09 and 2013–14 academic years. The contemporaneous course sample is restricted to the first college-level course taken by each student in each field of study. We exclude courses with pass-fail grades.
Source: Authors' calculations using AUCC Office of Institutional Research administrative data.

outcomes, and Panel C presents subsequent academic outcomes. As shown in Panel A, average course grades are fairly similar among the three types of instructors. With subsequent enrollment outcomes, students who take their introductory course with teaching faculty or research faculty seem to be equally likely to enroll in a second course in the same field of study (roughly 84 percent), while students who take an introductory course with lecturers do so at slightly lower rates (80 percent).

For longer-term academic outcomes, students who take an introductory course with teaching faculty earn the lowest grades, on average, in subsequent courses. (As mentioned previously, however, these descriptive patterns could reflect student-level and course-level selection.) Students who take their introductory course with teaching or research faculty earn roughly 25 to 26 credits in the same field of study, while students who take introductory courses with lecturers take only 18 credits. Students are least likely to declare a major in the same field of study as their introductory course when they take it with lecturers (17 percent), compared with research faculty (30 percent) and teaching faculty (20 percent).

Estimation Strategy

The two major methodological challenges of estimating the impact of instructor type on student academic outcomes are student self-selection into courses and the nonrandom assignment of instructors to different classes. To minimize selection bias, we build on the existing literature by using a three-way fixed effects model that controls for student-level fixed effects, initial-course fixed effects, and next-class fixed effects. This eliminates unobservable biases that are constant at the individual level (e.g., academic capacity), the initial-course level (e.g., course difficulty), or the next-class level (e.g., selection into less difficult classes after initial exposure to a field).[16] We also limit the analysis to courses students took during their first quarter at AUCC, which is when they are least likely to have existing knowledge about different types of faculty.

Our primary empirical specification for current course outcomes and subsequent enrollment outcomes relates student i's outcomes (Y) in section s of course c in field k in term t to the type of instructor that the student had during his or her initial exposure to a field of study, shown in Equation 1.

$$Y_{icskt} = \alpha + \beta\ \text{Instructor}_{icskt} + \rho_{ck} + \pi_t + X_{cskt} + \gamma_i + \mu_{icskt} \quad (1)$$

The key explanatory variable is the type of instructor with whom a student took the introductory course. We use research faculty as the reference group. Therefore, the vector ($\text{Instructor}_{icskt}$) includes two dichotomous variables: lecturer and teaching faculty. The variable ρ_{ck} represents course fixed effects, which capture both observable and unobservable course-level characteristics (e.g., field of study, prerequisites, course requirements, course topics, and level of difficulty). The course fixed effects allow for comparisons among different sections of the same course taught by different types of instructors. The variable π_t represents term fixed effects that account for overall variations in course grades and faculty composition over time at AUCC.[17]

As Eric Bettinger and Bridget Terry Long point out, even when including course and term-level fixed effects, there still may be selection bias due to nonrandom sorting of students who systematically seek out (or avoid) certain types of faculty. For example, more academically motivated students might prefer research faculty for potential research opportunities. We investigate the prevalence of student sorting by relating the type of instructor teaching a section to a wide range of student-level characteristics, controlling for course fixed effects, term fixed effects, and observable section-level characteristics.

These results are presented in Table 3 and suggest that there is no consistent relationship between types of instructors and indicators of a student's previous academic performance. To minimize possible selection bias, we further include student fixed effects (γ_i) into the model, which control for both observable and unobservable student-level characteristics that are constant for an individual, such as students with certain characteristics preferring a particular type of instructors.

Equation 1 draws on two sources of variation. The first includes student-level variations, whereby a student takes introductory courses with different types of instructors in different fields of study. For example, a student may take an introductory physics course with teaching faculty but an introductory math course with research faculty. Most students (95 percent) in our first-term freshman sample took their introductory courses with a mixture of instructors.

In addition to within-student variation, we draw on between-section variations in the type of instructors in a course. This could be due to within-term variations, in which multiple sections are offered during a particular term and are taught by different types of faculty in that term. (Fourteen percent of the course enrollments are from courses with this variation.) It could also be due to between-term variation, in which different types of instructors teach the same course during different terms. (Seventy percent of the enrollments are from courses with this overtime variation.)

We have sufficient variation in individual student course-taking patterns and in the courses that different types of faculty teach, which supports the use of the two-way fixed effects model. We cluster standard errors at the student and subject level to consider correlations in classes taken by the same student and correlations between classes in the same field of study.

When examining how an introductory course instructor affects a student's performance in a subsequent course, the initial course likely influences the student's next class choice. For example, if students find the introductory course too difficult, they might enroll into a less-challenging course in the same field. Similarly, if students take their introductory course with a lecturer and have an unsatisfactory experience, they may intentionally avoid classes that instructor teaches or even all classes lecturers in the same department teach. To address the additional variation, we extend Equation 1 by further controlling for next-class fixed effects for subsequent course performance measures.

$$Y_{icskt+1} = \alpha + \beta\ \text{Instructor}_{icskt} + S_{cskt+1} + \rho_{ck} + \gamma_i + \pi_t + X_{cskt} + \mu_{icskt+1} \quad (2)$$

Equation 2 estimates student *i*'s outcomes in the next class section *s* in course *c* in field *k* in time *t+1* in relation to the student's experience with the type of instructor in the student's introductory course ($\text{Instructor}_{icskt}$). Since the next-class fixed effect

Table 3. Probability of Taking an Introductory Course with Different Types of Instructors

