# Limited Contracts, Limited Quality? Effects of Adjunct Instructors on Student Outcomes*

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**Abstract**

A growing literature documents significant differences in college student outcomes between adjunct and full-time instructors, although little is known regarding the causes of these differences. Many existing studies implicitly treat instructor quality—as measured by an instructor's effect on student outcomes—as a fixed trait. However, instructor quality itself may be sensitive to employment rank, given that adjunct and full-time instructors work under very different conditions. Understanding mechanisms driving these differences is important for informing policy decisions aimed at improving student outcomes. Using panel data on first-semester students at public colleges in Arkansas, this paper first establishes that adjuncts have significantly worse student outcomes than full-time counterparts on a number of metrics. Next, I investigate mechanisms underlying differences in outcomes across instructor rank. I take advantage of the panel structure of the data and use an instructor fixed effects approach to provide evidence that within instructors, student outcomes improve when the instructor is full-time, compared to when the instructor is an adjunct. Results indicates improving student outcomes is about more than just getting better instructors, since instructor quality is not a fixed trait. Rather, factors like an instructor's conditions of employment and teaching and working environment may affect the outcomes of their students.

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# I Introduction

Over the past two decades years, colleges across the United States have significantly increased their share of adjunct instructors, who are paid per course taught, relative to their share of full-time, salaried instructors. From 1999 to 2018, the number of part-time faculty increased by 60 percent on average across all institutions, while the number of full-time faculty increased by only 40 percent (NCES, 2020). Adjuncts currently make up approximately 35% of instructional staff at four-year colleges and 51% of instructional staff at two-year colleges (AAUP, 2019).[1]

Adjunct instructors cost significantly less to hire than their full-time counterparts, making them an attractive solution for colleges, many of which face increasing financial pressures (Zhang et al., 2015). In 2017-2018, the average pay per course for adjuncts was $3,894 (AAUP, 2019).[2] Many adjuncts do not qualify for employee benefits and have contracts that are more easily terminated than those of full-time instructors (Curtis and Thronton, 2013). Furthermore, beginning in 1994, the Age Discrimination in Employment Act eliminated mandatory retirement age policies in higher education, thereby increasing the opportunity cost to hire full-time instructors—and, in turn, increasing the incentive to hire adjunct faculty instead (Ehrenberg, 2000).

It is not obvious what effects these hiring trends have on student outcomes. On the one hand, differences in educational attainment as well as institutional involvement may make adjuncts less effective teachers than full-time instructors. Adjuncts are significantly less likely to hold professional degrees than their full-time counterparts, raising concerns that they are less qualified instructors (Anderson, 2002; Monks, 2009), although differences in degree attainment between adjunct and full-time instructors are more muted at two-year colleges (Eagan, 2007). Adjuncts may also be less engaged in their institutions overall, as they are significantly less likely to have workplace benefits, access to private office space, or input in matters of college governance (Akroyd et al., 2004; Levin et al., 2006; Curtis and Thronton, 2013). Prior studies find that relative to full-time counterparts, adjunct instructors feel less satisfied with their level of job security and

[1] Adjuncts are often referred to as part-time workers, though this term can be somewhat misleading as adjuncts may teach more courses than their full-time counterparts.

[2] Average pay breakdown by institution type: $4,911 at four-year doctoral institutions, $3,438 at four-year master's institutions, $3,785 at four-year baccalaureate institutions, $4,070 at two-year institutions where instructors have ranks, and $3,894 at two-year institutions where instructors do not have ranks.

compensation, relationships with colleagues and administrators, and allocation of office space and resources (Levin et al., 2006; Eagan, 2007; Umbach, 2007; Eagan et al., 2015). In addition, adjuncts are significantly more likely to hold additional jobs, either at other schools or outside of teaching, which may also contribute to reduced time on campus and lower institutional engagement (Gappa, 2002; Monks, 2009). On the other hand, differences in duties, professional affiliations, and teaching incentives may make adjuncts more effective teachers. For example, adjuncts may have more time to focus on teaching than full-time instructors with research or administrative duties. Furthermore, some adjuncts hold concurrent professional appointments, which may allow them to bring useful real-world job experience and perspectives to the classroom (Green, 2007).

In this paper, I use student transcript data from public two- and four-year colleges in Arkansas from 2004 to 2011. I first analyze whether students experience different academic outcomes from taking courses with adjunct instructors, compared to taking courses with full-time instructors. Next, I assess what drives differences in student outcomes between the two types of instructors. I focus on comparisons of adjuncts with full-time, non-tenure-track instructors since tenure-track positions often place a larger focus on non-teaching duties, such as research. I look at a number of academic outcomes, both course-specific (whether a student takes a subsequent course in the subject or majors in the subject) and non-course-specific (whether a student returns for a second year of college, graduates on time, or transfers to a four-year college from a two-year college). To minimize concerns of students selecting non-randomly into different instructors by rank, I focus on outcomes for students in their first semester of college (Figlio et al., 2015).

For subject-specific outcomes, I implement a two-way fixed effects model with course-level and student-level fixed effects. Course fixed effects control for differences in student outcomes that are due to differences in the types of courses that adjuncts and full-time instructors teach.[3] Student fixed effects address the concern may sort into instructor ranks non-randomly by isolating variation in instructor rank within students. The key identifying assumption underlying this approach is that students do not demonstrate heterogeneous preferences for instructor rank across different course subjects. Thus, as a robustness check, I also implement an alternative instrumental variables strategy from Bettinger and Long (2010) to address endogenous

[3]Courses are classified as school-specific classes that have the same course name and course number.

enrollment into instructors by rank. This strategy uses term-specific variation in the composition of faculty rank in a department to instrument for the likelihood a student takes a course with an adjunct instructor.

Non-subject-specific outcomes do not vary across courses within a student, so a two-way fixed effects approach cannot be used to assess the role of instructor rank on these outcomes. Instead, I assess how the share of a student's instructors that are adjunct affects academic outcomes. I include a course bundle fixed effect for the set of courses a student takes in their first semester of college. To address the concern that students sort into classes by rank of instructor non-randomly, I augment this specification with an instrumental variables approach. I instrument for the share of a student's instructors that are adjunct using the mean term-specific variation in departmental faculty composition by rank across all departments a student takes a course in, weighted by the number of courses she takes in that department.

Results indicate students do worse on multiple outcomes when they take courses with adjuncts rather than full-time instructors: Taking a course with an adjunct decreases a four-year college student's likelihood of taking a subsequent course in the subject by 1.8% of the baseline propensity of take a subsequent course in the subject. For two-year college students, taking a course with an adjunct decreases the propensity of taking a subsequent course in the subject by 2.7% of the baseline. Additionally, a 10% increase in the proportion of a student's first-semester instructors that are adjuncts decreases the propensity for four-year college students to persist into a second year of college by 1.6% of the baseline and decreases the persistence rate for two-year college students by 2.8%. I find no significant effects of instructor rank on majoring in a subject, on-time graduation, or transfer rate from a two-year to a four-year college.

Multiple potential mechanisms could explain these differences. For example, if the labor market sorts instructors into different positions based on teaching quality, then full-time, non-tenure-track hires may simply be higher-quality instructors than their adjunct peers. However, teaching differences could also stem from institutional differences in treatment in terms of pay, benefits, institutional involvement, teaching conditions, office space, etc. From a policy perspective, it is important to understand the mechanism behind these differences in student outcomes across instructor rank. If schools would like to improve student outcomes through instructor hiring decisions, it is difficult to anticipate the relative costs and benefits of different actions without having information on what drives these differences.

Next, I explore the role of differences in working conditions by instructor rank on student outcomes.[4] To isolate the effect of instructor rank from baseline differences in instructor quality, I use an instructor fixed effects approach. This identification strategy looks at within-instructor changes in rank across terms to assess the effect of rank on student outcomes. I find that at four-year colleges, when an instructor is full-time, their students are 1.7 percentage points more likely to take a subsequent course in the subject than when the instructor is adjunct, a 3.4% increase from the baseline propensity for students to take a subsequent course in the subject. Estimates at two-year college students on subsequent course taking are positive but not statistically significant. Additionally, a 10% increase in the share of adjuncts a two-year college student has in their first year of college increases the probability the student will persist into a second year of college by 1.5 percentage points, a 2.6% increase from the baseline persistence rate. Estimates of four-year college students on persistence are positive but not statistically significant.

This paper contributes to a growing literature exploring the role of instructor rank in higher education outcomes. Griffith and Sovero (2021) analyze how grading patterns differ across instructor rank and gender and find that instructors with more job uncertainty and risk aversion respond to higher incentives to have positive teaching outcomes by systematically awarding higher grades. Carrell and West (2010) randomly assign students to teachers at the United States Air Force Academy to explore the relationship between student evaluations, contemporaneous achievement, and follow-on achievement across instructor ranks, though they do not look at adjunct instructors. Figlio et al. (2015) compare the role of full-time, non-tenure-track with tenure-track instructors on student learning, and Feld et al. (2019) look at the performance of student instructors versus professors on academic and labor market outcomes at a Dutch business school.

