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The Effects of Adjunct Professors on Student Outcomes

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July 3, 2003

ABSTRACT

One of the most pronounced trends in higher education over the last decade has been the increased reliance on adjunct professors. While proponents of adjuncts claim that they are essential to maintaining first-rate universities in a tight fiscal environment, critics argue that using adjuncts deteriorates the quality of higher education. Surprisingly, however, little research exists to document any of the positive or negative claims about the relative effectiveness of adjuncts on student outcomes. This paper attempts to fill this void using a unique dataset of public four-year colleges in Ohio. This paper attempts to quantify how having adjunct instructors affects student performance and persistence. The paper also analyzes how taking an adjunct in a particular discipline affects the likelihood of enrollment and success in subsequent courses within the same subject. Because students with adjunct instructors may differ systematically from other students due to individual class selection and the course registration process, the paper offers several methods to control for bias. Preliminary findings suggest that, in general, adjunct instructors do not adversely or positively affect student success relative to full-time, tenure-track faculty, but the effects differ by discipline.

The authors thank the Ohio Board of Regents for their support during this research project. Dr. Robert Sheehan, former Associate Vice Chancellor for Performance Reporting and Analysis, and Andy Lechler, HEI Senior Analyst, provided invaluable help with the data. In addition, Erin Riley, Suzan Akin, and Jason Weaver provided excellent research assistance. Bettinger completed much of this research while a Visiting Scholar at the American Academy of Arts and Sciences. All opinions and mistakes are our own.

I. Introduction

One of the most pronounced trends in higher education over the last two decades has been the growing reliance on adjunct instructors. From 1987 to 1999, the percentage of courses taught by adjuncts, often defined as part-time faculty, increased by 30 percent at four-year colleges and universities. The trends were especially pronounced at public research and doctoral institutions during which time adjuncts increased by 50 and 80 percent, respectively (NCES 1997, 2001). While adjuncts made up an increasing proportion of new hires, they also steadily replaced full-time positions. Between 1993 and 1998, 40 percent of all universities replaced full-time positions with part-time faculty (NCES, 2001). By 1998, nearly 43 percent of all teaching faculty were part-time (Chen, 2002).

The use of adjunct instructors is partly explained by increasing pressure on colleges to reduce costs (Leslie, 1998b). According to a 2001 report by the College and University Professional Association for Human Resources (CUPA-HR), if universities compensated faculty solely for teaching, then full-time faculty would average $2,674 per credit hour.[1] In contrast, universities paid adjunct faculty at the same institutions $592 per credit hour. The attractiveness of adjuncts as an inexpensive alternative to full-time, tenure-track faculty is even more pronounced considering that 47 percent of universities do not offer benefits to part-time faculty (NCES, 2001). The growing reliance on adjunct professors also relates to larger trends in the American labor market. The end of mandatory retirement for tenured faculty members in January 1994 greatly increased the cost of tenure for colleges (Ehrenberg, 2002). Therefore, the growing presence of adjuncts may reflect a shift in higher education towards using temporary workers, a trend common in other industries that have faced increases in the cost of employment. Temporary employment may help universities to screen for potential full-time faculty members (Autor, 2000). Furthermore, temporary contracts allow colleges to maintain a flexible workforce in response to changes in the demand and resources. For these reasons, proponents of the growing use of adjuncts argue that they are essential to maintaining high quality universities in a tight fiscal environment.

[1] The average salary of a full-time faculty member at a four-year public university was $58,828 in 2001, and the average course load of full-time faculty was 22 semester hours.

However, many have voiced concern about whether the growing use of adjunct instructors has affected the quality of higher education. Because many adjuncts do not have Ph.D.s or other terminal degrees, critics question whether they can provide the same quality of education as full-time faculty members with Ph.D.s. Moreover, some question the impact of adjuncts on student interest in a subject (National Institute of Education 1984). In the humanities, for instance, the Modern Language Association (MLA) has asserted that the increased usage of part-time faculty has led to a deterioration in university quality (MLA 2002, MLA 1985). In addition to affecting instruction, some suggest adjuncts could impact the quality of student advising and affect the distribution of other departmental tasks such as committee work. On the other hand, there may be gains due to specialization from hiring adjuncts. Adjuncts typically focus on teaching, and therefore, may be better instructors than faculty members who have to balance other job demands. Similarly, adjuncts may allow full-time, tenure-track faculty to more effectively focus on research. Finally, adjunct instructors may bring critical industry knowledge into the classroom if they have concurrent employment outside of the university.

Surprisingly, however, little research exists to document any of the positive or negative claims about the relative effectiveness of adjuncts. Whereas researchers and policymakers continually debate measures of teacher quality and the effect of teacher characteristics on student outcomes in primary and secondary school (e.g. Murnane et. al. 1991, Card and Krueger 1998, Hoxby 2002, Temin 2002, Hanushek and Rivkin 2003), little is known about instructor quality in higher education or its impact on college students. While several papers document the growing trend in adjunct teaching (Burgan, Weisbuch, and Lowry 1999, Balch 1999) and others describe the employment conditions of adjuncts (Gappa and Leslie 1993, Gappa 2000, NCES 2001), there is little research on the impact of adjunct instructors. One reason for the lack of research in this area is the inability to link individual collegiate outcomes to instructors' characteristics. While data exist on the experiences of college students (e.g. Baccalaureate and Beyond and the National Education Longitudinal Study of 1988) and other data survey faculty characteristics (e.g. the National Study of Postsecondary Faculty), one cannot link these sources. Therefore, researchers are unable to identify

the characteristics of the faculty members that teach and advise students. However, this study attempts to fill this gap using a unique longitudinal dataset.

This paper estimates the impact of adjunct instructors on student outcomes by examining their effect on persistence, the likelihood of taking additional courses in a particular subject, performance in subsequent courses, and graduation. The analysis is based on administrative and transcript data available through a collaborative agreement with the Ohio Board of Regents (OBR). We track the nearly 25,000 first-time freshman students at 12 public, four-year colleges in Ohio[2] with information on students' course-taking behavior and performance as well as the characteristics of the corresponding faculty member responsible for each course from Fall 1998 to Spring 2002. Moreover, the OBR provides basic information on each student's background, high school performance and academic interests, and test scores. In addition to the wealth of information available, the data allow one to distinguish between students who withdraw from school and those who transfer to other Ohio public colleges. Therefore, our measures of persistence and transfer rates are much more accurate than other data that force researchers to overestimate dropout rates.

To determine the impact of adjuncts on student outcomes, we compare the outcomes of students who had different types of instructors (i.e. adjunct or full-time professor) early in their college careers or during the first time a particular subject was taken. Due to the detailed nature of the data, we are able to exploit multiple sources of variation to identify the effects of adjuncts. Moreover, because the likelihood of having an adjunct may be related to student characteristics such as ability due to individual class selection and the course registration process, we employ several estimation strategies. First, we use course fixed effects to measure the impact of adjuncts by comparing students who signed up for the same course but were assigned different sections with different types of instructors. As a second strategy, we use an instrumental variable approach that exploits the substantial variation across years in the reliance of individual departments on adjuncts.

[2] The only 4-year, public institution that we do not include is Shawnee State University. Data were not available for this university at the time of this draft. Shawnee is a small, non-selective college representing less than 2 percent of the total enrollment at 4-year, public colleges.

The results measure the effects of college instructor quality on student outcomes while also commenting on the tradeoffs between different types of labor in the production of higher education.