	(1) Teaching Faculty	(2) Lecturer
Student-Level Characteristics		
Female	0.006**	0.008*
	(0.002)	(0.004)
Black	–0.005	0.003
	(0.008)	(0.006)
Hispanic	–0.001	–0.004
	(0.003)	(0.004)
Asian	0.001	0.003
	(0.003)	(0.004)
Other	–0.007	0.009
	(0.009)	(0.010)
Age When Taking the Course	–0.000	–0.000
	(0.001)	(0.001)
Low-Income Status	0.003	–0.006**
	(0.002)	(0.003)
First-Generation Status	0.002	–0.001
	(0.002)	(0.001)
SAT Math Score	–0.000	–0.000
	(0.000)	(0.000)
SAT Verbal Score	–0.000	0.000
	(0.000)	(0.000)
High School GPA	0.002	–0.004
	(0.004)	(0.004)
Entering Units	–0.000	–0.002
	(0.001)	(0.001)

Note: All regressions control for high school fixed effects, course fixed effects, term fixed effects, and cohort fixed effects. We also include section-level controls. The base group for regressions is research faculty. The base group for race is white. Standard errors are clustered at the subject level. Robust standard errors are in parentheses. *** $p < 0.01$; ** $p < 0.05$; * $p < 0.1$.
Source: Authors' calculations using AUCC Office of Institutional Research administrative data.

S_{cskt+1} combines course, time, and specific section, this model specification compares student performance in the same next course section.[18] This procedure controls for the possibility that a student's initial experience in a field influences his or her next course choice and preference for different types of instructors.[19]

Results

The results of our empirical models are presented in Tables 4 and 5. Table 4 presents the contemporaneous course results based on Equation 1 that controls for student, term, and introductory course fixed effects, and the outcome measure is the numeric measure of

Table 4. How Different Types of Faculty Affect Contemporaneous Course Outcomes

	Full Sample		Courses Outside Intended Major	
	(1) Grade (Including Withdrawal)	(2) Grade (Excluding Withdrawal)	(3) Grade (Including Withdrawal)	(4) Grade (Excluding Withdrawal)
Teaching Faculty	–0.044	–0.048	–0.067*	–0.070*
	(0.039)	(0.039)	(0.036)	(0.036)
Lecturer	0.016	0.015	0.006	0.005
	(0.038)	(0.038)	(0.038)	(0.038)
N	72,470	72,226	49,742	49,560
R-Squared	0.748	0.746	0.748	0.745
Term Fixed Effects	—	—	—	—
Introductory Course Fixed Effects	—	—	—	—
Student Fixed Effects	—	—	—	—

Note: Columns 1 and 2 include all observations in our analytical sample, while Columns 3 and 4 restrict the sample to courses outside a student's intended major declared upon initial college enrollment (when course performance and enrollment decisions are most plausibly affected by the quality of the instructor). For each sample, we present results including students who withdrew from courses, where a withdrawal corresponds to a zero (Columns 1 and 3), and excluding these students (Columns 2 and 4). The base group for all models is research faculty. Controls for all models include course section characteristics of the introductory course including enrollment size, delivery method, other students' average SAT score in the class, and class day and time. Classes on a pass-fail grading system are excluded. Standard errors are two-way clustered at the student and subject level. Robust standard errors are in parentheses. *** $p<0.01$; ** $p<0.05$; * $p<0.10$.
Source: Authors' calculations using AUCC Office of Institutional Research administrative data.

course grade on a zero to four grading scale (where an A corresponds to four and an F corresponds to zero).[20]

The results from our main analyses (Table 4, Columns 1 and 2) indicate no significant differences in the grades received among students who take their introductory courses across the three types of faculty. When restricting the sample to courses taken outside a student's intended major, we observe that teaching faculty have a slightly negative effect on the numeric course grades that students receive (Table 4, Columns 3 and 4).

However, the results on average grade outcomes may mask potential differences in the underlying grade distribution across difference types of instructors. To explore this possibility, we further examine how different types of instructors affect the full distribution of the letter grades awarded in all introductory courses. Our results are presented in Appendix C. We find that teaching faculty are equally likely to grant As, Bs, and Cs as are either research faculty or lecturers, but students on the margin of failing a course are more than 3 percentage points more likely to receive an F when taking the course with teaching faculty.

Table 5 presents results for subsequent course outcomes. Panel A includes the full first-term introductory course sample, and Panel B restricts the sample to courses taken outside a student's initially declared major. Similar to our results on contemporaneous course outcomes, we find no relationship between the type of instructor and students' subsequent course outcomes for the full sample analysis (Panel A).

Once we restrict the sample to courses outside a student's intended major, we observe that students who take their introductory course with teaching faculty, rather than research faculty (Panel B), are more likely to attempt another course in the same field of study by 2 percentage points. Lecturers, on the other hand, are

Table 5. How Different Types of Faculty Affect Subsequent Course Outcomes

	Enrolled in Subsequent Course (1)	Average Grade of Second Course (2)	Subsequent Course Grade (3)	Total Credits Earned (4)	Declared a Major (5)
Panel A. Full Sample					
Teaching Faculty	0.017	–0.009	0.029	0.568	0.009
	(0.011)	(0.006)	(0.021)	(0.438)	(0.008)
Lecturer	0.005	–0.007	–0.021	–0.640	0.007
	(0.008)	(0.007)	(0.021)	(0.570)	(0.008)
N	72,470	54,439	48,355	72,470	70,629
R-Squared	0.582	0.873	0.787	0.640	0.625
Term Fixed Effects	—	—	—	—	—
Introductory Course Fixed Effects	—	—	—	—	—
Student Fixed Effects	—	—	—	—	—
Next-Class-Taken Fixed Effects	—	—	—	—	—
Panel B. Introductory Courses Outside Intended Major					
Teaching Faculty	0.021*	–0.006	0.003	0.106	–0.005
	(0.011)	(0.010)	(0.023)	(0.503)	(0.006)
Lecturer	0.006	–0.012*	–0.052*	–0.808	–0.004
	(0.009)	(0.007)	(0.025)	(0.517)	(0.007)
N	49,742	34,418	29,348	49,742	48,039
R-Squared	0.593	0.891	0.798	0.633	0.612
Term Fixed Effects	—	—	—	—	—
Introductory Course Fixed Effects	—	—	—	—	—
Student Fixed Effects	—	—	—	—	—
Next-Class-Taken Fixed Effects	—	—	—	—	—