Prior research comparing the effects of adjunct and full-time instructors on student outcomes find mixed evidence. Using national, institutional-level data, Ehrenberg and Zhang (2005) find that increasing the proportion of part-time faculty at a school decreases first-year retention rates and graduation rates at four-year colleges. Subsequent studies using student-level data report similar results, finding that students who take a higher proportion of courses taught by adjuncts in their first year have a lower chance of returning to college for a second year (Bettinger and Long, 2006; Jaeger and Hinz, 2008; Jaeger and Eagan, 2011a).

[4] I use the term working conditions to refer broadly to an instructor's terms of employment and teaching and working environment.

In a subsequent study, Bettinger and Long (2010) look at finer, course-specific individual outcomes using the same data as (Bettinger and Long, 2006) and find that taking a class with part-time faculty actually increases the likelihood a student will take a subsequent course or major in the subject of the course. Ran and Xu (2018) find that students are less likely to take a subsequent course in the subject and have lower grades conditional on taking a subsequent course for courses taken with adjuncts, compared to full-time, non-tenure-track instructors. Eagan and Jaeger (2009) and Jaeger and Eagan (2011b) find that increased exposure to part-time instructors is associated with a lower propensity for two-year students to transfer to a four-year school, controlling for observable characteristics. Hoffmann and Oreopoulos (2009) find no effect of instructor rank on subsequent course-taking or course performing behaviors at a large Canadian public university, and Feld et al. (2018) similarly find that instructor rank in small group instruction tutorial sections in a Dutch business school is unrelated to student outcomes.

This paper makes two key contributions to research on teaching quality in higher education. First, it expands prior studies by exploring the contexts and reasons for differences in teaching quality across instructor ranks. Prior studies have found mixed results on the effects of adjunct instructors, which may stem from differences in institutional setting, outcomes analyzed, or both. This paper analyzes a broader and more comprehensive range of student outcomes. Second, this paper explores mechanisms behind differences in student outcomes between adjuncts and full-time instructors. Namely, I assess the extent to which the outcomes of an instructor's students is affected by factors related to the instructor's working conditions. I find that changing an instructor's rank from adjunct to full-time improves teaching outcomes on multiple outcomes, indicating teaching quality is sensitive to institutional treatment of instructors.

These findings have significant policy implications in showing differences in working conditions between adjunct and full-time instructors affect teaching quality in higher education. One important thing to note is that there are many differences in employment conditions, teaching environment, and general workplace environment that adjuncts and full-time instructors face. While pinpointing which factors matter for teaching quality is outside the scope of this paper, this study provides a pathway for future research to explore these mechanism in more depth by showing teaching outcomes are sensitive to working conditions.

In the remainder of the paper, Section II first introduces and describes the data. Next, Section III

measures the effects of taking a course with an adjunct instructor instead of a full-time instructor on academic outcomes. I find that students perform worse on multiple outcomes when taking a course with an adjunct instructor. This leads to the next section, which focuses on understanding why adjunct instructors have worse student outcomes than full-time counterparts. Specifically, in Section IV, I ask whether an instructor's student outcomes change when the instructor switches rank. Finally, Section V summarizes and discusses the implications of the findings in the paper.

# II Data

Data for this project come from the Arkansas Department of Higher Education (ADHE) and contain information for all students enrolled in an Arkansas public institution of higher education for the academic years 2004-2012.[5] These institutions consist of 10 four-year colleges and 22 two-year colleges. For each student in the sample, I observe background characteristics and course transcript data for each term of enrollment. Conditional on graduation, I also observe degree information.

This study focuses on degree-seeking, first-time, undergraduate students entering college between 2004 and 2011, approximately 263,000 students.[6] Table 1 displays summary statistics on students in the sample. More women than men are enrolled in college in the sample, a difference that is especially pronounced at community colleges. The median age of first-time students is 18 at four-year colleges and 20 at two-year colleges. Four-year college students are less likely to be part-time and more likely to pay out-of-state tuition, compared to two-year students. On average, four-year students take 4.1 classes in their first semester of college during the sample period, while two-year college students take an average of 2.9 classes.

Key to this study, data also contain detailed information on instructors, including employment rank in each term. At four-year schools, instructor ranks include tenure-track/tenured, full-time non-tenure-track, adjunct, and graduate student. I distinguish between tenure-track/tenured and full-time non-tenure track instructors because tenure-track job duties often differ significantly from non-tenure-track in terms of focus on research and other non-teaching duties.[7] Two-year schools do not employ tenure-track/tenured or graduate

[5] Academic year 2012 represents the semesters Fall 2011 and Spring 2012, and so forth for the other academic years.

[6] I restrict the sample to students entering in 2011 at the latest because I need to observe student outcomes for at least one subsequent year for all outcomes of interest, which I am unable to do for first-time students in 2012.

[7] The main focus of this paper is on comparing outcomes between adjunct and full-time, non-tenure track instructors, although

Table 1: First-time Student Characteristics

| | Four-year College Students | Two-year College Students |
|---|---|---|
| Male | 0.45 | 0.41 |
| Part-Time | 0.13 | 0.32 |
| In-State tuition status | 0.85 | 0.96 |
| Age (median) | 18 | 20 |
| | (5.89) | (9.42) |
| Number of classes taken | 4.12 | 2.87 |
| | (1.41) | (1.43) |
| $N$ | 149,884 | 113,306 |

Sample includes first-time students between 2004-2011. Age is imputed from high school graduation year, under the assumption that students graduate high school at age 18. I display age as a median value since the distribution is positively skewed by some outlier older students; otherwise main values denote means. Standard deviations are in parentheses. "Number of classes taken" refers to number of classes taken in the first semester.

student instructors, so instructor ranks there include full-time non-tenure-track and adjunct.

Table 2 displays summary statistics for instructors teaching during the sample period. Units of observation at the instructor×term level, so instructors appear in the sample once for each term they teach are teaching. There are 9,787 unique instructors in the four-year school sample and 6,152 unique instructors in the two-year school sample. I separate instructors by institution type (four-year or two-year) and rank. Going left to right from tenure-track/tenured to full-time to adjunct to graduate student, instructors get younger and earn less on average by rank. At both two-year and four-year schools, full-time instructors earn more than twice as much as adjuncts from their institutions, although this may reflect differences in teaching and administrative loads. Full-time instructors teach more classes than adjunct instructors at both four-year and two-year schools. While women make up over half of all full-time non-tenure-track, adjunct, and graduate student instructors at four-year schools, they represent only 32% of tenure-track/tenured faculty.

Next, I examine differences in student characteristics across instructor rank in Table 3. Characteristics of students could vary across instructor rank due to both student selection into instructors, as well as differences in the types of courses taught by instructors of different ranks. Observations in Table 3 represent student×course units. Differences in student characteristics between full-time instructors and adjuncts are significant at the .01 level for all characteristics.[8] Notably, adjuncts are significantly more likely to teach part-time and transfer students at both four-year and two-year schools. Approximately 35% of four-year

I include controls for tenure-track/tenured instructors and graduate students in estimations for completeness.

[8]Due to the large sample size, some values are statistically different even though they are similar in magnitude.

Table 2: Instructor Characteristics

| | Four-year Schools | | | | Two-Year Schools | |
|---|---|---|---|---|---|---|
| | Ten.-track/Ten. | Full-time | Adjunct | Grad. Stud. | Full-time | Adjunct |
| Male | 0.68 | 0.43 | 0.49 | 0.44 | 0.48 | 0.46 |
| Age | 51.51 | 46.40 | 45.43 | 30.09 | 49.39 | 47.53 |
| | (10.63) | (11.59) | (12.12) | (7.24) | (10.74) | (11.92) |
| Number of classes taught | 2.96 | 3.07 | 1.96 | 1.79 | 4.10 | 2.18 |
| | (1.30) | (1.49) | (1.16) | (0.73) | (1.61) | (1.25) |
| Salary (9-month, $) | 63,859 | 40,379 | 18,282 | 10,231 | 40,407 | 11,133 |
| | (19543.51) | (17939.65) | (20578.69) | (3655.75) | (63339.99) | (14789.88) |
| *N* | 17,265 | 10,424 | 8,390 | 3,281 | 14,463 | 15,714 |

Observations denote instructor×semester units for instructors teaching during 2004-2011. Standard deviations in parentheses. "Full-time" refers to full-time, non-tenure-track instructors. Salaries are reported in real 2010 dollars.

students and 39% of two-year students take at least one course with both an adjunct instructor and a full-time, non-tenure track instructor in their first semester.

Table 3: Student Characteristics by Instructor Rank

| | Four-year Schools | | | | Two-Year Schools | |
|---|---|---|---|---|---|---|
| | Ten.-track/Ten. | Full-time | Adjunct | Grad. Stud. | Full-time | Adjunct |
| Male | 0.46 | 0.46 | 0.44 | 0.48 | 0.43 | 0.43 |
| Part-time | 0.06 | 0.07 | 0.11 | 0.03 | 0.15 | 0.25 |
| Transfer Student | 0.29 | 0.22 | 0.24 | 0.18 | 0.25 | 0.31 |
| In-State Tuition | 0.85 | 0.86 | 0.86 | 0.81 | 0.96 | 0.98 |
| Age | 19.98 | 20.02 | 20.57 | 18.91 | 23.71 | 24.99 |
| | (4.94) | (5.19) | (5.87) | (3.27) | (8.74) | (9.12) |
| *N* | 220,052 | 219,568 | 114,108 | 53,319 | 204,905 | 126,011 |

Observations are student×course units from 2004-2011. Standard deviations in parentheses. "Full-time" indicates full-time, non-tenure-track instructors. "Transfer Student" refers to first-time students who were previously enrolled at a different college. Results from two-sampled t-tests and proportions tests indicate full-time and adjunct instructors differ significantly in terms of what types of students they teach at the .01 level for all characteristics.