II. LITERATURE REVIEW

Teacher Characteristics and Student Outcomes

In the K-12 literature, researchers routinely use and reevaluate measures of teacher quality. For example, Hoxby (2000) measures what types of teacher characteristics districts value when they are facing strong competitive pressures. To measure teacher quality, researchers often use undergraduate college selectivity, subject matter expertise (measured by test scores and college performance), the completion of advanced degrees, and experience. For example, Figlio and Rueben (2001) use the test scores of education majors to gauge how tax limits affect the quality of new teachers. Other studies directly link proxies for teacher quality to student outcomes. Ehrenberg and Brewer (1994) found that students with teachers from more selective undergraduate institutions scored higher on standardized tests after controlling for student background characteristics. This information has been helpful in larger debates about the tradeoffs between different types of investments that could be made in schools. Assuming higher-quality teachers are more expensive, schools often must choose between increasing teacher quality (and thereby employing fewer teachers) or lowering class size.

Research about the connection between instructor characteristics and student outcomes in higher education is much less prevalent. The few studies that have been done focus on the effect of teaching assistants on student performance. Borjas (2000) analyzes the impact of foreign teaching assistants on economics students' performances at Harvard. Norris (1991) also examines the effect of nonnative English-speaking teaching assistants on students at the University of Wisconsin. However, both of these studies are based on relatively small samples and do not have much information on student background. Moreover, they are unable to address issues related to professors or the growing use of adjunct instructors. Therefore, this paper addresses a considerable gap in the postsecondary literature about the effects of different kinds of instructors on students.

The Increasing Use of Adjuncts

While little is known about the impact of adjuncts on student outcomes, several papers document the growing use of adjuncts. Foremost, David Leslie provides a wealth of information on this trend in a series of articles. In *The Growing Use of Part-Time Faculty* (1998a), Leslie uses the 1993 National Survey of Postsecondary Faculty to quantify the increase. He finds that 42 percent of teaching faculty members at that time were part-time. Moreover, there is a great deal of variation by institution type and discipline. Research universities were least likely to employ them while public, two-year faculties were 60 percent part-time. Other work provides further evidence of the growing use of adjuncts. Burgan, Weisbuch, and Lowry (1999) find an increase in the use of instructors on term contracts when analyzing a survey of non-tenure track faculty. Similarly, Balch (1999) examines the increased use of part-time faculty as a trend that will continue to persist. Many other papers discuss trends at particular institutions. For example, Jackson (1999) documents the growth of temporary and part-time appointments at Maryland's public colleges from 1981 to 1998

A couple of reports examine the impact of adjuncts at particular institutions. For instance, Haeger (1998) discusses the problems and solutions associated with adjunct instructors at Towson University. However, due to a lack of data, researchers have not been able to perform large-scale analyses of the impact of adjuncts on student outcomes. Instead, several have speculated about their effects. Leslie (1998b) notes that adjuncts could affect education quality because fewer have Ph.D.s. In addition to affecting instruction, Pisani and Stott (1998) argue that the use of adjuncts erodes the quality of student advising, and others suggest that part-time faculty affect the distribution of other departmental tasks such as committee work. The MLA (2003), the National Institute of Education (1984), and the Education Commission of the States (Palmer 1998) have all issued reports or policy statements that link the growing use of part-time professors to a decline in educational quality. On the other hand, Leslie and Gappa (1995) argue that part-time faculty could help broaden academic programs by introducing real-world experiences into the classroom. Others have documented the employment conditions and dissatisfaction of adjuncts (Gappa and Leslie 1993, Gappa 2000, and Fulton 2000). Given the fact that many have express feelings of being treated as second-class

citizens, Leslie (1995) questions how their treatment might affect the quality of education adjuncts are able to supply.

III. THEORETICAL FRAMEWORK

In this section, we outline two possible frameworks that may characterize the potential impact of adjunct instructors on students and the supply of different types of instructors.

The Effect of Instructor Quality and the Demand for Adjuncts

Presumably, students choose the courses, schedule, and faculty members that maximize utility (current leisure/work and future educational returns). Suppose students can take classes from two types of instructors, adjuncts or tenure-track, full-time professors. Suppose further that the instructors may differ in the amount of general and specific knowledge they provide.

The specific knowledge pertains to the discipline. On the one hand, adjunct instructors often do not have terminal degrees, and therefore, may not be as knowledgeable about a particular subject as full-time professors, the majority of whom have Ph.D.s. In addition, adjuncts are not as involved in university research, so to the extent that research influences teaching quality, full-time faculty may be better teachers and provide more specific knowledge about a subject. On the other hand, adjuncts do not have research or service requirements and can specialize in teaching. Therefore, they may be better at providing specific knowledge.

There may also be a difference in the general knowledge that adjuncts and full-time professors provide. Because adjuncts are typically temporary, they may not have the same stock of general knowledge about the university in comparison to full-time professors. In addition, adjunct professors may not be as effective in advising students or in arranging research opportunities that may prepare students for graduate-level education. However, if they are concurrently employed in industry, they may have more practical knowledge and provide better access to future employment than a full-time faculty member.

The amount of specific and general knowledge provided by the two types of instructors could affect subsequent outcomes. First, the specific knowledge provided could affect the likelihood

of student success in subsequent courses. Likewise, general knowledge might influence student persistence. For example, if adjunct faculty members do not help integrate students into a university community, then one might observe students taking many adjuncts to be disaffected with the school and more likely to withdraw. Experiences with instructors may also affect future course-taking behavior. If a student chooses his courses (and major) based on his comparative advantage and experiences in a given subject, the type of instructor he has in a given discipline could influence subsequent course selection and major choice. First, if the experience in a course produces additional knowledge that changes the subject in which the student has a comparative advantage, then the student may change their major or choose a different set of courses. Additionally, if knowledge in one course affects students' success in subsequent courses, taking an adjunct may affect the likelihood that students take subsequent courses.

In choosing courses, students may have ex-ante beliefs about the relative effectiveness of different kinds of instructors. For example, if students believe that adjunct professors are not as good of instructors as full-time faculty, then students, especially those who are taking a subject in their potential major, will attempt to take courses from full-time faculty when available. However, in some disciplines, adjuncts may provide more effective and practical knowledge to students. For example, students may prefer to take a class in management from the retired business leader as compared to young assistant professor. This introduces possible self-selection issues into the estimation of the impact of adjuncts.

The Supply of Adjuncts: The Allocation of Different Types of Instructors

One could also model the interaction between students and adjuncts from the supply-side. We assume that universities and departments attempt to maximize student outcomes and faculty productivity (mainly teaching and research) while minimizing costs. In this model, the key tradeoff for university administrators is whether the benefits of adjuncts outweigh their costs.

To highlight some of the issues, we assume momentarily that the university only produces teaching. In this case, the cost savings of adjuncts should be directly compared to the consequences of having them teach. If part-time and full-time faculty members are perfect substitutes, then part-

time faculty may help reduce or maintain smaller class sizes without any loss of quality. However, if part-time and full-time faculty members are imperfect substitutes with adjuncts being less effective, then their cost must be compared to the amount saved in salaries. This cost may include a loss of prestige associated with perceived reductions in quality, student enrollment within a given department, and the number of student majors in a given discipline. There may also be administrative costs to managing adjuncts and dealing with turnover. Departments may be able to minimize costs by employing full-time faculty instead of adjuncts in places where the relative benefit of a full-time faculty is higher (e.g. attracting top students in honors sections of a course). Being able to quantify these costs can help administrators fully weigh the costs and benefits.