Note: Column 1 shows the probability of taking another course in the same field of study. Column 2 uses the average course grade of the next course a student takes to capture possible influences introductory courses have on a student's subsequent course choice in the same field. Column 3 presents the results for subsequent course grade based on Equation 2 that controls for student fixed effects, introductory course fixed effects, and next-class fixed effects. Columns 4 and 5 show the results of total credits earned in the same field of study and whether students declare a major in the same field of study as their introductory course. The base group for all models is tenure-track research faculty. Controls for all models include course section characteristics of the introductory course including enrollment size, delivery method, the average SAT score of other students in the class, and class day and time. Students receiving a withdrawal in the introductory course are dropped from the sample. Classes on a pass-fail grading system are excluded. Standard errors are two-way clustered at the student and subject level. Robust standard errors are in parentheses. *** $p < 0.01$; ** $p < 0.05$; * $p < 0.10$.
Source: Authors' calculations using AUCC Office of Institutional Research administrative data.

associated with negative outcomes for students taking courses outside their intended major. Specifically, students who took their introductory course with lecturers, rather than research faculty (Panel B), enrolled in "easier" subsequent courses (those in which students received higher grades, on average) and received a 1 percent lower overall grade in the subsequent course. For long-term measures of student interest, we find no relationship between faculty type and subsequent credits earned in the field outside a student's intended major. We also do not observe a relationship between instructor type and major declaration.

The average effects might mask potential differences in credit distribution across students taking courses from different types of faculty. We investigate this possibility by estimating the impact of faculty type on three different outcome measures: the probability of earning at least one credit, the probability of earning eight or more credits, and the probability of earning 12 or more credits. (These results are presented in Appendix D.) Students who take their introductory course with teaching faculty, rather than research faculty, are 4 percentage points more likely to earn at least eight credits (roughly two additional courses) in the same field of study. These results remain consistent when we restrict the sample to introductory courses outside the students' intended major. In contrast, students taking their introductory course with lecturers are 2 percentage points less likely to earn 12 credits or more in fields that are not their initially intended major.

Discussion and Conclusion

Our results offer several implications for higher education policy and practice. We find that, on average, students are equally likely to receive As, Bs, and Cs in courses taught by research faculty (i.e., professors) and teaching faculty (i.e., lecturers with opportunity for tenure).

With downstream academic outcomes, we find that all three instructor types—contingent lecturers, research faculty, and teaching faculty—are about equally as likely to spur students' interest in pursuing subsequent courses in fields of study outside their intended major. However, students who take an introductory course in a field outside their intended major are 2 percentage points *more likely* to enroll in a subsequent course in that field if the initial course is taught by teaching faculty.

Given that prior research has identified that subsequent course enrollment and performance are important measures of whether instructional quality had a lasting impact on student learning, our results suggest that identifying the mechanisms through which different types of faculty influence outcomes is an important avenue of future research. It could be that tenure-track teaching faculty use instructional strategies that stimulate interest in a field or, at minimum, provide students with a relatively enjoyable classroom experience. Future research may wish to collect detailed classroom observation data, student interview data, and instructor interview data to shed light on these possibilities.

For those worried that reliance on contingent faculty may lower instructional quality or lead to grade inflation, our findings provide reason for optimism: We find no such evidence of this at elite research institutions. Given that the increasing reliance on contingent faculty shows no sign of slowing—especially in light of the COVID-19 pandemic—policymakers and higher education institutions should consider new and creative ways to better support and compensate these instructors. In our sample, for instance, the monthly compensation is noticeably lower for contingent faculty than tenure-track faculty.

Reformers should also acknowledge that changing the compensation structure could lead to unintended consequences. For instance, adjuncts and lecturers can be hired part time and on short-term contracts, which is especially useful for colleges when enrollment levels are above or below anticipated levels. If higher education institutions cannot hire short-term lecturers (or if doing so comes with increased financial penalties), then colleges might have no choice but to pass additional costs to students through increased tuition. Alternatively, colleges may not be able to offer as many course sections in a given term, which could delay students' pathways to graduation.

One possible approach, as examined in this report, might be implementing a dual-tenure-track system. The new teaching faculty position may lead adjuncts and lecturers to stable employment opportunities, increased compensation and benefits, and better working conditions. At the same time, this model could allow research faculty to focus on scholarship and publishing research with the time that would otherwise be spent teaching courses. Findings from this report indicate that tenure-track teaching faculty assume a substantially larger teaching load than their tenure-track research colleagues and lecturers do, yet they produce comparable student outcomes.

Tenure-track teaching faculty may also bring other benefits to an institution. For example, teaching faculty could serve as pedagogical leaders in their respective departments.[21] Granted, incorporating a dual-tenure-track model might still be expensive for colleges and universities, but limiting the number of available teaching faculty positions could help institutions initially control costs. Even though the UC system employs a sizable number of teaching faculty, it still employs large shares of adjuncts and lecturers, too. Given the comparable student learning outcomes and the other benefits associated with teaching faculty, future research should examine the dual-tenure-track model in various institutional contexts to better understand its possible impact on students and institutions.