Tables 4 and 5 show descriptive student outcomes by instructor rank at four-year and two-year colleges, respectively. As in the main analysis, I focus on courses taken by students in their first semester, dropping remedial courses from the sample. I assess a broad range of academic outcomes, including both immediate course-specific outcomes and broader non-course-specific outcomes to provide a better understanding for the specific margins through which instructor rank affects student outcomes. Specifically, I analyze the following outcomes: taking another course in the subject, majoring in the subject of the course (four-year college

students only), persistence after the first year, transferring to a four-year college (two-year college students only), and on-time graduation rate.

Each outcome is measured as an indicator variable for whether students achieve the outcome within a specific time frame. Since I only observe student outcomes until 2012, the sample of analysis varies across outcomes analyzed based on how many of years if takes for me to observe the outcome of interest. Taking another course in the subject takes a value of one if the student takes a student takes a subsequent course in the subject within three years of their first semester and zero otherwise. The sample of analysis for this outcome includes students entering college between 2004-2010, with 2010 being the last year for which I am able to observe students' course-taking outcomes for three years. Majoring in the subject of a course takes a value of one if the student receives a bachelor's degree in the subject of the course within four years of their first semester and includes students entering college between 2004-2009. I restrict my sample to courses in subjects in which it is possible to earn a major at the school when assessing this outcome. On-time graduation takes a value of one for four-year students if the student receives a bachelor's degree within four years of their first semester and includes students entering college between 2004-2009. For two-year college students, this variable takes a value of one if the student receives an associate's degree within two years of their first semester and includes students entering college between 2004-2011. Persistence after first year takes a value of one if the student is still in college the following year and includes students entering college between 2004-2011. Transferring to a four-year school takes a value of one if the student takes a student transfer to a four-year college in Arkansas within three years of their first semester and includes students entering college between 2004-2010.

Table 4 looks at on outcomes for students at four-year colleges. For the outcomes of interest, descriptive statistics show that students have better outcomes with full-time instructors, compared to adjuncts, with the exception of whether or not they major in the subject of the course.[9] A two-sample test of proportions indicates differences in student outcomes between full-time instructors and adjuncts are significant at the .01 level for all outcomes at four-year schools. Next, Table 5 looks at outcomes of interest at two-year colleges. Once again, the descriptive statistics indicate that students with full-time instructors have better outcomes

[9]The difference in propensity to major in a subject are small in magnitude, so they do not appear in Table 4. However, students are actually slightly more likely to major in the subject of the course when taught by an adjunct (0.044) than when taught by a full-time instructor (0.038).

for those with adjuncts. A two-sample test of proportions indicates differences in student outcomes between full-time instructors and adjuncts are significant at the .01 level for all outcomes at two-year colleges as well.

Table 4: Descriptive Outcomes by Instructor Rank, Four-year Colleges

| | All | Ten.-track/Ten. | Full-time | Adjunct | Grad. Student |
|---|---|---|---|---|---|
| Takes another course in subject | 0.50 | 0.51 | 0.50 | 0.48 | 0.55 |
| Majors in subject | 0.05 | 0.07 | 0.04 | 0.04 | 0.02 |
| Persistence after first year | 0.79 | 0.80 | 0.78 | 0.76 | 0.84 |
| Four-year Graduation | 0.29 | 0.33 | 0.26 | 0.23 | 0.36 |
| *N* | 617,633 | 222,922 | 226,385 | 113,806 | 54,520 |

Observations denote student×course units. Standard deviations in parentheses. I observe student outcomes until 2012, and sample years are outcome-specific based on how many of years if takes to observe the outcome of interest. All outcomes are indicator variables. "Takes another course in subject" takes a value of one if the student takes a student takes a subsequent course in the subject within three years of their first semester and includes students entering college between 2004-2010. "Majors in subject" takes a value of one if the student receives a bachelor's degree in the subject of the course within four years of their first semester and includes students entering college between 2004-2009. "Four-year Graduation" takes a value of one if the student receives a bachelor's degree within four years of their first semester and includes students entering college between 2004-2009. "Persistence after first year" takes a value of one if the student is still in school after the first year and includes students entering college between 2004-2011.

The descriptive trends in Tables 4 and 5 provide suggestive evidence of heterogeneous effects in teaching quality across instructor rank. Namely, they suggest that full-time instructors may be more effective instructors on the margins measured than adjunct counterparts. However, values in these tables should not be interpreted causally. They do not account for the possibility that students select into instructor ranks based on ability, or that certain ranks of instructors are more likely to teach certain courses, which may be driving outcomes. In the next section, I focus on isolating the role of instructor rank on student outcomes.

# III Instructor Rank on Student Outcomes

This section analyzes the effects of adjunct instructors compared to full-time, non-tenure-track instructors on student outcomes. A priori, it is unclear how taking more courses with adjunct instructors relative to full-time instructors affects student outcomes in this setting. As mentioned in the introduction, arguments have been made both for why adjuncts could be more or less effective instructors than full-time counterparts, and prior studies looking at different settings and outcomes find mixed results.

Table 5: Descriptive Outcomes by Instructor Rank, Two-year Colleges

| | All | Full-time | Adjunct |
|---|---|---|---|
| Takes another course in subject | 0.41 | 0.44 | 0.34 |
| Persistence after first year | 0.57 | 0.58 | 0.55 |
| Two-year Graduation | 0.09 | 0.10 | 0.06 |
| Transfers to four-year school | 0.16 | 0.16 | 0.15 |
| $N$ | 331,999 | 205,739 | 126,260 |

Observations denote student×course units. Standard deviations in parentheses. I observe student outcomes until 2012, and sample years are outcome-specific based on how many of years if takes to observe the outcome of interest. All outcomes are indicator variables. "Takes another course in subject" takes a value of one if the student takes a student takes a subsequent course in the subject within three years of their first semester and includes students entering college between 2004-2010. "Two-year Graduation" takes a value of one if the student receives an associate's degree within two years of their first semester and includes students entering college between 2004-2011. "Persistence after first year" takes a value of one if the student is still in school after the first year and includes students entering college between 2004-2011. "Transfers to four-year school" takes a value of one if the student takes a student transfer to a four-year college in Arkansas within three years of their first semester and includes students entering college between 2004-2010.

## III.A Empirical Strategy

I divide outcomes into two main categories: subject-specific and non-subject-specific. Subject-specific outcomes denote outcomes that may vary across courses for a given student. These outcomes include taking a subsequent course in the subject and majoring in the subject of the course. Non-subject-specific outcomes denote aggregate outcomes that do not vary across courses for an individual. These outcomes include retention after the first year, on-time graduation, and transferring to a four-year college.

### Subject-Specific Outcomes

To assess the effects of instructor rank on subject-specific student outcomes, I estimate the following equation:

$$Y_{icrst} = \mathbf{I}'_{icrst}\beta + \alpha_i + \rho_r + \epsilon_{icrst} \tag{1}$$

where $Y_{icrst}$ is an indicator outcome variable for individual $i$ in class $c$ of course $r$ in school $s$ at time $t$. Depending on the outcome of interest, $Y_{icrst}$ represents either an indicator variable for whether $i$ takes a subsequent course in the same subject as $r$ or and indicator varible for whether $i$ majors in the subject of $r$.

Courses, $r$, are school-specific and consist of sets of classes with the same course number and course name. A class, $c$, represents a unique section within a course and is school-specific, year-specific, and term-specific. The explanatory variable of interest, $\mathbf{I}_{icrst}$, is a vector of indicator variables for the rank of the instructor teaching class $c$. I use full-time, non-tenure track instructors as the omitted base group. At four-year colleges, other instructor ranks includes tenure-track/tenured, adjunct, and graduate student instructors. At two year colleges, this vector only includes an indicator variable for whether the instructor is an adjunct instructor.

Equation 1 includes a student fixed effect, $\alpha_i$, to address concerns that students select non-randomly into instructors by rank along unobserved characteristics such as ability that also affect outcomes of interest. Another potential concern is that instructors of different ranks may teach different types of courses, and course attributes could in turn be driving outcomes. To address this, I include a course fixed effect, $\rho_r$. Since the analysis focuses on students in their first semester of college, $\alpha_i$ implicitly controls for time-specific trends affecting outcomes.

The key identifying assumption in this research design is that there is no differential sorting into instructor rank within students, across courses. One potential concern is that while student fixed effects, $\alpha_i$, address systematic differences in sorting patterns to instructors across students, they do not address selection into instructors across different courses *within* students. This is a potential threat to identification since students are able to choose their section enrollment within a course, subject to capacity constraints. For example, students who are particularly interested in a subject may try choose a full-time instead of an adjunct instructor in that subject, while perhaps taking classes with adjuncts for "unimportant" subjects. Within a term, approximately 27% of courses offer multiple section, and slightly over half of the courses have sections taught by both full-time and adjunct instructors.