When research is included in the output of a university, the cost-benefit analysis changes. If part-time and full-time faculty members are complements, then part-time faculty might facilitate greater specialization and increased research productivity among the full-time faculty. Since departments enjoy a salary cost savings with adjunct faculty, they may have surplus that can be reallocated to full-time faculty. This surplus could take the form of teaching buyout, research funds, or other items which enhance research productivity. As a result, research productivity could increase. As before, there may be substantial heterogeneity among departments in the optimal mix of part-time and full-time faculty.

While most of the decisions on hiring adjuncts typically take place at the department or school level, the use of adjuncts also poses some interesting principal-agent problems within the hierarchy of the university. For example, university administrators (the principals) care about maximizing research and teaching productivity. These administrators may see adjunct teachers as a means to free up full-time faculty to do research while providing a dedicated teaching workforce.[3] While department chairs may also care about these objectives, they also care about enrollment in their discipline. Enrollment patterns generally influence the allocation of funds across departments, and if adjuncts negatively affect student enrollment in a subject, then they could also influence

[3] While university administrators may be concerned that increased use of adjuncts may affect their competitiveness with similar institutions, these concerns are likely ameliorated by the fact that public universities in Ohio have similarly increased their reliance on adjuncts over the last decade.

resource allocation. As such, universities where the flow of resources does not track enrollments may encourage the hiring of adjuncts more than other universities. Moreover, beyond a threshold, adjuncts may reduce the research climate if they replace full-time faculty and are less engaged in academic research. The optimal use of adjuncts by department chairs, hence, depends on the net "cost" of adjuncts to the area. This framework suggests that knowing the effects of adjunct on enrollment is important in assessing the costs of adjuncts.

IV. EMPIRICAL STRATEGY AND ISSUES

We employ two strategies to measure the impact of adjuncts on students. In the first, we use the student as the level of observation. By doing so, we can measure the effect on outcomes such as persistence and graduation. However, an important set of questions related to adjuncts involves understanding how they affect the likelihood that students engage in particular subjects. Therefore, the second part of our analysis focuses on observations that are student by subject (i.e. *k* observations per student corresponding to the *k* subjects that each student takes classes in). In this draft, we characterize exposure to subjects as exposure to a particular department (e.g. Economics Department). We have also explored characterizing subjects with a school-level designation (e.g. the College of Humanities or School of Social Sciences).

Student-level Analysis

For the student-level analysis, the key dependent variable is the percentage of courses students take from adjunct faculty during their first semester. We relate this to outcomes such as drop out rates and likelihood of transferring to other schools. We will estimate equation (1) in these models:

$$y_i = \alpha + \beta Adjunct_i + \gamma X_i + C_j + \varepsilon_i \quad (1)$$

where $Adjunct_i$ is defined above and X_i includes controls for student i' s background, high school performance, and academic interests before college. Additionally, we control for differences by institution, we include fixed effects for the campus of attendance denoted by C*j*.

Student-By-Subject Analysis

To evaluate students' experiences in a particular major, we employ models with observations that are student-by-subject. In this case, the data are organized as an *i* x *k* matrix of *i* students and *k* subjects. The key dependent variable is the proportion of the courses in subject *k* that student *i* took from adjuncts during the first semester student *i* was exposed to the topic. For example, if a student took his or her first course in subject *k* from an adjunct professor, the variable would equal one. If the student took the course from a full-time faculty member, the variable would equal zero. For those cases where students take multiple courses in a given subject in the first semester of exposure, we set the adjunct variable equal to the proportion of faculty that were adjuncts (weighted by number of semester credits for each course).

Our basic strategy will be to compare student *i*'s outcomes in subject *k* to their experience with adjuncts:

$$y_{ik} = \alpha + \beta Adjunct_{ik} + \gamma X_{ik} + \lambda_k + \delta_i + \varepsilon_{ik} \quad (2)$$

where λ_k represents fixed effects for the particular subject and X_{ik} includes controls for student characteristics, the first course that a student takes, the semester the student was first introduced to the topic, and the number of credit hours students attempted in the first semester. We can also include course fixed effects so that we measure variation across sections of the same course. The outcomes examined include the number of additional courses taken, the total number of additional semester hours taken, and students' pass rate in additional courses.[4] Future work will also examine how adjuncts affect the likelihood that students remain in a major and the ability of departments to "convert" majors in other subjects.

Student Selection Issues

The distribution of students across courses taught by adjuncts and full-time faculty members may not be random. This may be due to a combination of supply and demand issues. For example, if adjuncts are more likely to teach in particular majors or during evenings or weekends, then certain

[4] An empirical issue arises when comparing the performance of students who did and did not have adjuncts in introductory courses. If adjuncts instructors affect the likelihood that students take additional courses, then the comparison groups will not be identical. Several possible solutions include the Heckman selection model or a truncation strategy. As we show below, we find that adjuncts had a negligible effect on enrollment patterns effectively ameliorating our concerns.

types of students will be more likely to have them in courses (e.g. students with particular interests/abilities or who are more likely to take evening courses). Additionally, students may choose courses based on the type of instructor. As discussed above, students might prefer full-time professors if they perceive that they produce greater knowledge or provide better advising than adjunct faculty, and the preferences for particular types of instructors may be stronger within a student's major. If students who take adjunct professors are systematically different from other students, then our results will be biased by these traits.

We use two strategies to deal with the potential endogeneity of taking an adjunct. First, in the student-by-subject analysis, we use course fixed effects. It is an effective method in controlling for unobserved heterogeneity in students course-taking behavior since it estimates the effect of adjuncts on student who take the same courses but have different instructors due to multiple sections being offered. Essentially we are identifying off variation in the assignment of adjuncts between different sections of the same course.

Unfortunately, the regressions with course fixed effects will not be robust if there is observable or unobservable sorting across sections. If, for example, honors students can register before other students, they may enroll in sections of a course with professors whom they perceive as "better." As a result, there may be differences in students across sections within the same course. As a result of this type of concern, we also use an instrumental variable strategy. A successful instrument should be correlated with the likelihood that a student takes a particular course from an adjunct and uncorrelated with subsequent course-taking behavior or success. One such variable is the term-by-term variation in courses taught by tenure-track or tenured faculty in a department. From year to year, individual departments vary in their use of adjuncts in a particular term. While the "steady-state" for a particular department may be to staff 30 percent of Fall classes with adjuncts, there may be years in which departments may deviate from their steady-state. This may be the result of unexpected outcomes in the hiring process or from temporary shifts in the number of sections offered in a particular course. This variation is likely uncorrelated with student outcomes, and as we show below, this variation is highly correlated with the likelihood that a student took the class from

an adjunct. However, this methodology has a potential problem if the increased use of adjunct is due to the deterioration of a department.[5]

The Data

The paper focuses on full-time, traditional (age 18 to 20), first-time freshman who entered public, four-year colleges in Ohio during Fall 1998. The data are provided by the respective institutions to the OBR and include information on student demographics, enrollment, credit hours completed, and grade point averages. Furthermore, OBR has linked the student records to ACT and SAT records. Most Ohio students take the ACT exam, and the ACT records include the highest test score of the student and the most recent responses to the ACT survey, which includes important student-reported information on high school preparation, performance and academic interests.[6] Summary statistics of the student sample can be found in Table 1 by the selectivity of the institution.[7] The last two columns show characteristics for the subsample of students who took the ACT exam. Since many of our covariates are only available for these students, we will restrict our sample to these students throughout the paper.

As Table 1 shows, the average age of students in our sample is slightly over 18. About 7.6 percent of students at selective colleges are African-American while 14.3 percent of students at non-selective colleges are African-American. Slightly fewer than 2 percent of students are Hispanic. The average ACT score for students is about 23 (out of 36) at selective colleges and about 21 at non-selective colleges. Women make up about 55 percent of the student bodies at selective samples and 52 percent of the student body at non-selective colleges. By the end of four years, the average

[5] For each department, we define the "steady-state" for a particular term to be the average proportion of classes taught by adjuncts in that term (e.g. Spring semester) between 1998 and 2000.