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Acknowledgments

The research reported here was supported by the National Science Foundation (NSF), through Grant #1565073 and #1821724 to the University of California, Irvine. The authors are extremely grateful to Rachel Baker, Cody Christensen, Greg Duncan, Jacque Eccles, George Farkas, Brian Sato, and Laura Tucker for their valuable comments and suggestions on this report. We thank the Office for Institutional Research at the anonymous institution within the University of California system for providing high-quality data and expert guidance on the college context for this research. The opinions expressed are those of the authors and do not represent the views of AEI or NSF.

Appendix A

Table A1. Faculty Titles by Faculty Type

Teaching Faculty	Research Faculty	Lecturers
Emeritus Lecturer with Security of Employment	Emeritus Professor	Continuing Appointment Temporary August (Unit 18)
Senior Lecturer with Security of Employment	Acting Assistant Professor	Supervisor of Teacher Education (Unit 18)
Emeritus Senior Lecturer with Security of Employment	Research Professor	Summer Session Lecturer (Unit 18)
Lecturer with Security of Employment	Acting Professor	Adjunct Instructor
Senior Lecturer with Potential Security of Employment	Assistant Professor	Associate Adjunct Professor
Lecturer with Potential Security of Employment	Professor	Lecturer (Unit 18)
Lecturer with Potential Security of Employment (Unit 18)	Associate Professor	Adjunct Professor
	Acting Associate Professor	Senior Lecturer (Unit 18)
		Assistant Adjunct Professor

Note: "Unit 18" refers to non-senate faculty who are covered by a collective bargaining agreement between the regents of the University of California and the American Federation of Teachers.

Source: AUCC Office of Institutional Research administrative data.

Appendix B

DESCRIPTION OF RESEARCH FACULTY, TEACHING FACULTY, AND CONTINGENT LECTURERS

The University of California (UC) system employs three broad categories of faculty instructors: research faculty, contingent faculty, and teaching faculty. Research faculty in the UC system include assistant professors, associate professors, and full professors. All are part of the academic senate, in which faculty carry out shared governance responsibilities the UC governing body establishes. For example, they are involved in academic policy, admissions and granting degrees, authorizing and supervising new courses and curricula, and administering faculty appointments, promotions, and budgets.

Contingent faculty in the UC system are comprised of part- or full-time lecturers and adjuncts. Lecturers are exclusively hired to provide instructional services. They may teach up to nine courses over a three-quarter year and are often assigned to teaching introductory courses with large enrollment size. Adjunct faculty are hired to either teach courses or conduct research and can be advanced through the professorial series, which includes adjunct instructor, adjunct assistant professor, adjunct associate professor, and adjunct professor. In our dataset, less than 1 percent of courses were taught by adjunct instructors. We therefore combine lecturers and adjuncts into one category. In a separate robustness check, we exclude adjuncts from this category, and the results remain almost identical.

Lastly, the UC system's teaching faculty belong to the lecturer with security of employment (LSOE) series. Teaching faculty meet a university's long-term instructional needs by teaching and engaging in discipline-based education research to identify evidence-based teaching practices. Similar to lecturers, teaching faculty are responsible for large teaching loads, typically teaching two large undergraduate courses per quarter, totaling five to six courses per year.

Yet, as part of the tenure system, teaching faculty are also academic senate members and have the same rights and privileges in the departments and on campus as senate research faculty do. For example, teaching faculty have full voting rights in departmental decisions, are eligible for appointment to senate committees, and are evaluated for reappointment, merit salary increases, and promotion to tenure. However, the evaluation criteria differ for teaching faculty and research faculty. Teaching faculty are largely evaluated on their teaching excellence and professional achievements, while research faculty are evaluated on their research productivity and excellence for promotions.

While the term LSOE has also been used outside the UC system to refer to nontenure-track lecturers with long-term employment with an institution, the LSOE series in the UC system refers specifically to teaching faculty who are members of the academic senate and have achieved (or could achieve) tenure for teaching. As such, there is a roughly parallel track between teaching faculty and research faculty: Lecturers with potential security of employment are at the same level as assistant professors, lecturers with security of employment are at the same level as associate professors, and senior lecturers with security of employment are at the same level as full professors.[22] Promotion through the teaching faculty series is fairly similar to the traditional research faculty series, in which an assistant teaching professor becomes an associate teaching professor and an associate teaching professor becomes a full teaching professor.

Table B1 presents the average characteristics of the three categories of faculty among those who taught at least one course between fall 2008 and summer 2016,

Table B1. Instructor Descriptive Statistics

Instructor Level	All Courses			Courses in the Analytical Sample		
	(1) Teaching Faculty	(2) Research Faculty	(3) Lecturer	(4) Teaching Faculty	(5) Research Faculty	(6) Lecturer
Female	0.500	0.349	0.506	0.583	0.346	0.538
White	0.775	0.681	0.651	0.812	0.706	0.679
Black	0.037	0.027	0.018	0.021	0.034	0.023
Hispanic	0.075	0.064	0.072	0.062	0.061	0.057
Asian	0.087	0.201	0.177	0.104	0.179	0.167
Other	0.025	0.027	0.082	0.000	0.020	0.075
Instructor Age in 2008	43.150	45.011	38.914	45.208	46.863	41.894
Total Years at University (Maximum)	15.375	15.765	6.275	17.250	17.792	8.274
Full Time	0.750	0.916	0.110	0.729	0.929	0.120
Monthly Pay Rate	7,021.359	10,390.699	5,292.696	7,105.434	9,378.239	5,005.450
Average Number of Courses per Term	2.318	1.463	1.477	2.418	1.613	1.693
Average Number of Course Credits per Term	8.204	5.503	5.595	8.644	6.112	6.621
Average Income per Credit	3,563.679	7,298.622	3,526.925	3,433.939	5,938.419	2,958.737
N	80	1,329	1,090	48	592	442