As a starting point to assessing this concern, Table 15 in the Appendix looks at whether, within a course, adjunct and full-time instructors teach the same kinds of students in terms of observables. Estimations indicate that within a course, students who take courses with adjuncts do look different from those who take courses with full-time instructors on various characteristics. Namely, at both four-year and two-year colleges, students taking courses with full-time instructors are less likely to be part-time and less likely to be transfer students. Students at four-year colleges are also less likely to have in-state tuition status. One possibility

is that these differences in the composition of students between courses taught by adjuncts and full-time instructors are being driven by sorting across students. If this were the case, then the two-way fixed effects approach in Equation 1 that incorporates student fixed effects will address selection issues. However, it is also possible that these differences are being driven by differential sorting within students across courses, which presents a challenge to the key identifying assumption.

To address student sorting concerns, I implement two different robustness checks. First, I assess whether students display a differential propensity to sign up with an adjunct instructor for courses in their intended major compared to courses outside their intended major. I also re-run my analysis using only courses taken outside of a student's intended major. Second, I run my analysis with an alternative instrumental variables strategy, from Bettinger and Long (2010), for cross-validation. This complementary approach exploits term-specific variation in the rank composition of department's faculty to instrument for a student's likelihood of taking a course with an adjunct in a given subject. The intuition behind this approach a department is often subject to term-by-term variations in full-time faculty due to circumstances like retirements, job switches, and sabbaticals. To deal with these fluctuations, departments often use adjunct instructors, who are employed on short-term, flexible contracts. I construct the instrument for whether a student takes a course with an adjunct in a given department and term as the deviation from the term-specific average share of courses in the department taught by instructors of each rank. The key assumption for this approach is that term-specific deviations in the share of courses in a department taught by each instructor rank only affect students through their propensity of taking the course with an adjunct.

**Non-Subject-Specific Outcomes**

I modify my empirical strategy for non-subject-specific outcomes, since there is no within-student variation across courses for these outcomes, making a two-way fixed effects approach using student fixed effects infeasible. Instead, for these outcomes, I run a student level analysis:

$$Y_{isbt} = \mathbf{Prop\_I}'_{isbt}\beta + \delta' X_i + \rho_b + \tau_t + \epsilon_{isbt} \tag{2}$$

where $Y_{isbt}$ is an indicator outcome variable for individual $i$ in school $s$ at time $t$, taking a bundle of courses,

$b$. This variable measures whether a graduates on time, persists in college after the first year, or transfers to a four-year college. The explanatory variable of interest, $\mathbf{Prop\_I}_{isbt}$, is a vector of variables for the proportion of student $i$'s bundle of courses $b$ that she took with an instructor of each rank in her first semester. I use the share of full-time, non-tenure track instructors as the omitted base group. I include course bundle fixed effect, $\rho_b$, to restrict my comparison of a student's outcomes to those of students to take the same set of courses in their first semester. This ensures that the specification is not picking up differences in course composition that are correlated with instructor rank. I also include time period fixed effects, $\tau_t$.

Since Equation 2 does not contain student fixed effects, one concern for identification is that student may select into instructor by rank. As a starting point, I include a vector of observable characteristics of students, $X_i$. This still leaves open the possibility that students sort into courses with instructors of different rank along unobserved characteristics that also affect outcomes of interest. To address this concern, I augment this specification using an instrumental variables approach from Bettinger and Long (2006), exploiting term-by-term variation in the rank composition of a department's faculty. To construct this instrument, I first calculate the term-specific deviation in share of courses taught by instructors of each rank relative to the department's average share, similar to the approach used to assess subject-specific outcomes. I obtain this value for each course a student takes and create the instrument using the average deviation values across all of a student's courses. This approach is very similar to the Bettinger and Long (2010) instrument used for subject-specific outcomes, with the key difference being that the non-subject-specific instrument is a weighted average of the department-specific instruments calculated in Bettinger and Long (2010).

## III.B Results

### Subject-Specific Outcomes

Table 6 displays results from Equation 1 estimating effects of instructor rank on the propensity for a student to take a subsequent class in the subject of the course within three years of the student's first semester. Using a linear probability model, I analyze results separately for four-year schools and two-year schools in columns (1)-(3) and (4)-(6), respectively. Columns (1) and (4) display baseline specifications, which do not include any fixed effects. For both four-year and two-year colleges, estimates suggest adjuncts are associated

with a lower propensity for a student to take a subsequent course in the subject, although results are not statistically significant for four-year schools. With the addition of course fixed effects in columns (2) and (5), results are similar and become more precisely estimated at four-year schools. At two year schools, the magnitude of estimates decreases by over half, suggesting adjuncts are significantly more likely to be teaching courses that do not tend to lead to subsequent courses taken in the subject of the course, compared to full-time counterparts. In the preferred specifications of columns (3) and (6), I include student fixed effects, in addition to course fixed effects, to control for the possibility that students sort into instructor ranks along unobserved characteristics. The addition of student fixed effects further lowers the magnitude of estimates on the effect of adjunct versus full-time instructors on the propensity for a student to take a subsequent course, indicating controlling student sorting into instructor rank is important.

Results from the preferred specifications indicate taking a course with an adjunct decreases the propensity for a student to take a subsequent course in the same subject by 0.9 percentage points at four-year schools, which is equivalent to a 1.8% decrease from the baseline propensity for first-semester college students to take a subsequent course in the subject. At two-year colleges, taking a course with an adjunct leads to a 1.1 percentage point decrease, equivalent to a 2.7% decrease from the baseline.

Table 6: Effects of Instructor Rank on Taking a Subsequent Course in Subject

| | Four-Year Schools | | | Two-Year Schools | | |
|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) |
| | OLS | Course FE | Course+Student FE | OLS | Course FE | Course+Stud FE |
| Adjuncts | -0.015 | -0.018*** | -0.009*** | -0.077*** | -0.035*** | -0.011*** |
| | (0.014) | (0.003) | (0.003) | (0.010) | (0.003) | (0.003) |
| Course FE | | Y | Y | | Y | Y |
| Student FE | | | Y | | | Y |
| $N$ | 468,326 | 466,730 | 457,687 | 249,467 | 248,813 | 224,560 |
| $R^2$ | 0.002 | 0.259 | 0.595 | 0.006 | 0.237 | 0.674 |

Outcome: whether student takes a subsequent course in the subject of the course. Observations are student×course units, 2004-2010. The omitted category of instructors is full-time, non-tenure-track. Estimations involving students at four-year schools include controls for instructor ranks of tenure-track/tenured and graduate students, although coefficients are not reported in the table. Standard errors are reported in parentheses and two-way clustered at the student and instructor level: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Next, I look at the effects of taking a course with an adjunct on whether a student majors in the subject of the course within four years of starting school. I focus on students at four-year colleges since students at two-year colleges do not have majors. Table 7 displays results on whether or not a student majors in the subject of the course. Column (1) displays results from a basic regression without fixed effects and

documents no significant relationship taking a course with an adjunct and propensity for a student to major in the subject of the course. With the addition of course fixed effects in column (2), this coefficient becomes negative, indicating adjuncts tend to teach courses in which students are more likely to eventually major in the subject of the course. In the preferred specification in column (3), which includes both course and student fixed effects, I find no significant effect of taking a course with an adjunct instructor instead of a full-time instructor on the propensity for a student to major in the subject of the course within four years of entering a four-year college.

Table 7: Effects of Instructor Rank on Majoring in Subject

| | (1) OLS | (2) Course FE | (3) Course+Student FE |
|---|---|---|---|
| Adjuncts | 0.0041 | -0.0025** | -0.0012 |
| | (0.0039) | (0.0011) | (0.0011) |
| Course FE | | Y | Y |
| Subject FE | | | Y |
| $N$ | 387,821 | 386,364 | 377,792 |
| $R^2$ | 0.0062 | 0.2917 | 0.5996 |

Outcome: whether student majors the subject of the course at four-year schools. Observations are student×course units at four-year schools, 2004-2009. The omitted category of instructors is full-time, non-tenure-track. Estimations include controls for instructor ranks of tenure-track/tenured and graduate students, although coefficients are not reported in the table. Standard errors are reported in parentheses and two-way clustered at the student and instructor level: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

In the preferred specification in Table 7, I define majoring in a subject to be an indicator variable taking a value of one if a student majors the subject of the course at four-year schools within four years of their first semester, unconditional on graduation. I do not condition on graduation in the main specification because if instructor rank affects a marginal student's propensity to graduate, this could lead to sample selection in the major in subject analysis that would bias estimates. On the other hand, one limitation of the preferred specification is that this analysis estimates a combination effect of graduation on time and major in the subject, which makes it difficult to disentangle the effect of majoring in a subject. I run an alternative specification in Table 16 in the Appendix, which looks at the role of instructor rank on a student's propensity to major in a subject, conditional on graduating within four or six years of the student's first semester. Taking a course with an adjunct is negatively associated with the propensity for a student to major in the subject of the course, conditional on graduating within four years, but this result is not very precisely

estimated. Taking a course with an adjunct does not significantly affect the propensity for a student to major in the subject of the course within six years of their first semester, conditional on graduating within six years. Overall, results do not provide strong support to conclude taking a course with an adjunct instructor significantly affects a student's propensity of majoring in the subject of the course.