[6] Unfortunately, the subject codes from the ACT survey did not match perfectly with the OBR codes. While in many cases we were able to make one-to-one matches ourselves, in other cases, three majors in one field corresponded to one in another. Our solution was to create a third code that categorizes the major headings into approximately 25 subjects corresponding to the largest 25 departments at Ohio State University.

[7] Selective and non-selective institutions are distinguished by their admissions policies – non-selective colleges have open admissions. The six selective colleges include Bowling Green State University, University of Cincinnati, Kent State University, Miami University, Ohio State University, and Ohio University. Miami University and Ohio State University are the top ranked public universities in Ohio. Miami University is the only university to be referred to as "highly selective" by the Barron' s Guide to College (Barrons 1997). In the 2002 version of US News and World Reports' college rankings, Miami ranks in the second tier (53rd -131st) of national universities with doctoral programs.

student had amassed 105 semester hours at selective colleges and about 86 semester hours at non-selective colleges. About 26 percent of students had dropped out of selective colleges while about 39 percent of students had dropped out of non-selective colleges. These numbers are lower than the national averages since we have included students who dropped out of one institution to attend another institution in Ohio. At selective colleges, about 5 percent of students had done so. At non-selective colleges almost 8 percent had transferred. For students attending selective colleges, the average GPA was about 2.9 and 28 percent of students had finished some sort of 2- or 4-year degree. At non-selective colleges, the average GPA was 2.4 and 14 percent of students had finished some sort of degree.

The last two columns of Table 1 show characteristics for the sub-sample of students who took the ACT. The major difference between these columns and the preceding columns is the representation of Ohio students. Almost all of the students in the ACT sample are from Ohio. This is true for both selective and non-selective colleges. With this in mind, the effects that we estimate based on this sub-sample are likely to be internally consistent for the set of Ohio residents that attend Ohio four-year colleges.

The most important sources of information for this project are the students' transcripts, which detail every course in which a student enrolls.[8] From these data, we know the following information for each section of each course: topic covered, how many hours the course was worth, a faculty identifier for the faculty member chiefly responsible for the course, and whether the student passed or failed the course. We use the faculty identifier to link courses to the faculty members responsible for the course. For each faculty member, we observe whether the faculty is full-time or part time, tenure or non-tenure track, highest degree completed, age, race, gender, title, and to a limited extent salary. Following the national literature on adjunct teaching, we refer to adjuncts as part-time faculty.[9]

[8] For schools on quarter rather than semester schedules, OBR converts the quarter hours to semester hours to standardize the analysis.
[9] Another possible definition of adjuncts is non-tenure-track instructors.

Tables 2a and 2b summarize the characteristics of the faculty in the sample. In Table 2a, we show faculty characteristics for those who taught courses with an enrollment greater than 50 students in Fall 1998. The unit of observation is the instructor, so if a professor teaches multiple courses or multiple sections, he or she is only listed once. About 53 percent of faculty members hold Ph.D.s. The number is fairly similar across selective and non-selective colleges. About 25 percent of faculty members are part-time employees. This is slightly higher for non-selective campuses (29 percent) as opposed to selective campuses (22 percent). About 11 percent of faculty are graduate assistants although this is much higher (15 percent) in the selective colleges as opposed to the non-selective colleges (5 percent). We also report the percentage of non-tenure track faculty (including part-time faculty) in Table 2a as this group may be an alternative definition of adjunct professors.

Table 2b shows characteristics for the faculty that are relevant to our study. These faculty members taught introductory courses at a four-year main campus at some point between Fall 1998 and Spring 2002. These faculty represent all courses regardless of enrollment. As in Table 2a, we show the characteristics of faculty for both selective and non-selective colleges. The first panel shows characteristics for full-time, tenure-track faculty who taught an introductory course. The second panel shows characteristics for part-time faculty. The unit of observation in each panel is the faculty member, so professors teaching multiple classes or sections will only be included once.

The average age of full-time faculty in introductory courses is similar to that of part-time faculty although non-tenure track faculty are 7 to 10 years younger. Adjunct faculty tend to include more women than the full-time faculty. About 26 percent of full-time faculty are women while 46 percent of part-time faculty are women. Minorities are also more represented in the adjunct population with about 27 percent of non-tenure track faculty being minority. Finally, there are dramatic differences in the likelihood that a faculty member has a Ph.D. across samples. Almost 90 percent of full-time faculty have Ph.D.'s while less than 25 percent of part-time faculty have them.

Table 3 displays how the proportion of faculty members that are adjunct instructors differs by campus and discipline. Table 3 includes all professors including those teaching upper-division or small courses. At selective institutions, the percentage of adjuncts teaching undergraduate level

courses ranges from just over 15 percent of the faculty at Ohio State University to about 31 percent at Kent State University. At non-selective institutions, this percentage varies from about 30 to 42 percent. The breakdown of faculties by school or department also shows tremendous variation. Architecture has the highest percentage of adjuncts with about 56 percent of their faculty being part-time. Social Work and Public Administration similarly employ adjuncts (46 percent of faculty). While examining the effects of adjuncts within subjects throughout this paper and in later tables, the focus is on five schools: the Humanities, Social Sciences, Sciences, Business and Computer Science. The faculties in the schools of Humanities, Business and Computer Science have a similar proportion of adjuncts, about 32-34 percent. The Sciences have the lowest proportion of adjuncts with about 10 percent of the faculty being adjuncts. About 22 percent of the faculty in the Social Sciences are adjuncts.

One limitation of this data is that we do not observe how many years a particular faculty member has been affiliated with a particular university (although we can measure this over the four years included in our study). We also cannot track movements of faculty to other universities or their professional activities at a particular university (including concurrent appointments at other universities). Another limitation is that the data only include students attending Ohio public universities. Students from Ohio that attend universities in other states, and students that attend private schools in Ohio are excluded from the sample. Additionally, students who transfer from Ohio public institutions to institutions located in other states are indistinguishable in the data from students who dropout of college. This potential bias, however, should be very small since the percentage of students who likely transferred to private institutions or those outside of the state make up a small fraction of the total number of observed dropouts.[10] Furthermore, this data does a much better job at tracking students than previous work.

[10] While we can not track students who transfer to private colleges or public out-of-state institutions, this is not likely to be a large group. Using data from the Integrated Postsecondary Education Data System (IPEDS) and assuming that transfer students are geographically representative of the freshman class, then one would expect around 650 Ohio students to transfer to the out-of-state colleges. If one further assumes that *all* 650 transfer students just finished their 1st year, then about 4.3 percent of observed dropouts in our data are actually transfer students.

V. EMPIRICAL RESULTS

Student-Level Analysis

Tables 4 and 5 examine the effect of having adjunct instructors on student outcomes. As shown in Table 4, students with higher ACT scores are less likely to have adjunct professors during their initial semester (Fall 1998). For every point higher that a student scores on their ACT exam, the proportion of classes that he or she takes from adjuncts is about 1 percentage point lower. This type of endogeneity may be related to savvy students choosing to take classes from tenure-track faculty or could be as a result of the assignment of full-time faculty to honors and other advanced classes taken by students with higher scores. To deal with this selection issue, we use the deviation from the steady state percentage of tenured and tenure-track faculty members by department as an instrument for the likelihood of having an adjunct. As seen in specifications 2 through 4, these variables are highly significant in predicting the proportion of credits students have taught by adjuncts.