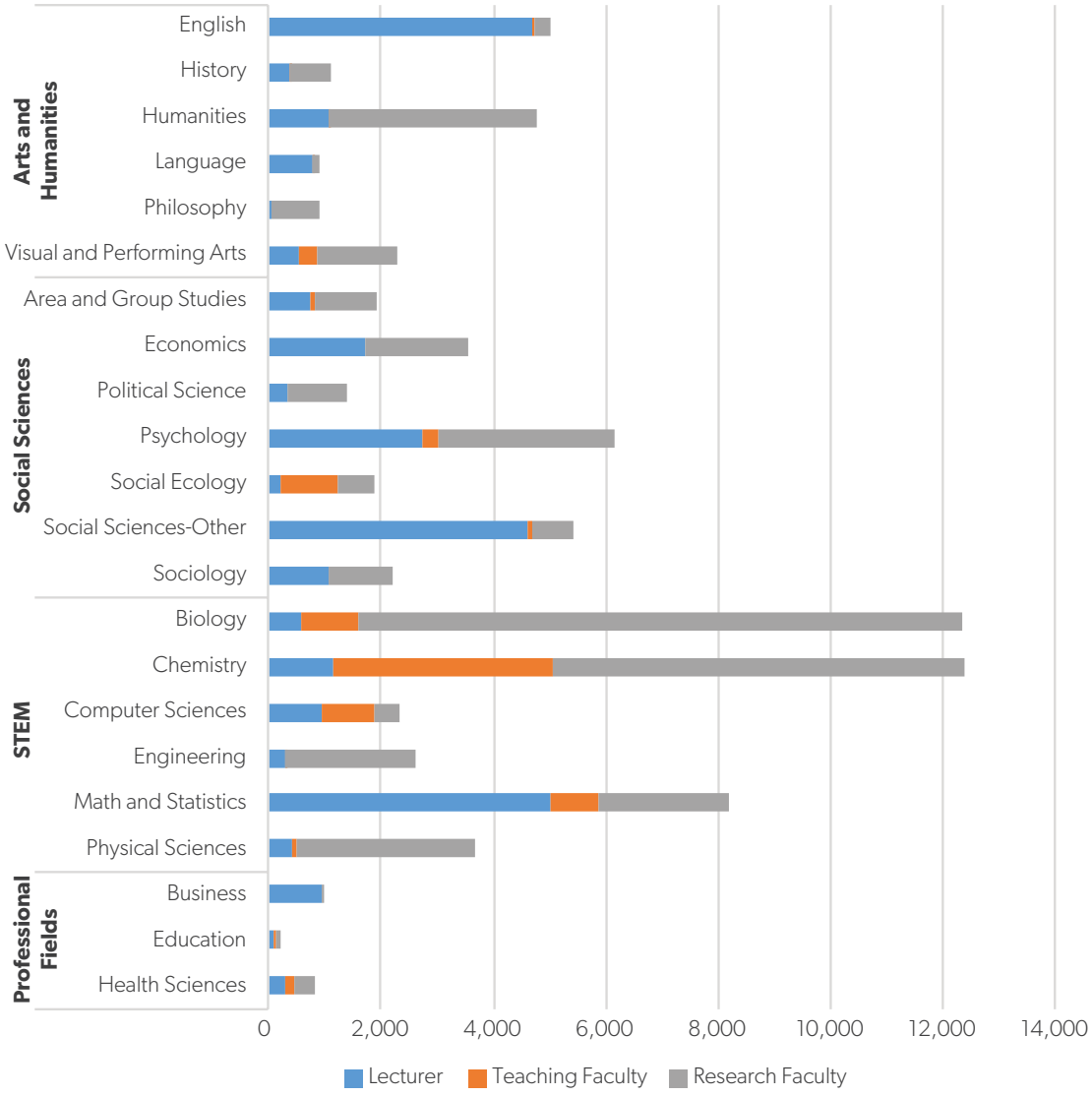
Note: Data are on instructors in the full sample who are tied to a course taken by 2008–13 cohorts. "Full Time" means the instructor worked full time during at least half the terms employed in the institution.
Source: Authors' calculations using AUCC Office of Institutional Research administrative data.

which includes 80 teaching faculty, 1,329 research faculty, and 1,090 lecturers (Columns 1–3). Compared with research faculty, teaching faculty are substantially more likely to be female (50 percent versus 35 percent) and white (78 percent versus 68 percent) and less likely to be Asian (9 percent versus 20 percent). Other than these demographic differences, however, teaching faculty and research faculty are fairly comparable in their age and total years working at the university.