The key identifying assumption underlying the estimations in Tables 6 and 7 is that students do not demonstrate different preferences for the rank of their instructors across courses in different subjects. As a robustness check, I first assess whether students are more likely to enroll in a course with a full-time instructor for courses in the subject of their intended degree field in Table 17 of the Appendix. Results indicate no significant difference for students at two-year colleges to enroll in a course with an adjunct for courses in their degree area. At four-year colleges, the coefficient of interest is not very precisely estimated but suggests students may be somewhat less likely to enroll in a course with an adjunct if the course is in the field of their intended major. As a robustness check, I re-estimate results from Tables 6 and 7 using only courses taken outside of a student's major in Table 18 in the Appendix. Results indicate estimates in the restricted sample are similar to estimates using the full sample. One notable finding is that for students taking courses outside of their intended major, taking a course with an adjunct instructor significantly decreases the propensity that the student will major in the subject of the course by 0.2 percentage points.

As a second robustness check, I use an alternative identification strategy from Bettinger and Long (2010). In this approach, I address endogeneity in student sorting into instructors by rank by instrumenting for instructor rank using term-specific variation in departmental faculty composition by rank from the average rank composition during the sample period. Table 19 in the Appendix show results of this estimation. All specifications include course fixed effects, as well as a vector of observable student characteristics. Using the instrumental variables (IV) approach, results indicate taking a course with an adjunct instructor decreases the propensity for students to take a subsequent course in the subject by 3.4 percentage points at two-year colleges, an effect size that is actually larger than the one found using the two-way fixed effects approach, 1.1 percentage points.[10]. At four-year colleges, while results using instrumental variables are no longer statistically significant, they are similar magnitude to estimates using the two-way fixed effects approach.

[10]Similarly, Ran and Xu (2018) also find significantly larger effects using IV compared to two-way fixed effects.

Namely, IV estimates suggest taking a course with an adjunct decreases a student's propensity to take a subsequent course in the subject by 1.2 percentage points, and the two-way fixed effects estimates find a decreased effect of 0.9 percentage points.

**Non-Subject-Specific Outcomes**

I next look at the effects of instructor rank on non-subject-specific outcomes using Equation 2. First, I examine effect of instructor rank on whether a student persists to a second year at a school. All specifications include controls for observable student characteristics. Columns (1) and (4) display estimation results from a basic regression, which do not include fixed effects. Estimates suggest there is no strong association between the share of adjuncts a student has in the first semester and propensity to stay in school after the first year. With the addition of course bundle fixed effects in, columns (2) and (5), the relationship between proportion adjuncts and persistence remains insignificant at four-year schools. At two year schools, the estimated coefficient on proportion adjuncts becomes negative, although imprecisely estimated, suggesting adjuncts tend to teach courses that are associated with higher retention.

While I control for observable student characteristics, a key concern in a causal interpretation of these estimates is that unobservable student characteristics may affect both sorting into instructors and academic outcomes, namely persistence. In the preferred specifications in columns (3) and (6), I augment the course bundle fixed effects approach with an instrumental variables approach. This approach takes advantage of term-by-term variation in department-specific faculty composition to instrument for the share of classes a student takes with adjunct instructors. I find that a 10% increase in the proportion of a student's instructors that are adjuncts decreases the propensity of persisting to a second year of college by about 1.3 percentage points (1.6% decrease from baseline persistence rate), although these effects are imprecisely estimated and statistically significant only at the 10% level. At two year colleges, a 10% increase in the proportion of adjunct instructors decreases a student's persistence probability by 1.6 percentage points (2.8% decrease from baseline).

Next, I look at the effect of instructor rank on a student's probability of graduating on-time in Table 9. The basic regressions in columns (1) and (4) that only control for observable student characteristics

Table 8: Effects of Instructor Rank on Persistence to Second Year

| | Four-Year Schools | | | Two-Year Schools | | |
|---|---|---|---|---|---|---|
| | OLS | Course Bundle FE | Cse Bundle FE+IV | OLS | Course Bundle FE | Cse Bundle FE+IV |
| | (1) | (2) | (3) | (4) | (5) | (6) |
| Proportion Adjuncts | -0.032 | 0.007 | -0.132* | 0.002 | -0.020* | -0.158** |
| | (0.025) | (0.009) | (0.077) | (0.023) | (0.010) | (0.064) |
| Male | -0.051*** | -0.055*** | -0.055*** | -0.088*** | -0.068*** | -0.068*** |
| | (0.010) | (0.008) | (0.008) | (0.011) | (0.008) | (0.008) |
| Part-Time Student | -0.140*** | -0.078*** | -0.071*** | -0.167*** | -0.083*** | -0.072*** |
| | (0.009) | (0.012) | (0.011) | (0.014) | (0.010) | (0.011) |
| Age | -0.022*** | -0.002 | -0.001 | 0.002 | 0.009*** | 0.010*** |
| | (0.004) | (0.005) | (0.005) | (0.003) | (0.002) | (0.002) |
| $Age^2$ | 0.000*** | 0.000 | 0.000 | -0.000 | -0.000*** | -0.000*** |
| | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) |
| In-State Tuition | 0.131*** | 0.112*** | 0.114*** | 0.147*** | 0.065*** | 0.065*** |
| | (0.018) | (0.013) | (0.013) | (0.044) | (0.022) | (0.021) |
| Transfer Student | 0.061*** | 0.032** | 0.031*** | 0.047** | 0.016** | 0.016** |
| | (0.014) | (0.012) | (0.012) | (0.019) | (0.008) | (0.007) |
| Course Bundle FE | | Y | Y | | Y | Y |
| $N$ | 130,816 | 54,624 | 56,266 | 102,206 | 65,102 | 65,936 |
| $R^2$ | 0.039 | 0.302 | 0.317 | 0.036 | 0.267 | 0.269 |

Outcome: whether student persists to a second year of college. Observations are student-level units, 2004-2011. The omitted category is proportion full-time, non-tenure-track instructors. Estimations involving students at four-year schools include controls for proportion tenure-track/tenured and graduate students instructors, although coefficients are not reported in the table. Standard errors are reported in parentheses and clustered at the school level: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

estimate a negative relationship between proportion of adjunct instructors in a student's first semester and on-time graduation rates at both four-year and two-year colleges. This negative relationship persists with the addition of course bundle fixed effects, although the magnitude of estimates decreases for four-year and two-year schools. In the preferred specifications that augment the course bundle fixed effects with the instrumental variables approach, I find no significant effect of the proportion of adjunct instructors a student takes courses with in her first semester on on-time graduation rates at four-year or two-year colleges.

Table 10 examines effect of instructor rank on the propensity for a student at a two-year college to transfer to a public four-year college within three years of their first semester. I only observe transfers if students transfer to a public four-year college in Arkansas, as opposed to a college outside of Arkansas or a private college within Arkansas. However, there is still be a useful metric because there is strong incentive for students at two-year colleges to transfer to public four-year colleges since course credits are guaranteed to transfer within public schools in-state. Additionally, conditional on transferring, the majority of community college students transfer to a public four-year college (Jenkins and Fink, 2015). As with previous analyses,

Table 9: Effects of Instructor Rank on Graduating On-Time

| | Four-Year Schools | | | Two-Year Schools | | |
|---|---|---|---|---|---|---|
| | OLS | Course Bundle FE | Cse Bundle FE+IV | OLS | Course Bundle FE | Cse Bundle FE+IV |
| | (1) | (2) | (3) | (4) | (5) | (6) |
| Proportion Adjuncts | -0.040* | -0.017** | -0.096 | -0.041*** | -0.006*** | -0.002 |
| | (0.021) | (0.007) | (0.092) | (0.007) | (0.002) | (0.011) |
| Male | -0.063*** | -0.038*** | -0.038*** | -0.014*** | -0.007*** | -0.007*** |
| | (0.011) | (0.009) | (0.009) | (0.004) | (0.002) | (0.002) |
| Part-Time Student | -0.129*** | 0.005 | 0.009 | -0.058*** | -0.011*** | -0.012*** |
| | (0.015) | (0.012) | (0.011) | (0.007) | (0.002) | (0.002) |
| Age | -0.015*** | -0.004*** | -0.004*** | -0.000 | 0.001*** | 0.001*** |
| | (0.004) | (0.001) | (0.001) | (0.001) | (0.000) | (0.000) |
| $Age^2$ | 0.000*** | 0.000** | 0.000** | 0.000 | -0.000* | -0.000* |
| | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) |
| In-State Tuition | 0.002 | -0.010* | -0.009* | 0.003 | 0.004 | 0.004 |
| | (0.020) | (0.005) | (0.005) | (0.009) | (0.003) | (0.003) |
| Transfer Student | 0.173*** | 0.016* | 0.016** | 0.060*** | 0.016*** | 0.016*** |
| | (0.021) | (0.008) | (0.007) | (0.009) | (0.003) | (0.003) |
| Course Bundle FE | | Y | Y | | Y | Y |
| $N$ | 95,536 | 38,018 | 40,381 | 102,206 | 65,102 | 65,936 |
| $R^2$ | 0.065 | 0.473 | 0.510 | 0.030 | 0.374 | 0.391 |

Outcome: whether student graduates on-time. For four-year college students, on-time graduation consists of obtaining a bachelor's degree within four years of a student's first semester. For two-year college students, on-time graduation consists of obtaining an associate's degree within two years of a student's first semester. Observations are student-level units, 2004-2009 for four-year students and 2004-2011 for two-year students. The omitted category is proportion full-time, non-tenure-track instructors. Estimations involving students at four-year schools include controls for proportion tenure-track/tenured and graduate students instructors, although coefficients are not reported in the table. Standard errors are reported in parentheses and clustered at the school level: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

I start with a basic regression in Table 10 and build up to the preferred specification using course bundle fixed effects and instrumental variables approach. I do not find a significant relationship between the share of adjunct instructors a student takes courses with in her first semester and probability of transferring to a public four-year school in-state in any specifications.