Table 5 estimates the effect of adjunct instructors using the straightforward OLS model and the instrumental variables approach. Two outcomes are examined: college attrition and graduation. In theory, if different kinds of instructors have varying success in engaging students with the university community and preparing them for subsequent courses, then they could affect these "macro" outcomes. At first glance, adjuncts appear to increase the likelihood of student dropping out of college and reduce the probability of completing a degree after four years (specifications 1 and 3). However, once accounting for selection issues using the instruments, these effects change sign and become statistically insignificant. Therefore, while adjuncts may appear to negatively impact students, this effect is really due to the lower-ability level of the students taught by adjuncts. We are unable to detect a statistically significant effect of adjuncts on dropout and degree completion after four years.

Student-by-Course Analysis

Dealing with Selection Issues using Course Fixed Effects

The rest of the analysis focuses how exposure to adjuncts in particular subjects affects subsequent course-taking behavior and performance overall and in that subject. Similar to above, Table 6 shows that students with higher ACT scores are less likely to be taught by adjuncts. The first panel shows estimates of a regression of the proportion of courses taught by adjuncts in students' first exposure to a subject on student characteristics including ACT scores. A one point increase in a student's ACT score decreases the likelihood that they take an adjunct in a particular course by 0.16 percentage points. Overall, this observed selection is small; however, it varies in magnitude by discipline category. The ability bias is strongest in the humanities, business, and computer science. There appears to be no relationship between students' ACT scores and the types of instructors that they take in the Social Sciences and Sciences. Table 6 also shows that students are also less likely to have adjuncts in courses related to their intended major, most notably in the social sciences and computer science.

The second panel of Table 6 estimates the same regressions including course fixed effects. Using course fixed effects reduces the selection issue since we are focusing on variation in adjunct behavior across sections of the same course instead of across courses. As shown in specification 7 in comparison to specification 1, the magnitude of the ability bias based on ACT is cut in half when course fixed effects are included. Similar reductions are found in the estimates focusing on particular disciplines. In addition, the use of course fixed effects eliminates the tendency for students to differ in their instructor choice when the subject is in their intended major.

While the estimates in Table 6 are statistically significant, the estimate for the sample of all subjects is extremely small in magnitude. If a student's ACT score increase by 10 points – a dramatic increase, it only decreases the likelihood of having an adjunct by 0.8 percentage points. Our large sample size (236,529) enables us to identify even small differences that are statistically significant but small and potentially unimportant in magnitude. Hence, while the results in Table 6 do not provide conclusive that course fixed effects purges the model of observable selection effects, we assume, at least for the time, that the extremely small effects of ACT score on adjunct-taking behavior are too small in magnitude to bias estimated effects of adjuncts on student course outcomes.

The next sections examine the impact of adjuncts on particular outcomes using the course fixed effects to address the observed ability bias.[11]

The Effect of Adjuncts on Subsequent Enrollment

While adjunct instructors may affect "macro" outcomes such as persistence and graduation, one question of interest among department administrators has been how the use of adjuncts affects the likelihood that a student will take an additional course in a subject. If exposure to adjunct instructors reduces the interest a student has in a subject and enrollment in that discipline declines, then the department is likely to lose resources in its budget. Tables 7a and 7b examine the effect of adjuncts on the number of credit hours taken in subsequent semesters *in the particular subject*.

In specifications 1 and 2 of Table 7a, adjuncts are not found to have a significant, differential effect from full-time faculty members on the total semester hours taken after the first semester. However, when course fixed effects are used in the last two models of the table, the result becomes positive and statistically significant. Taking a first class from an adjunct rather than a full professor increases the total number of hours that a student takes in a given subject by 0.09. While the estimate is statistically significant, it is extremely small in magnitude. Students take, on average, an additional 4.3 semester hours in any given subject. Having an adjunct only leads to a 0.09 hour increase. In essence, the results suggest that students who have adjunct instructors in a course take more credits in the same department in later semesters than students *in the same course* that had a full-time instructor in a different section, but the additional amount of credits is extremely small in magnitude.

Table 7b looks within certain disciplines to determine if the impact of adjuncts differs by subject. We only focus on the humanities, social sciences, sciences, business, and computer science. In these subjects, we are unable to find a significant difference in the number of hours. The point estimate is negative in the humanities, sciences, and computer science, but positive in the case of the social sciences and business. However, even if we create a 95 percent confidence interval around

[11] If only certain subjects or types of courses had multiple sections, then one would be concerned that the course fixed effects results are based on a skewed sample. However, this is not the case in terms of subject – all of the subject categories are represented when limiting the sample to courses with multiple sections.

each point estimate, the estimated effect is small in magnitude. In the sciences, for example, a 95 percent confidence interval suggests an effect on enrollment between a 0.2 hour increase or a -0.3 hour decrease. At either bound of the interval, the estimated effect is small in magnitude compared to the fact that the average student in the sciences takes an additional 7.2 hours.

Table 8 provides a different measure of the effect of adjuncts on subsequent course-taking behavior. In Table 8, the dependent variable is a binary indicator for whether the student ever took an additional course in the given subject. As shown in Tables 8a and 8b, adjunct instructors are not found to have any differential effect on students as compared to full-time professors. None of the estimated coefficients of the effect of adjuncts on the likelihood of taking an additional course in a subject are statistically significant. Furthermore, the magnitudes of the coefficients (and their 95 percent confidence intervals) are largely zero.

Effect on Subsequent Performance

Table 9 estimates the effects of having an adjunct on students' passage rates in subsequent courses. In a similar manner, students do not seem to be adversely impacted by having an adjunct instructor in terms of their performance in subsequent courses. Columns 1 and 2 of Table 9a shows the estimated effects without course fixed effects while Columns 3 and 4 show the estimated effects with course fixed effects. As Column 4 of Table 9a shows, the estimated effect of having an adjunct is a 0.35 percentage point decrease in the likelihood a student passes the next course. The estimated effect is insignificant and a 95-percent confidence interval ranges from a 0.15 percentage point increase to a 0.85 percentage point decrease in the percentage of classes that a student passes after the first exposure to a course. Given that the average pass rate is 87.6 percent, the estimated effects and their 95 percent confidence intervals are extremely small in magnitude.

In Table 9b, we estimate similar specifications by discipline. As before, there was no significant difference between the passage rates for students who had adjunct instructors in an initial course as compared to students who had full-time professors. The one exception is in the Social Sciences. Students with adjuncts during their first exposure to a discipline were slightly less likely to pass a subsequent course (specification 2 in Table 9b).

One of the potential problems in Table 9 is if adjuncts led to changes in enrollment. As Table 7 shows, after controlling for course-specific effects, adjuncts had a small effect on student enrollment in subsequent courses. Moreover, Table 6 shows that adjuncts tended to teach students with lower ACT scores. The resulting effect on estimates in Table 9 should be negative. Even if adjuncts do not actually affect student success, we would expect passage rates to be lower for their students since their students had lower test scores initially. This bias, however, is likely small in magnitude since the effect on enrollment is so small in magnitude.

There may be additional biases based on the number of courses that students take. We are measuring exposure to an adjunct by looking at the first course that a student takes from a given department. While the estimates in Table 8 suggest that students are equally likely to take an additional course, the correct passage rate to compare may be that of the next course rather than the overall passage rate as we have done in this draft of the paper. If failing the 2nd course leads to students never taking an additional course, then our estimates may be biased by "survivors." Future drafts of the paper will compare the passage rate in the next semester of exposure as well.