Yet, the average monthly pay rate is noticeably lower for teaching faculty than research faculty ($7,021 versus $10,391), even though the average teaching load among teaching faculty is substantially larger than that of research faculty (2.3 courses per term versus 1.5 courses per term or 8.2 course credits per term versus 5.5 course credits). As a result, the gap in average per-course-credit income is further enlarged ($3,564 versus $7,299) after accounting for their differential teaching load.[23]

Compared with both types of tenure-track faculty, lecturers at AUCC tend to be younger and have fewer years as a university employee. Four-fifths of the lecturers are also employed part time with a monthly pay rate half the rate for research faculty. Although most lecturers are part time, their teaching load roughly equals research faculty's load (1.5 courses per term or 5.5 course credits per term). As a result, the difference

Figure B1. Student Enrollments by Field of Study and Type of Faculty



Source: Authors' calculations using AUCC Office of Institutional Research administrative data.

in per-course-credit income between lecturers and research faculty remains similar to that of teaching and research faculty ($3,527 versus $7,299).

Although the per-course-credit income is fairly comparable between teaching faculty and lecturers ($3,564 versus $3,527), this calculation does not take into account the additional benefits faculty receive. Since most lecturers are part time, they typically receive reduced benefits from the university. Therefore, the institutional costs of hiring teaching faculty instead of lecturers would be higher for similar levels of course load.[24] Columns 4–6 further limit the sample to faculty who taught at least one course in our analytical sample, which includes only the first course taken by a student in a field of study. The patterns of the between-faculty distinction resemble the patterns described for the full-course sample.

To further shed light on possible variations in reliance on different types of faculty across departments, Figure B1 shows the proportions of total student

Table B2. Faculty Distribution by Field of Study

Field of Study (Subject)	Teaching Faculty	Research Faculty	Lecturer
Area and Group Studies	65	1,084	757
Biology	1,001	10,747	577
Business	0	38	958
Chemistry	3,894	7,345	1,146
Computer Science	969	433	930
Economics	0	1,827	1,711
Education	26	94	89
Engineering	4	2,350	276
English	18	314	4,699
Health	161	379	286
History	5	733	358
Humanities	4	3,698	1,052
Language	33	92	764
Math and Statistics	856	2,347	5,005
Philosophy	0	851	45
Physical Sciences	104	3,149	406
Political Science	0	1,068	318
Psychology	280	3,134	2,727
Social Ecology	1,022	642	208
Social Sciences	106	709	4,600
Sociology	0	1,153	1,071
Visual and Performing Arts	313	1,432	538

Note: Each cell indicates the total number of course enrollments for each faculty type in each subject. The table includes the analytical sample.
Source: Authors' calculations using AUCC Office of Institutional Research administrative data.

course enrollments with each type of faculty by fields of study using the analytical sample. The specific number of enrollments with each type of faculty across fields of study is presented in Table B2. In general, research faculty serve as the primary teaching force in most fields. In some fields, such as humanities, almost all the course enrollments are with research faculty. Teaching faculty are responsible for a relatively large number of course enrollments in four of the 22 distinct fields of study: biology, chemistry, computer sciences, and social ecology. In two of these subfields, social ecology and chemistry, teaching faculty are responsible for 55 percent and 31 percent of course enrollments, respectively. In contrast, lecturers are less likely to be housed in STEM fields, except for being responsible for roughly 60 percent of course enrollments in mathematics. Lecturers also teach a relatively large proportion of students in English, psychology, and other social sciences.

Appendix C

Table C1. How Different Types of Instructors Affect Course Performance: Grade Distribution

Outcome	(1) Grade: A or Equivalent	(2) Grade: B or Better	(3) Grade: C or Better	(4) Grade: D or Better	(5) Grade Numeric
Panel A. Contemporaneous Course Performance					
Teaching Faculty	0.007	–0.017	–0.006	–0.033*	–0.048
	(0.011)	(0.015)	(0.008)	(0.012)	(0.039)
Lecturer	0.009	0.001	0.002	–0.006	0.015
	(0.017)	(0.015)	(0.008)	(0.007)	(0.038)
N	72,226	72,226	72,226	72,226	72,226
R-Squared	0.636	0.656	0.598	0.550	0.746
Term Fixed Effects	—	—	—	—	—
Introductory Course Fixed Effects	—	—	—	—	—
Student Fixed Effects	—	—	—	—	—
Panel B. Subsequent Course Performance					
Teaching Faculty	0.012	0.013	0.010	0.000	0.029
	(0.009)	(0.017)	(0.007)	(0.006)	(0.021)
Lecturer	–0.002	–0.005	–0.008	–0.002	–0.021
	(0.008)	(0.013)	(0.007)	(0.006)	(0.021)
N	48,355	48,355	48,355	48,355	48,355
R-Squared	0.721	0.714	0.642	0.601	0.787
Term Fixed Effects	—	—	—	—	—
Introductory Course Fixed Effects	—	—	—	—	—
Student Fixed Effects	—	—	—	—	—
Next-Class-Taken Fixed Effects	—	—	—	—	—

Note: All models include students' first course in a field of study during their first term. Base group is tenure-track research faculty. Controls for all models include course section characteristics of the introductory course, including enrollment size, delivery method, other students' average SAT score in the class, and class day and time. Students receiving a withdrawal in the next course are dropped from the sample. Classes on a pass-fail grading system are excluded. Standard errors are two-way clustered at the student and subject level. Robust standard errors are in parentheses. *** $p < 0.01$; ** $p < 0.05$; * $p < 0.10$.
Source: Authors' calculations using AUCC Office of Institutional Research administrative data.