**Summary of Results**

I find evidence that the use of adjunct instructors has a negative effect on some academic outcomes that I investigate and no significant effects on others. Specifically, taking class with an adjunct instructor decreases the propensity that both four-year and two-year college students will take a subsequent course in the subject. Additionally, a higher proportion of adjunct instructors in a student's first year of college decreases the probability a student will persist to a second year. On the other hand, I find no significant effect of the use of adjunct instructors on longer-term outcomes, such as whether a student majors in the subject of the course taught by an adjunct, graduates on-time, or transfers to a four-year college.

Table 10: Effects of Instructor Rank on Transferring to a Four-Year School

| | OLS | Course Bundle FE | Cse Bundle FE+IV |
|---|---|---|---|
| | (1) | (2) | (3) |
| Proportion Adjuncts | -0.008 | -0.006 | -0.004 |
| | (0.011) | (0.005) | (0.018) |
| Male | -0.005 | 0.007** | 0.007** |
| | (0.005) | (0.003) | (0.003) |
| Part-Time Student | -0.053*** | -0.013*** | -0.013*** |
| | (0.008) | (0.004) | (0.004) |
| Age | -0.015*** | -0.006*** | -0.006*** |
| | (0.001) | (0.001) | (0.001) |
| $Age^2$ | 0.000*** | 0.000*** | 0.000*** |
| | (0.000) | (0.000) | (0.000) |
| In-State Tuition | 0.063*** | 0.033*** | 0.033*** |
| | (0.011) | (0.009) | (0.009) |
| Transfer Student | 0.116*** | 0.045*** | 0.045*** |
| | (0.009) | (0.010) | (0.010) |
| Course Bundle FE | | Y | Y |
| $N$ | 85,133 | 52,848 | 54,299 |
| $R^2$ | 0.035 | 0.286 | 0.315 |

Outcome: whether student persists transfers to a four-year school. Observations are student-level units at two-year schools, 2004-2010. The omitted category is proportion full-time, non-tenure-track instructors. Standard errors are reported in parentheses and clustered at the school level: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

# IV Effects of Changing Instructor Rank

Findings from the previous section indicate adjunct instructors have worse effects on student outcomes than full-time counterparts on subsequent course taking in a subject and persistence in college. From a policy perspective, it is important to understand why this is the case. In this section, I investigate how within-instructor changes in rank affect student outcomes. I hypothesize that a given instructor will have better outcomes or no difference in outcomes on average when teaching as a full-time instructor, compared to teaching as an adjunct instructor. Results of this analysis are informative of the mechanism behind adjunct instructors' worse student outcomes. No effects would suggest that the key driver for adjuncts having worse outcomes than full-time counterparts is that adjuncts are disproportionately drawn from a lower quality instructor pool. On the other hand, positive effects would suggest that at least part of the difference in student outcomes between adjuncts and full-time instructors is driven by less favorable working conditions in terms of some combination of employment conditions, teaching environment, and general workplace environment.

## IV.A Descriptive Overview

In the sample, 10,202 instructors in the sample teach as adjuncts or full-time between 2004 and 2011. Of these instructors, 1,257 (12%) teach in both an adjunct and full-time capacity during this period, and I refer to these instructors as "switchers". Approximately 20% of switchers change rank from full-time to adjunct across terms, 34% change from adjunct to full-time, and 46% make rank changes in both directions during the sample period. To measure how changing an instructor's rank affects student outcomes, I exploit variation in rank among the set of instructors who work as both adjunct and full-time instructors during the sample period. This is unlikely to be a random sample of adjuncts, as some instructors in the data may not be able to become full-time if they do not meet certain institution-specific requirements of full-time instructors (e.g. not having a PhD or first professional degree). Thus, I interpret the analysis results as applying to the set of instructors who are eligible for full-time positions.

Table 11 displays descriptive statistics for adjunct and full-time instructors. For each instructor rank, I separate observations by instructors who change rank compared to those who never change rank during the sample period. Instructors appear in the table once for each term in the data in which they teach. I find that adjunct instructors who also work as full-time instructors at some point teach more classes while they are adjuncts and earn significantly more on average while they are adjuncts than their adjunct counterparts who never switch. Adjunct switchers teach on average 2.38 courses per semester and earn $18,527 for nine months while they are adjunct in the data, compared to adjunct never-switchers, who teach on average 2.03 courses and earn $12,403 for nine months salary. Full-time instructors who also work as adjuncts instructors at some point teach fewer classes while they are full-time and earn significantly less on average while they are full-time than their full-time counterparts who never switch ranks. Full-time switchers teach on average 3.55 courses per semester and earn $36,571 for nine months while they are adjunct in the data, compared to never-switchers, who teach on average 3.64 courses and earn $41,461 for nine months salary.

Next, Table 12 looks at instructors who switch rank and documents descriptively how outcomes for instructors differ between when instructors are full-time compared to when they are adjunct. Values in the table do not represent causal measurements since I do not take into account the possibility that better instructors may spend more time in the data as full-time in the sample, that instructors may get assigned

Table 11: Descriptive Outcomes for Instructors by Rank Switching

| | Adjunct Instructors | | | Full-time Instructors | | |
|---|---|---|---|---|---|---|
| | Switchers | Never-Switchers | (Switch-NeverSwitch) | Switchers | Never-Switchers | (Switch-NeverSwitch) |
| Male | 0.48 | 0.47 | 0.01 | 0.45 | 0.46 | -0.01 |
| | (0.50) | (0.50) | | (0.50) | (0.50) | |
| Age | 47.18 | 46.70 | 0.48 | 47.15 | 48.37 | -1.22 |
| | (11.39) | (12.18) | | (11.21) | (11.21) | |
| Number of Courses Taught | 2.38 | 2.03 | 0.35 | 3.55 | 3.64 | -0.09 |
| | (1.39) | (1.17) | | (1.73) | (1.61) | |
| Salary (9-month, $) | 18,527 | 12,403 | 6,124 | 36,571 | 41,461 | -4,890 |
| | (18239.55) | (16846.96) | | (46087.62) | (50401.42) | |
| *N* | 4,572 | 19,537 | | 6,394 | 18,759 | |

Observations are instructor×term units, 2004-2011. Standard deviations in parentheses. For each characteristic and for each instructor type, I perform a two-sample test of proportions or a t-test between adjuncts who switch to full-time at some point and those who never switch. For both adjunct and full-time instructors, switchers and non-switchers are significantly different on all outcomes at the 5% level with the exception of gender.

a different set of courses when they are full-time versus when they are adjuncts, or that they may attract a different set of students depending on their employment rank. However, these values do provide an overview of trends in the data. For most outcomes in the table, instructors have better outcomes as full-time instructors, although this does not hold at four-year schools for taking another course in the subject or majoring in the subject of interest.

Table 12: Descriptive Outcomes for Instructors Who Switch Ranks

| | Four-Year Schools | | Two-Year Schools | |
|---|---|---|---|---|
| | Full-Time | Adjunct | Full-Time | Adjunct |
| Takes another course in subject | 0.455 | 0.529 | 0.394 | 0.302 |
| Persistence after first year | 0.785 | 0.773 | 0.577 | 0.495 |
| Majors in subject | 0.036 | 0.047 | | |
| On-time graduation | 0.190 | 0.184 | 0.092 | 0.059 |
| Transfers to four-year school | | | 0.164 | 0.141 |
| *N* | 53,080 | 28,220 | 53,641 | 27,820 |

Observations denote student×class units. I restrict the sample to observations in which the instructor of the class appears as both adjunct and full-time during the sample period For each set of outcomes, I perform a two-sample test of proportions to analyze whether descriptive statistics differ for full-time vs. adjunct instructors. All outcomes differ significantly across instructor rank at the 5% level.

## IV.B Empirical Strategy

### Subject-Specific Outcomes

To assess the effects of changing instructor rank on subject-specific student outcomes, I estimate the following equation:

$$Y_{icrjst} = \beta F_{crjst} + \alpha_i + \rho_r + \phi_j + \gamma_1 A_{crjst} + \gamma_2 A^2_{crjst} + \epsilon_{icrjst} \tag{3}$$

where $Y_{icrjst}$ represents the outcome of interest for individual $i$ in class $c$ of course $r$ in school $s$ with instructor $j$ in academic year $t$. The variable of interest, $F_{crjst}$ denotes whether instructor $j$ is full-time at time $t$, and the coefficient $\beta$ captures how an instructor's student outcomes change when she is employed as a full-time, non-tenure-track instructor, compared to when she employed as an adjunct. A student fixed effect, $\alpha_i$, controls for non-random student sorting into instructors by rank. Since I assess students only in their first semester of college, student fixed effects also absorb temporal shocks that may affect outcomes independently of instructor rank. For example, if an institution receives a large funding shock, this may mean they have the resources to promote more instructors to full-time, as well as to spend more resources on classroom technology. Course fixed effects, $\rho_r$, control for differences in outcomes driven by any changes in an instructor's course composition that are associated with rank change.