Dealing with Selection Issues using Instrumental Variables Approach

Course fixed effects is only one approach to dealing with selection issues in which students are taught by adjuncts. Instrumental variables is another strategy to address this issue. Similar to the analysis above, we use term by term deviations from the steady state percentage of tenured and tenure-track faculty members by department as an instrument for the likelihood of having an adjunct in a given semester.[12]

Table 10a shows the first-stage results. The coefficient on ACT scores is similar to Table 6. A one point increase in a students ACT score corresponds to a 0.07 percentage point reduction in the likelihood that a student takes a class from a part-time instructor. The coefficients on the instruments suggest are statistically significant. Their magnitudes are also significant. A 10 percent increase in the number of tenured faculty teaching classes during a particular term reduces the probability that a

[12] We also include controls for graduate assistants. We treat the proportion of classes offered by graduate assistants as endogenous as well. Hence, we have two endogenous regressors and two instruments and are just identified.

student takes his or her first course from an adjunct by 5.5 percent. A similar increase in tenure track faculty leads to a similar effect.

Tables 10b displays the IV results. Column 1 shows the estimated effect on total courses taken. Here the estimated effect is positive and significant. Taking an adjunct leads to a 2.70 semester hour increase in future courses taken. The result is significant in magnitude and suggests that taking an adjunct increases the number of courses taken by almost an entire semester class. Similarly, the estimate in Column 2 suggests that adjuncts increase students' likelihoods of ever taking an additional course by 2.6 percent – a significant increase. The final column presents IV estimates of the effect of adjuncts on subsequent passage rates. We fail to find a statistically significant effect on passage rates. The point estimate is negative (-0.018) however the standard error is large (0.202).

VI. CONCLUSIONS AND FUTURE RESEARCH

While the growing use of adjuncts has alarmed many higher educational policymakers and interest groups, the results in this paper do not suggest that taking an adjunct adversely affects student outcomes. Estimating the effect of adjuncts on student behavior is tricky since adjuncts tend to teach students with lower test scores. These students may be more inclined to withdraw from school or not succeed. However, in our estimation strategies, we have attempted to control for these differences by exploiting variation across sections and by using an instrumental variables strategy. In both of these estimation strategies, we find significant, positive effects on enrollment. While we do not find significant results on dropout rates, we do find that adjuncts have a marginal, positive effect on degree completion (although this includes four- and two-year degrees). As for course-taking behavior, while the estimates from our fixed effect strategies are small in magnitude, the estimates from the instrumental variable models are significant. Adjuncts seem to increase student enrollment, particularly in the social sciences and business. We find no statistical differences in students' subsequent performance after having an additional course from an adjunct.

The results are helpful and necessary in estimating the effects of adjuncts; however, they are not sufficient to provide a full-scale cost-benefit analysis of using adjuncts. The results suggest that adjuncts do not negatively affect enrollments or student success in subsequent courses, but they do not offer any insight into the effects of adjuncts on research and service. As discussed above, adjuncts may affect the research climate by either reducing the number of active research faculty or by allowing research faculty to more fully specialize. The results also do not indicate whether adjunct teaching affects students' success in graduate school or in the labor market. In order for one to conduct a more thorough cost-benefit analysis, one must account for the effects of adjuncts on these courses. Nonetheless, the paper makes an important first step in calculating the effect of adjuncts on student course-taking behavior.

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Table 1: Full-time, Traditional-aged Students at Four-year, Public Colleges in Ohio

	All Students		Students with ACT Information	
Institution Type	Selective	Non-selective	Selective	Non-selective
Background Characteristics				
Age in 1998	18.4 (.508)	18.5 (.594)	18.4 (.496)	18.4 (.565)
Female	.548	.519	.560	.533
Black	.076	.143	.072	.125
Hispanic	.017	.018	.014	.017
Asian	.025	.015	.024	.014
White	.852	.765	.868	.793
Ohio Resident	.865	.932	.999	.999
Course-Taking Behavior				
In Remedial Math	.064	.290	.067	.279
Credits of Remedial Math Attempted	.347 (1.26)	1.58 (3.02)	.368 (1.29)	1.51 (2.94)
In Remedial English	.021	.251	.021	.240
Credits of Remedial English Attempted	.161 (.988)	1.35 (2.85)	.168 (1.01)	1.24 (2.64)
Total Credit Hours (Fall98 – Spring02)	105.2 (36.98)	85.53 (41.29)	107.20 (35.01)	88.35 (40.30)
Postsecondary Outcomes				
College GPA	2.88 (.740)	2.43 (.989)	2.89 (.738)	2.48 (.961)
Dropped Out before Spring 2002	.264	.385	.240	.354
Completed at least Two-year degree	.281	.135	.276	.141
Transferred Down	.054	.077	.060	.082
Ability and High School Measures				
Took the ACT	.796	.822	1.00	1.00
ACT Overall Score (36 maximum)	22.9 (4.05)	20.7 (4.25)	22.9 (4.06)	20.7 (4.25)
High School GPA from ACT Survey	3.28 (.489) [16,819]	3.00 (.590) [7,368]	3.28 (.489) [16,819]	3.00 (.590) [7,368]
Observations	22,038	9,418	17,549	7,741

Standard deviations are shown in the parentheses. The number of observations for variables with less than the total observations is shown in brackets. Sample is restricted to full-time individuals age 18 to 20 who were first-time students in Fall 1998. Selective institutions are defined as having competitive, non-open admissions (Bowling Green State University, University of Cincinnati, Kent State University, Miami University, Ohio State University, and Ohio University).

Table 2a: Faculty Characteristics

Institution Type	All Universities	Selective Campuses	Non-selective Campuses
% with a Ph.D.	52.73	53.53	51.48
% Part-time Instructors	24.65	21.84	29.05
% Non-Tenure Track Instructors	47.12	48.04	45.67
% Graduate Assistants	10.75	14.74	4.48
Number of Courses	2,808	1,716	1,092

Sample includes all courses in Fall 1998 where the enrollment across sections is greater than 50. The average is not weighted by the number of students nor the number of sections. The six selective colleges include Bowling Green State University, University of Cincinnati, Kent State University, Miami University, Ohio State University, and Ohio University. University Branch campuses are not included.

Table 2b: Instructor Characteristics

Institution Type	All University	Selective Campuses	Non-selective Campuses
FULL-TIME, TENURE TRACK PROFESSORS TEACHING 1st COURSES IN A SUBJECT			
Year Born	1950 (10.63)	1950 (13.61)	1949 (9.01)
% Female	25.86	25.36	26.84
% Minority	16.17	14.09	20.19
% with a Ph.D.	89.59	90.29	88.24
Observations	3,785	2,492	1,293
ADJUNCTS (Part-time Faculty) TEACHING FIRST COURSES IN A SUBJECT			
Year Born	1953 (13.31)	1953 (13.61)	1953 (11.53)
% Female	45.89	46.11	45.59
% Minority	19.19	20.05	18.02
% with a Ph.D.	24.41	27.87	19.68
Observations	2,986	1,726	1,260

Restricted to active faculty teaching between 1998-2002 at the undergraduate level regardless of enrollment. The six selective colleges include Bowling Green State University, University of Cincinnati, Kent State University, Miami University, Ohio State University, and Ohio University. University Branch campuses are not included.