Appendix D

Table D1. How Different Types of Instructors Affect Credit Accumulation

Outcome	(1) Earned at Least One Credit	(2) Earned Eight Credits or More	(3) Earned 12 Credits or More	(4) Total Credits Continuous
Panel A. Full Sample				
Teaching Faculty	0.019	0.039**	0.022	0.568
	(0.011)	(0.017)	(0.014)	(0.438)
Lecturer	0.006	–0.004	–0.016	–0.640
	(0.008)	(0.010)	(0.011)	(0.570)
N	72,470	72,470	72,470	72,470
R-Squared	0.590	0.521	0.513	0.640
Term Fixed Effects	—	—	—	—
Introductory Course Fixed Effects	—	—	—	—
Student Fixed Effects	—	—	—	—
Panel B. Introductory Courses Outside Intended Major				
Teaching Faculty	0.022*	0.039**	0.027	0.106
	(0.011)	(0.018)	(0.017)	(0.503)
Lecturer	0.008	–0.005	–0.020*	–0.808
	(0.010)	(0.012)	(0.011)	(0.517)
N	49,742	49,742	49,742	49,742
R-Squared	0.600	0.621	0.612	0.633
Term Fixed Effects	—	—	—	—
Introductory Course Fixed Effects	—	—	—	—
Student Fixed Effects	—	—	—	—

Note: All models include students' first course in a field of study during their first term. Base group is tenure-track research faculty. Controls for all models include course section characteristics of the introductory course, including enrollment size, delivery method, other students' average SAT score in the class, and class day and time. Students receiving a withdrawal in the next course are dropped from the sample. Classes on a pass-fail grading system are excluded. Standard errors are two-way clustered at the student and subject level. Robust standard errors are in parentheses. *** $p < 0.01$; ** $p < 0.05$; * $p < 0.10$.
Source: Authors' calculations using AUCC Office of Institutional Research administrative data.

Notes

1. For examples, see Phyllis Korkki, "Adjunct Professors Step Up Their Efforts to Increase Pay," *New York Times*, April 5, 2018, https://www.nytimes.com/2018/04/05/education/learning/adjunct-professors.html; and Phyllis Bernstein, "Colleges Using More Adjuncts," *New York Times*, November 17, 1985, https://www.nytimes.com/1985/11/17/nyregion/colleges-using-more-adjuncts.html.

2. Adrianna Kezar and Daniel Maxey, "The Changing Academic Workforce," *Trusteeship Magazine* 21, no. 3 (May/June 2013): 15–21, https://agb.org/trusteeship-article/the-changing-academic-workforce; American Association of University Professors, "Data Snapshot: Contingent Faculty in US Higher Ed," October 11, 2018, https://www.aaup.org/sites/default/files/10112018%20Data%20Snapshot%20Tenure.pdf; and Douglas Belkin and Melissa Korn, "Colleges' Use of Adjuncts Comes Under Pressure," *Wall Street Journal*, February 16, 2015, https://www.wsj.com/articles/colleges-use-of-adjunct-instructors-comes-under-pressure-1424118108.

3. Editorial Board, "The College Faculty Crisis," *New York Times*, April 13, 2014, https://www.nytimes.com/2014/04/14/opinion/the-college-faculty-crisis.html?module=inline.

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5. Kelly Coate, Ronald Barnett, and Gareth Williams, "Relationships Between Teaching and Research in Higher Education in England," *Higher Education Quarterly* 55, no. 2 (April 2001): 158–74, https://onlinelibrary.wiley.com/doi/abs/10.1111/1468-2273.00180; David Figlio and Morton O. Shapiro, "Are Great Teachers Poor Scholars?," Brookings Institution, January 26, 2017, https://www.brookings.edu/research/are-great-teachers-poor-scholars; John Hattie and H. W. Marsh, "The Relationship Between Research and Teaching: A Meta-Analysis," *Review of Educational Research* 66, no. 4 (Winter 1996): 507–42, https://www.jstor.org/stable/1170652?seq=1; and Mohammad Qamar uz Zaman, *Review of the Academic Evidence on the Relationship Between Teaching and Research in Higher Education*, Department for Education and Skills, 2004, http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.145.1140&rep=rep1&type=pdf.

6. For a full review of existing evidence on the relationship between teaching and research excellence, see Zaman, *Review of the Academic Evidence on the Relationship Between Teaching and Research in Higher Education*.

7. Michael Bérubé and Jennifer Ruth, *The Humanities, Higher Education, and Academic Freedom: Three Necessary Arguments* (London: Palgrave Macmillan, 2015).

8. The dual-tenure-track system was first implemented across University of California institutions decades ago. However, a policy change in 2002 solidified its specific role, causing the number of teaching faculty to expand substantially over the past two decades.

9. David Figlio, Morton Schapiro, and Kevin Soter explored how contingent teaching faculty affect students' subsequent course enrollment and success relative to tenure-track/tenured faculty based on eight recent cohorts of first-year students at Northwestern University by using a two-way fixed effects model. The authors identified a sizable positive impact of contingent faculty on students' subsequent performance. Using data from public four-year colleges in Ohio, Eric Bettinger and Bridget Terry Long also identified positive effects of part-time adjunct instructors on subsequent student interest, though the effects are much smaller and vary substantially