I include an instructor fixed effect, $\phi_j$, to control for unobservable differences across instructors by employment rank. This fixed effect means that the coefficient of interest, $\beta$, captures changes in student outcomes for the same instructor across different employment ranks. This is key to the analysis in separating the extent to which instructor teaching outcomes are affected by employment rank, rather than higher-quality instructors being more likely to receive full-time employment contracts. Finally, I include continuous controls for instructor's age and age squared, $A_{crjst}$ and $A^2_{crjst}$ respectively to capture continuous changes in teaching quality over time with experience.[11]

### Non-Subject-Specific Outcomes

To assess the effects of changing instructor rank on non-subject-specific student outcomes, I use a very similar specification:

[11] I use age as a proxy for experience since I do not observe direct information on teaching experience in the data.

$$Y_{icrjst} = \beta F_{crjst} + \delta' X_i + \rho_r + \phi_j + \pi_{st} + \gamma_1 A_{crjst} + \gamma_2 A^2_{crjst} + \epsilon_{icrjst} \quad (4)$$

The key difference between Equations 3 and 4 is that I do not include a student fixed effect in Equation 4 since there is no variation within a given student's courses. Instead, I include a vector of student observable student characteristics, $X_i$. I also include a school×year fixed effect, $\pi_{st}$ to control for any school-specific temporal shocks that may affect student outcomes. A key assumption of this approach is that an instructor does not attract a fundamentally different set of students after changing rank. To test the plausibility of this assumption, I analyze whether a given instructor's rank in a semester is predictive of whether they attract students who intend to major in the subject of the course in their classes, as well as whether instructor rank is predictive of a variety of other observable characteristics of their students. I find that within-instructor rank changes are largely unrelated to the types of students who enroll in an instructor's courses in terms of observable characteristics.

## IV.C Results

### Subject-Specific Outcomes

Table 13 displays results from Equation 3, which assesses how changing an instructor's rank from adjunct to full-time affects subject-specific student outcomes. All specifications show in the table include course, student, and instructor fixed effects. Columns (1) and (2) assess the outcome of taking a subsequent course in the subject at four-year and two-year colleges, respectively. Coefficient estimates find that an instructor switching from adjunct to full-time, non-tenure-track at a four-year school increases the propensity that their students will take a subsequent course in the subject by 1.7 percentage points. This effect is 3.4% of the baseline propensity for four-year students to take a subsequent course in the subject. This effect is sizable, given that the gap I found in the propensity for students to take a subsequent course in the subject between full-time and adjunct instructors at four-year colleges in Section III is 0.9 percentage points. At two year colleges, an instructor switching from adjunct to full-time is associated with an increase in propensity for students to take a subsequent course in the subject by 0.4 percentage points, although estimates are not

statistically significant.

Next, column (3) of Table 13 assesses the outcome of majoring in the subject of the course. Estimation results find no statistically significant association of instructors changing rank with their students' propensity to major in the subject of the course. This is unsurprising, given that results in Section III find no significant difference in student major outcomes between adjunct and full-time, non-tenure-track instructors.

Table 13: Effects of Changing Instructor Rank on Subject-Specific Student Outcomes

| | Subsequent Course | | Major |
|---|---|---|---|
| | Four-Year | Two-Year | Four-Year |
| | (1) | (2) | (3) |
| Full-Time | 0.017** | 0.004 | 0.003 |
| | (0.007) | (0.008) | (0.003) |
| Instructor Age | -1.309 | 0.237 | -0.021 |
| | (589.437) | (853.711) | (95.504) |
| Instructor Age$^2$ | 0.000 | -0.000 | 0.000 |
| | (0.000) | (0.000) | (0.000) |
| Instructor FE | Y | Y | Y |
| Course FE | Y | Y | Y |
| Student FE | Y | Y | Y |
| $N$ | 215,514 | 215,621 | 196,604 |
| $R^2$ | 0.677 | 0.689 | 0.690 |

Outcome variable in columns (1) and (2) is whether student takes a subsequent course in the subject of the course. Outcome variable in column (3) is whether student majors in the subject of the course. Observations are student×course units. I restrict the sample to observations in which the instructor's rank is adjunct or full-time, non-tenure-track, and the omitted rank category is adjunct. Standard errors are reported in parentheses and two-way clustered at the student and instructor level: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

**Non-Subject-Specific Outcomes**

Next, Table 14 displays results from Equation 4 to look at effects of within-instructor rank changes between adjunct and full-time on non-subject-specific student outcomes. All estimations shown in the table include course and instructor fixed effects. Columns (1) and (2) assess the outcome of whether a student persists in school to the second year of college. Coefficient estimates on an instructor in a given term working as full-time are positive at both four-year and two-year colleges, although results are statistically insignificant for four-year colleges. At two-year colleges, for a given instructor, working in a full-time role increases the propensity that their students will persist into a second year of college by 1.5 percentage points. This effect is 2.6% of the baseline propensity for two-year students persist to a second year of college. This effect is similar

to the magnitude gap I found in persistence rates between full-time and adjunct instructors at two-year colleges in Section III is 1.6 percentage points.

Next, columns (3) and (4) measure the effects of within-instructor rank changes on on-time graduation rates. I find no statistically significant results for teaching full-time at either four-year or two-year colleges, although coefficients are positive for both samples. Column (5) measures the effects of changing instructor rank on propensity for students at two-year colleges to transfer to a four-year school within three years of their first semester. I also find no significant effects of changing instructor rank on the propensity for their students to transfer. It is unsurprising that changing instructor rank does not affect on-time graduation or transfer propensities, given that I did not find significant differences in these outcomes between full-time and adjunct instructors in Section III.

Table 14: Effects of Changing Instructor Rank on Non-Subject-Specific Student Outcomes

| | Persistence | | Graduation | | Transfer |
|---|---|---|---|---|---|
| | Four-Year | Two-Year | Four-Year | Two-Year | Two-Year |
| | (1) | (2) | (3) | (4) | (5) |
| Full-Time | 0.005 | 0.015** | -0.001 | 0.006 | 0.001 |
| | (0.006) | (0.007) | (0.009) | (0.004) | (0.006) |
| Instructor Age | -0.214 | -1.845 | 5.228 | -2.259 | 0.539*** |
| | (131.299) | (3147.891) | (898.750) | (1513.845) | (0.000) |
| Instructor Age$^2$ | 0.000 | -0.000 | 0.000 | -0.000 | -0.000 |
| | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) |
| Male | -0.049*** | -0.056*** | -0.067*** | -0.018*** | 0.005 |
| | (0.003) | (0.004) | (0.003) | (0.002) | (0.003) |
| Part-Time Student | -0.125*** | -0.118*** | -0.100*** | -0.053*** | -0.061*** |
| | (0.006) | (0.004) | (0.004) | (0.002) | (0.003) |
| Age | -0.014*** | 0.002 | -0.012*** | -0.000 | -0.013*** |
| | (0.002) | (0.001) | (0.001) | (0.001) | (0.001) |
| Age$^2$ | 0.000*** | -0.000 | 0.000*** | 0.000** | 0.000*** |
| | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) |
| In-State Tuition | 0.107*** | 0.076*** | -0.003 | 0.002 | 0.066*** |
| | (0.005) | (0.009) | (0.005) | (0.006) | (0.008) |
| Transfer Student | 0.009* | 0.010** | 0.083*** | 0.041*** | 0.074*** |
| | (0.005) | (0.004) | (0.005) | (0.003) | (0.004) |
| Instructor FE | Y | Y | Y | Y | Y |
| Course FE | Y | Y | Y | Y | Y |
| Student FE | Y | Y | Y | Y | Y |
| $N$ | 302,842 | 299,316 | 220,405 | 299,316 | 254,271 |
| $R^2$ | 0.115 | 0.132 | 0.177 | 0.139 | 0.125 |

Outcome variable in columns (1) and (2) is whether student persists to second year of college. Outcome variable in columns (3) and (4) is whether student graduates on-time. Outcome variable in column (6) is whether student transfers to a four-year college. Observations are student×course units. I restrict the sample to observations in which the instructor's rank is adjunct or full-time, non-tenure-track, and the omitted rank category is adjunct. Standard errors are reported in parentheses and two-way clustered at the student and instructor level: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

As mentioned in the empirical strategy, a key assumption of this approach is that an instructor does not attract a fundamentally different set of students after changing rank. I test this by looking at whether within-instructor rank changes affect the observable composition of students who sign up for the instructors courses. Table 20 in the Appendix displays results for this analysis. The outcome variable of interest is whether an instructor is full-time, non-tenure track, as opposed to adjunct, and specifications include instructor and course fixed effects. I do not find evidence that an instructor's rank is predictive of whether they attract students who intend to major in the course. I also do not find that instructor rank affects the composition of students in their classes along multiple other characteristics: gender, in-state tuition, and transfer status. The only statistically significant finding is that for two-year college instructors, switching from adjunct to full-time decreases their propensity of their students being part-time, although this effect is smaller than one percentage point in magnitude. While I cannot directly test for changes in student sorting on unobservable characteristics, Table 20 provides support from observable characteristics that instructors changing rank largely does not affect student enrollment decisions.