Table 3: The Use of Adjuncts by Institution and Subject

	Percent of Faculty that are Adjuncts (part-time)
By University Campus	
Selective Institutions	
Bowling Green University	20.06
University of Cincinnati	30.75
Kent State University	31.37
Miami University	17.81
Ohio State University	15.34
Ohio University	25.68
Non-Selective Institutions	
University of Akron	36.49
Cleveland State University	42.16
Central State University	35.00
University of Toledo	29.86
Wright State University	30.29
Youngstown State University	39.17
By School/Department	
Humanities	32.27
Foreign Languages	22.18
Social Sciences	21.77
Journalism and Communication	36.51
Sciences	10.37
Mathematics and Statistics	38.64
Business	31.52
Computer Science	33.72
Engineering	18.75
Engineering Technology	16.67
Architecture	56.25
Education	23.44
Social Work & Public Administration	46.15

Restricted to active faculty teaching between 1998 and 2002 at the undergraduate level regardless of enrollment. Sample restricted to faculty teaching "first courses" in a subject.

Table 4: Predictors of Students Taking Adjuncts – *Student-level* Regressions

	Dependent Variable: Proportion of Credits from Adjuncts in Fall 1998			
	All Students (1)	All Students (2)	Selective (3)	Non-Selective (4)
ACT Composite Score	-.0095** (.0004)	-.0089** (.0004)	-.0060** (.0004)	-.0146** (.0007)
% Deviation from Steady-state Tenured Faculty in Dept		-.4871** (.0366)	-.5436** (.0444)	-.3601** (.0652)
% Deviation from Steady-state Tenure-Track Faculty in Dept		-.6050** (.0517)	-.7486** (.0627)	-.4114** (.0921)
Observations	25,289	25,289	17,549	7,740

* Significant at the 5% level ** Significant at the 1% level

Notes: Sample is restricted to those students who took the ACT exam. Regressions include controls for gender, race, state of residence, total credits taken in the semester, and campus fixed effects.

Table 5: The Effect of Adjuncts on Dropout and Degree Completion After 4 Years

Dependent Variable	Dropout from College as of Spring 2002		Completed Degree as of Spring 2002	
Dependent Variable Mean	.2991		.2373	
	OLS (1)	IV (2)	OLS (3)	IV (4)
Proportion Credits from Adjuncts in Fall 98	.0429** (.0135)	-.1029 (.0929)	-.0493** (.0121)	.1430* (.0787)
ACT Composite Score	-.0124** (.0007)	-.0133** (.0010)	.0137* (.0007)	.0141** (.0009)
Observations (students)	25,289	25,289	25,289	25,289

* Significant at the 5% level ** Significant at the 1% level

Notes: Sample is restricted to those students who took the ACT exam. The Proportion of Credits from Adjuncts is treated as an endogenous regressor. First-stage regressions appear in specifications 2 of Table 3. Models also include controls for courses taught by graduate assistants. Regressions include controls for gender, race, state of residence, total credits taken in the semester, and campus fixed effects.

Table 6: Predictors of Adjunct Usage in 1st Semester of Subject – *Student-by-Course* Regressions
Dependent Variable: Proportion PT in 1st semester of Exposure to Subject

	Without Course Fixed Effects					
	All Subjects (1)	Humanities (2)	Social Sciences (3)	Sciences (4)	Business (5)	Computer Science (6)
ACT Score	-.0016**	-.0029**	-.0003	.0029	-.0020**	-.0122**
	(.0002)	(.0001)	(.0007)	(.0024)	(.0006)	(.0025)
In Pre-College Major	-.1902**	.1341	-.2020**	-.1626	-.0250	-.3251**
	(.0272)	(-.1788)	(.0757)	(.1012)	(.1045)	(.1300)
(In Pre-College Major) *ACT	-.0005	-.0069	.0090**	.0067	.0014	.0086
	(.0011)	(.0072)	(.0034)	(.0044)	(.0042)	(.0053)
Observations (stud x subj)	236,529	29,591	24,185	18,805	13,655	2,440
Number of Students	25,255	20,191	15,319	12,107	5,612	2,434
	With Course Fixed Effects					
	All Subjects (7)	Humanities (8)	Social Sciences (9)	Sciences (10)	Business (11)	Computer Science (12)
ACT Score	-.0008**	-.0023**	.0008	-.0004	-.0007	-.0078**
	(.0002)	(.0007)	(.0007)	(.0006)	(.0010)	(.0026)
In Pre-College Major	-.0311	.1599	-.0949	-.0139	-.0205	-.2269
	(.0272)	(.1889)	(.0809)	(.1087)	(.0605)	(.1384)
(In Pre-College Major) *ACT	.0005	-.0072	.0042	.0007	-.0006	.0057
	(.0012)	(.0076)	(.0036)	(.0044)	(.0027)	(.0057)
Observations (stud x subj)	236,529	29,591	24,185	18,805	13,655	2,440
Number of Students	25,255	20,191	15,319	12,107	5,612	2,434

* Significant at the 5% level ** Significant at the 1% level

Sample: Full-time, traditional-age, first-time students who began at an Ohio university main campus during Fall 1998.

Notes: Standard errors correct for correlation within observations of the same student. Regressions include controls for gender, race, state of residence, and total credits taken in the semester. All models have fixed effects for campus, department subject, and term. The departments not listed separately but included in "All Subjects" are Communications, Math, Engineering, Architecture, Education, and Social Work.

Table 7a: Effect of Adjuncts on Subsequent Semester Hours Taken – *Across Subjects*

	Dependent Variable: Total Credit Hours Taken in Subject after 1st Exposure to Subject			
	(1)	(2)	(3)	(4)
Proportion Adjunct in 1st Semester	-.0404 (.0396)	.0149 (.0379)	.0686* (.0348)	.0892** (.0342)
ACT Score	.1253** (.0043)	.1019** (.0040)	.0139** (.0033)	.0058 (.0032)
In Pre-College Major		2.141 (1.239)		-.7713 (1.054)
(In Pre-College Major) *ACT		.4711** (.0534)		.3152** (.0461)
Course Fixed Effects	No	No	Yes	Yes
N (students X subjects)	236,529	236,529	236,529	236,529
N (students)	25,255	25,255	25,255	25,255

* Significant at the 5% level ** Significant at the 1% level

Standard errors correct for correlation within observations of the same student. Regressions include controls for gender, race, state of residence, and total credits taken in the semester. Models also include controls for courses taught by graduate assistants and fixed effects for campus, department subject, and term.

Table 7b: Effect of Adjuncts on Subsequent Semester Hours Taken – *Within Subject*

	Dependent Variable: Total Credit Hours Taken in Subject after 1st Exposure to Subject				
	Humanities	Social Sciences	Sciences	Business	Computer Science
	(1)	(2)	(3)	(4)	(5)
Proportion Adjunct in 1st Semester	-.1191 (.1048)	.1848 (.1150)	-.0575 (.1332)	.2683 (.1576)	-.3090 (.3895)
ACT Score	.0054 (.0102)	.0248* (.0105)	.0597** (.0113)	.0506** (.0160)	.1737** (.0459)
In Pre-College Major	-3.219 (6.923)	-4.252 (2.455)	.3027 (2.910)	1.237 (1.406)	-1.605 (3.420)
(In Pre-College Major) *ACT	.4772 (.2965)	.3784** (.1124)	.0491 (.1208)	-.0144 (.0606)	.1476 (.1442)
Course Fixed Effects	Yes	Yes	Yes	Yes	Yes
N (students X subjects)	29,591	24,185	18,805	13,655	2,440
N (students)	20,191	15,319	12,107	5,612	2,434

* Significant at the 5% level ** Significant at the 1% level

Standard errors correct for correlation within observations of the same student. Regressions include controls for gender, race, state of residence, and total credits taken in the semester. Models also include controls for courses taught by graduate assistants and fixed effects for campus, department subject, and term. The departments not listed separately but included in "All Subjects" are Communications, Math, Engineering, Architecture, Education, and Social Work.