by discipline. In contrast, using data that include both public two-year community colleges and four-year institutions in an anonymous state, Florene Xiaotao Ran and Di Xu found that nontenure-track instructors are positively associated with students' contemporaneous course performance but are negatively associated with subsequent course enrollment and performance in the same field of study. Similarly, based on data from the Virginia Community College System, Xu also identified a sizable negative impact of part-time adjuncts on students' subsequent enrollment and performance. Finally, Florian Hoffmann and Philip Oreopoulos used data from a large Canadian university and found little variation in student course dropout rates and subsequent course performance by instructor academic rank. Eric P. Bettinger and Bridget Terry Long, "Does Cheaper Mean Better? The Impact of Using Adjunct Instructors on Student Outcomes," *Review of Economics and Statistics* 92, no. 3 (August 2010): 598–613, https://www.mitpressjournals.org/doi/10.1162/REST_a_00014; Scott E. Carrell and James E. West, "Does Professor Quality Matter? Evidence from Random Assignment of Students to Professors," *Journal of Political Economy* 118, no. 3 (June 2010): 409–32, https://www.journals.uchicago.edu/doi/abs/10.1086/653808; David Figlio, Morton O. Schapiro, and Kevin B. Soter, "Are Tenure Track Professors Better Teachers?," *Review of Economics and Statistics* 97, no. 4 (October 2015): 715–24, https://www.mitpressjournals.org/doi/pdf/10.1162/REST_a_00529; Florian Hoffmann and Philip Oreopoulos, "Professor Qualities and Student Achievement," *Review of Economics & Statistics* 91, no. 1 (February 2009): 83–92, https://www.researchgate.net/publication/24008781_Professor_Qualities_and_Student_Achievement; Florene Xiaotao Ran and Di Xu, "Does Contractual Form Matter? The Impact of Different Types of Non-Tenure-Track Faculty on College Students' Academic Outcomes," *Journal of Human Resources* 54, no. 4 (October 2019): 1081–120, http://search.proquest.com/docview/2312780511; and Di Xu, "Academic Performance in Community Colleges: The Influences of Part-Time and Full-Time Instructors," *American Educational Research Journal* 56, no. 2 (April 2019): 368–406, https://journals.sagepub.com/doi/abs/10.3102/0002831218796131?journalCode=aera.

10. Ashley Harlow et al., "Characterizing the University of California's Tenure-Track Teaching Position from the Faculty and Administrator Perspectives," *PLOS ONE* 15, no. 1 (January 2020), http://dx.doi.org.mutex.gmu.edu/10.1371/journal.pone.0227633.

11. Viet Quoc Vu, "Documenting Instructional Practices in Large Introductory STEM Lecture Courses" (PhD diss., University of California, Irvine, 2017), https://escholarship.org/uc/item/1b15t5q8.

12. For example, Ran and Xu defined adjuncts as those hired in transitory positions; approximately one-fifth terminated their employment with the college and never returned to teaching after their first year. In contrast, most adjunct faculty in Figlio, Schapiro, and Soter's study had a long-term relationship with the university. Accordingly, the impact of contingent faculty employed under different contracts and in diverse working conditions might also be distinct from each other in faculty engagement and satisfaction with the institution and their impact on student learning outcomes. Figlio, Schapiro, and Soter, "Are Tenure Track Professors Better Teachers?"; Bettinger and Long, "Does Cheaper Mean Better?"; Ran and Xu, "Does Contractual Form Matter?"; Xu, "Academic Performance in Community Colleges"; and Hoffmann and Oreopoulos, "Professor Qualities and Student Achievement."

13. National Center for Education Statistics, Integrated Postsecondary Education Data System, https://nces.ed.gov/ipeds.

14. The total course enrollments with graduate students are 14 percent of the student-course sample.

15. Carrell and West, "Does Professor Quality Matter?"

16. See Figlio, Schapiro, and Soter, "Are Tenure Track Professors Better Teachers?"; Ran and Xu, "Does Contractual Form Matter?"; and Xu, "Academic Performance in Community Colleges."

17. In addition to the term fixed effects and course fixed effects, the model controls for student-term-level information that varies over time (i.e., total credits taken in this term) and characteristics that are specific to a particular section (i.e., whether the course section is online or face-to-face, class size, the average SAT score of peers enrolled in the section, and the class day and time), as indicated by the vector X_{cskt}.

18. We use the term section or class to refer to a particular offering of a course with a specific instructor at a specific time, such as "MATH 101 Calculus—section 01 in the fall term of 2009." Hence, a "section" or "class" is uniquely defined by course title, term, and section number.

19. The introductory course fixed effects from Equation 1 are still included in Equation 2. Controlling for characteristics at the introductory course level is necessary even though the outcome is a measure of student performance in the subsequent course. For example, students might take an introductory course—such as microeconomics—taught by a teaching faculty, which prepares them well for a subsequent course: macroeconomics. Other students, however, may take an introductory course—such as the history of

economics—with a research faculty member, thereby becoming ill-prepared for macroeconomics. If the students taking microeconomics do better (or worse) in macroeconomics, they might have taken a class that better prepared them for the subsequent course.

20. We did not include course persistence as an outcome measure in this report because almost no student in our sample withdrew from a course, resulting in an overall course persistence rate of 99.7 percent.

21. Seth D. Bush et al., "Fostering Change from Within: Influencing Teaching Practices of Departmental Colleagues by Science Faculty with Education Specialties," *PLOS ONE* 11, no. 3 (March 8, 2016): 1–20, https://doi.org/10.1371/journal.pone.0150914.

22. The term "Senior," whether appointed to a potential security of employment position or security of employment position, is assigned to individuals who provide services of exceptional value to the university and whose excellent teaching and professional accomplishments have made him or her a recognized leader in his or her professional field or education.

23. Ideally, we would like to use total annual income divided by total number of credits taught in a year to calculate per-course-credit income. However, the University of California dataset we received does not include faculty's annual income. Therefore, we multiply monthly pay rate by three for a rough calculation of a faculty member's quarterly income and then divide it by the average number of credits by term to obtain an estimate of per-credit income.

24. A detailed explanation regarding benefits eligibility can be found at University of California, "Benefits Eligibility Level Indicator (BELI) and Status Qualifier Code (SQC): Assignment or Reassignment," https://ucnet.universityofcalifornia.edu/tools-and-services/administrators/docs/upay726-beli-form.pdf.