**Summary of Results**

This section focuses on how student outcomes vary within an instructor depending on an instructor's rank in a given semester. I find that when an instructor is full-time, their students have a higher propensity of taking a subsequent course in the subject and a higher persistence rate into a second year of college compared to when the same instructor is adjunct. The magnitudes of the improvements in these two student outcomes is especially notable because they are large relative to the differences in student outcomes between full-time and adjunct instructors found in Section III. I find no within-instructor differences by rank in the other student outcomes I measure: majoring in the subject of the course, on-time graduation rates, and transfer to a four-year college. Lack of significant differences within instructors by rank is unsurprising here, given that I do not find significant differences in estimation results between adjuncts and full-time instructors for these outcomes in Section III.

# V Discussion

This study uses statewide student transcript records to assess effects of instructor rank on a wide range of student outcomes. I find that adjunct instructors have worse student outcomes than full-time counterparts with respect to taking a subsequent course in the subject and persistence to the second year of college. I find no significant differences in student outcomes by instructor rank for longer-term outcomes such as majoring in the subject, on-time graduation, and transfer to a four-year college. This paper also provides novel information on the mechanisms driving differences in student outcomes between adjuncts and full-time instructors. I find that changing an instructor's rank from adjunct to full-time improves student outcomes for subsequent course-taking and persistence, suggesting teaching quality is sensitive to working conditions.

These findings help to shed light on what is driving the gap in student outcomes between adjunct and full-time instructor, emphasizing the role of instructor working conditions on student outcomes. To understand policy implications, one approach is to compare the increased costs of hiring an instructor in a full-time role instead of an adjunct role with the academic benefits students accrue from taking courses with full-time instructors. However, focusing on the costs and benefits of hiring a full-time instructor in place of an adjunct is not necessarily the most efficient takeaway from these findings. This is because there are many factors that differ between the adjunct and full-time instructor experience, and not all of them may affect teaching quality. These differences include a broad range of factors affecting employment and teaching environment, such as pecuniary and non-pecuniary compensation, involvement in institutional governance, propensity to seek outside employment, priority in course choice and scheduling, and access to teaching resources. Understanding the specific factors affect an instructor's teaching outcome is important from a policy perspective for optimal allocation of limited resources towards student instruction in higher education. Future research on this topic is needed to better understand which aspects of the institutional changes instructors experience with rank change are most salient in affecting teaching quality, as well as to provide a cost-benefit analysis of the marginal dollar allocated towards different instructor resources in maximizing student benefits.

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# Appendix

Table 15: Student Sorting into Instructor Rank within Courses

| | Four-Year | Two-Year |
|---|---|---|
| | (1) | (2) |
| Male | 0.001 | -0.002 |
| | (0.001) | (0.002) |
| In-State Tuition | -0.015*** | -0.002 |
| | (0.002) | (0.004) |
| Part-Time | -0.050*** | -0.093*** |
| | (0.003) | (0.002) |
| Transfer Student | -0.015*** | -0.018*** |
| | (0.002) | (0.002) |
| Course FE | Y | Y |
| $N$ | 356168 | 319730 |
| $R^2$ | 0.444 | 0.435 |

Outcome variable is an indicator for whether an instructor is full-time. Observations are student×course units, and sample consists of instructors who are either adjunct or full-time. Standard errors are reported in parentheses and clustered at the student level: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 16: Alternative Major Specifications: Effects of Instructor Rank on Majoring in Subject

| | Major (1) | Major\|Grad 4yr. (2) | Major\|Grad 6yr. (3) |
|---|---|---|---|
| Adjunct | -0.001 | -0.007* | -0.003 |
| | (0.001) | (0.003) | (0.004) |
| Course FE | Y | Y | Y |
| Student FE | Y | Y | Y |
| $N$ | 377,792 | 111,176 | 100,754 |
| $R^2$ | 0.600 | 0.669 | 0.654 |

Outcome in column (1) is whether four-year college student majors the subject of the course within four years of entering college. Outcome in column (2) is whether four-year college student majors the subject of the course, conditional on graduating within four years. Outcome in column (6) is whether four-year college student majors the subject of the course, conditional on graduating within six years. Observations are student×course units at four-year schools. The omitted category of instructors is full-time, non-tenure-track. Estimations include controls for instructor ranks of tenure-track/tenured and graduate students, although coefficients are not reported in the table. Standard errors are reported in parentheses and two-way clustered at the student and instructor level: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 17: Probability of Enrolling in Class with Adjunct Instructor by Intended Degree

| | Four-Year (1) | Two-Year (2) |
|---|---|---|
| Intended Degree | -0.004* | 0.003 |
| | (0.002) | (0.005) |
| Course FE | Y | Y |
| Student FE | Y | Y |
| $N$ | 421,180 | 273,000 |

Outcome: whether student enrolls in course with an adjunct instructor, as opposed to a full-time, non-tenure-track instructor. Estimations involving students at four-year schools include controls for instructor ranks of tenure-track/tenured and graduate students, although coefficients are not reported in the table. Observations are student×course units, 2004-2011. At four-year colleges, "Intended Degree" is an indicator variable taking a value of one if the student intends to major in the subject of the course. At two-year colleges, this variable is an indicator variable taking a value of one if the course is part of the student's intended degree track. Standard errors are reported in parentheses and the student level: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 18: Courses Outside of Student's Intended Degree: Effects of Instructor Rank on Subject-Specific Outcomes

| | Subsequent Course | | Major |
|---|---|---|---|
| | Four-Year | Two-Year | Four-Year |
| | (1) | (2) | (3) |
| Adjuncts | -0.007* | -0.013*** | -0.002** |
| | (0.004) | (0.003) | (0.001) |
| Course FE | Y | Y | Y |
| Student FE | Y | Y | Y |
| $N$ | 229,488 | 165,065 | 189,519 |
| $R^2$ | 0.600 | 0.643 | 0.421 |

Outcome variable in columns (1) and (2) is whether student takes a subsequent course in the subject of the course, and the sample includes first-semester college students 2004-2010. Outcome variable in column (3) is whether student majors in the subject of the course, and the sample includes first-semester college students 2004-2009. Observations are student×course units, and the sample is restricted to students whose intended degree is not in the subject of the course. The omitted category of instructors is full-time, non-tenure-track. Estimations involving students at four-year schools include controls for instructor ranks of tenure-track/tenured and graduate students, although coefficients are not reported in the table. Standard errors are reported in parentheses and two-way clustered at the student and instructor level: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 19: Alternative IV Specification: Effects of Instructor Rank on Subject-Specific Outcomes

| | Next Course | | Major |
|---|---|---|---|
| | Four-Year | Two-Year | Four-Year |
| | (1) | (2) | (3) |
| Adjunct | -0.012 | -0.034** | -0.013 |
| | (0.015) | (0.017) | (0.008) |
| Male | -0.009*** | -0.031*** | -0.008*** |
| | (0.003) | (0.003) | (0.001) |
| Part-Time Student | -0.100*** | -0.089*** | -0.026*** |
| | (0.006) | (0.004) | (0.002) |
| Age | -0.007*** | 0.001 | -0.001 |
| | (0.002) | (0.001) | (0.001) |
| $Age^2$ | 0.000*** | 0.000 | 0.000 |
| | (0.000) | (0.000) | (0.000) |
| In-State Tuition | 0.018*** | 0.029*** | 0.003 |
| | (0.004) | (0.007) | (0.002) |
| Transfer Student | -0.012*** | -0.018*** | 0.017*** |
| | (0.005) | (0.003) | (0.002) |
| Intended Major | 0.188*** | 0.126*** | 0.130*** |
| | (0.005) | (0.006) | (0.004) |
| Course FE | Y | Y | Y |
| $N$ | 162,454 | 229,251 | 130337 |
| $R^2$ | 0.278 | 0.260 | 0.385 |

Outcome variable in columns (1) and (2)) is whether student takes a subsequent course in the subject of the course, and the sample includes first-semester college students 2004-2010. Outcome variable in column (3) is whether student majors in the subject of the course, and the sample includes first-semester college students 2004-2009. Observations are student×course units. The omitted category of instructors is full-time, non-tenure-track. The instrumental variable is the deviation from the departmental average proportion of classes taught by an instructor of a given rank in a term-specific semester. The average proportion is calculated over the time period 2004-2011. Standard errors are reported in parentheses and clustered at the student level: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 20: Changing Instructor Rank on Student Composition

| | Four-Year (1) | Two-Year (2) |
|---|---|---|
| Major in Course | 0.002 | -0.001 |
| | (0.002) | (0.003) |
| Male | 0.001 | 0.000 |
| | (0.001) | (0.001) |
| In-State Tuition | -0.002* | -0.001 |
| | (0.001) | (0.002) |
| Part-Time Student | -0.002 | -0.008*** |
| | (0.002) | (0.002) |
| Transfer Student | -0.002 | -0.001 |
| | (0.002) | (0.001) |
| Instructor FE | Y | Y |
| Course FE | Y | Y |
| $N$ | 230,814 | 289,329 |

Observations are student×course units, and I restrict observations to instances where the student's instructor is either adjunct or full-time, non-tenure track. The outcome is an indicator variable for whether an instructor is full-time, non-tenure track. Estimations include a quadratic variable in instructor age and school×year fixed effects. Standard errors are reported in parentheses and two-way clustered at the student and instructor level: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$