Table 8a: Effect on the Likelihood of Taking an Additional Course in that Subject – *Across Subjects*

	Dependent Variable: Any Hours Taken in subject after 1st Exposure to Subject			
	(1)	(2)	(3)	(4)
Proportion Adjunct in 1st Semester	-.0007 (.0024)	.0011 (.0024)	.0028 (.0024)	.0037 (.0024)
ACT Score	.0041** (.0003)	.0040** (.0003)	-.0019 (.0003)	-.0018** (.0003)
In Pre-College Major		.6139** (.0130)		.3654** (.0204)
(In Pre-College Major) *ACT		-.0078** (.0006)		-.0047** (.0009)
Course Fixed Effects	No	No	Yes	Yes
N (students X subjects)	236,529	236,529	236,529	236,529
N (students)	25,255	25,255	25,255	25,255

* Significant at the 5% level ** Significant at the 1% level

Standard errors correct for correlation within observations of the same student. Regressions include controls for gender, race, state of residence, and total credits taken in the semester. Models also include controls for courses taught by graduate assistants and fixed effects for campus, department subject, and term.

Table 8b: Effect on the Likelihood of Taking an Additional Course in that Subject – *Within Subject*

	Dependent Variable: Any Hours Taken in subject after 1st Exposure to Subject				
	Humanities	Social Sciences	Sciences	Business	Computer Science
	(1)	(2)	(3)	(4)	(5)
Proportion Adjunct in 1st Semester	.0002 (.0002)	.0002 (.0002)	-.0006 (.0007)	-.0019 (.0010)	-.0007 (.0007)
ACT Score	.00001 (.00001)	-.00002 (.00001)	.00004 (.00002)	.0000 (.0001)	.0001 (.0001)
In Pre-College Major	-.0012 (.0020)	-.0002 (.0002)	.0011 (.0009)	-.0038 (.0025)	.0033 (.0035)
(In Pre-College Major) *ACT	.0001 (.0001)	.00001 (.00001)	-.00004 (.00003)	.0002 (.0001)	-.0001 (.0001)
Course Fixed Effects	Yes	Yes	Yes	Yes	Yes
N (students X subjects)	29,591	24,185	18,805	13,655	2,440
N (students)	20,191	15,319	12,107	5,612	2,434

* Significant at the 5% level ** Significant at the 1% level

Standard errors correct for correlation within observations of the same student. Regressions include controls for gender, race, state of residence, and total credits taken in the semester. Models also include controls for courses taught by graduate assistants and fixed effects for campus, department subject, and term. The departments not listed separately but included in "All Subjects" are Communications, Math, Engineering, Archi tecture, Education, and Social Work.

Table 9a: Effect of Adjuncts on the Pass Rate in Subsequent Courses – *Across Subjects*

	Dependent Variable: Proportion of Classes Passed after 1st Exposure to Subject			
	(1)	(2)	(3)	(4)
Proportion Adjunct in 1st Semester	-.0004 (.0022)	-.0005 (.0022)	-.0034 (.0024)	-.0035 (.0024)
ACT Score	.0064** (.0003)	.0066** (.0003)	.0045** (.0003)	.0046** (.0003)
In Pre-College Major		.0461* (.0188)		.0205 (.0211)
(In Pre-College Major) *ACT		-.0024** (.0008)		-.0013 (.0009)
Course Fixed Effects	No	No	Yes	Yes
N (students X subjects)	119,980	119,980	119,980	119,980
N (students)	23,151	23,297	23,927	23,927

* Significant at the 5% level ** Significant at the 1% level

Standard errors correct for correlation within observations of the same student. Regressions include controls for gender, race, state of residence, and total credits taken in the semester. Models also include controls for courses taught by graduate assistants and fixed effects for campus, department subject, and term.

Table 9b: Effect of Adjuncts on the Pass Rate in Subsequent Courses – *Within Subject*

	Dependent Variable: Proportion of Classes Passed after 1st Exposure to Subject				
	Humanities	Social Sciences	Sciences	Business	Computer Science
	(1)	(2)	(3)	(4)	(5)
Proportion Adjunct in 1st Semester	-.0088 (.0051)	-.0133* (.0057)	.0084 (.0078)	.0064 (.0051)	.0154 (.0177)
ACT Score	.0029** (.0005)	.0053** (.0006)	.0069** (.0007)	.0037** (.0006)	.0032 (.0020)
In Pre-College Major	.0366 (.1064)	.1884** (.0725)	.0113 (.1061)	-.0292 (.0389)	-.1835 (.1211)
(In Pre-College Major) *ACT	-.0006 (.0041)	-.0086** (.0031)	-.0005 (.0041)	.0007 (.0016)	.0058 (.0049)
Course Fixed Effects	Yes	Yes	Yes	Yes	Yes
N (students X subjects)	29,590	24,184	18,802	13,639	2,439
N (students)	20,191	15,318	12,107	5,607	2,433

* Significant at the 5% level ** Significant at the 1% level

Standard errors correct for correlation within observations of the same student. Regressions include controls for gender, race, state of residence, and total credits taken in the semester. Models also include controls for courses taught by graduate assistants and fixed effects for campus, department subject, and term. The departments not listed separately but included in "All Subjects" are Communications, Math, Engineering, Architecture, Education, and Social Work.

Table 10a: First-Stage Estimates of Likelihood of Taking Adjunct Proffessor

Dependent Variable	Proportion of Adjuncts Taken During 1st Semester Exposure to Subject	
	(1)	(2)
Proportion Deviation in Tenured Faculty	-.5521** (.0081)	-.6179** (.0136)
Proportion Deviation in Tenure-Track Faculty	-.5490** (.0108)	-.6131** (.0179)
ACT Score	-.0007** (.0002)	-.0023** (.0003)
In Pre-College Major	-.0349 (.0284)	-.0534 (.0305)
(In Pre-College Major) *ACT	.0004 (.0012)	.0013 (.0013)
N (students X subjects)	236,005	119,760
N (students)	25,255	23,151

* Significant at the 5% level ** Significant at the 1% level

Sample is restricted to those students who took the ACT exam. Standard errors correct for correlation within observations of the same student. Regressions include controls for gender, race, state of residence, total credits taken in the semester. Models also include fixed effects for campus, term, and department subject.

Table 10b: IV Estimates of Effect of Adjunct Instructors

Dependent Variable	Total Credit Hours Taken after 1st Exposure to Subject	Any Class Ever Taken after 1st Exposure to Subject	Proportion of Classes Passed in Subsequent Courses
	(1)	(2)	(3)
Proportion Adjunct in 1st Semester	2.702** (.2223)	.0260* (.0146)	-.0176 (.2016)
ACT Score	.0171** (.0059)	-.0020** (.0004)	.0127 (.0372)
In Pre-College Major	-.8216* (.4438)	.3671** (.0292)	.0394 (.1335)
(In Pre-College Major) *ACT	.3212** (.0190)	-.0048** (.0012)	-.0014 (.0044)
N (students X subjects)	236,005	236,005	119,760
N (students)	25,255	25,255	23,151

* Significant at the 5% level ** Significant at the 1% level

Sample is restricted to those students who took the ACT exam. Standard errors correct for correlation within observations of the same student. Regressions include controls for gender, race, state of residence, total credits taken in the semester. Models also include controls for courses taught by graduate assistants and fixed effects for campus, term, and department subject. The instrumental variables for having an adjunct instructor are the deviation from the steady state percentage of tenured and tenure-track faculty members by department for a particular term.