Help or Hinder? Adjunct Professors and Student Outcomes

Eric Bettinger
Case Western Reserve University and NBER

Bridget Terry Long
Harvard Graduate School of Education and NBER

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ABSTRACT

College and universities are increasingly using part-time, adjunct instructors on their faculties to facilitate greater fiscal flexibility. However, critics argue that the use of adjuncts is causing the quality of higher education to deteriorate. This paper addresses questions about the impact of adjuncts on student outcomes. Using a unique dataset of public four-year colleges in Ohio, we quantify how having adjunct instructors affects student persistence after the first year. Because students taking courses from adjuncts differ systematically from other students, we use an instrumental variable strategy to address concerns about biases. The findings suggest that, in general, students taking an "adjunct-heavy" course schedule in their first semester are adversely affected. They are less likely to persist into their second year. We reconcile these findings with previous research that shows that adjuncts may encourage greater student interest in terms of major choice and subsequent enrollments in some disciplines, most notably fields tied closely to specific professions.

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I. INTRODUCTION

Adjuncts, defined as part-time instructors, are becoming an increasing proportion of college faculties. From 1987 to 1999, the percentage of courses taught by adjuncts at public research universities increased by 50 percent, and adjunct usage increased by 80 percent in public doctoral universities (NCES 1997, 2001). While some of these increases have been made to accommodate the growing number of students enrolling in higher education, college administrators at some institutions have preferred hiring adjuncts over traditional faculty members. Between 1993 and 1998, 40 percent of universities eliminated full-time faculty positions in favor of adjuncts (NCES, 2001).

The trend in adjunct usage is driven by many factors. In our previous work (Bettinger and Long 2004), we documented many of these factors. For example, adjuncts are as much as 80 percent less expensive than full-time faculty (CUPA-HR 2001). This cost savings is even greater considering that adjuncts often do not receive employment benefits (NCES 2001). Additionally, mandatory retirement was eliminated in 1994; hence, the cost of granting tenure has increased (Ehrenberg, 2002), and this may have led universities to employ fewer tenure-track faculty members as non-tenured, temporary labor, adjunct instructors afford colleges cost savings and greater flexibility.

The increased use of adjuncts is not without critics. The National Institute of Education (1984) claimed that adjuncts cannot provide the same quality of education because many adjuncts do not have Ph.D.s or other terminal degrees. Furthermore, the Modern Language Association (MLA) has claimed that the increased usage of part-time faculty has led to a deterioration in university quality (MLA 2002). While several papers document the growing trend in adjunct teaching (Burgan, Weisbuch, and Lowry 1999, Balch 1999) and their employment conditions (Gappa 2000, NCES 2001), education researchers have just begun to produce research relating the use of adjuncts to student outcomes.

Research has been slow to develop in this field primarily because of a lack of data linking students and their collegiate outcomes to instructors and their characteristics. National datasets such as Baccalaureate and Beyond and the National Education Longitudinal Study of 1988 document students' experiences and outcomes. Other datasets such as the National Study of Postsecondary Faculty document characteristics of universities' faculties. Without a way to link students and their instructors, researchers have had to focus on either case studies on particular institutions (e.g. Norris 1991) or comparisons of institution-level outcomes and institution-specific experiences with adjuncts (e.g. Ehrenberg and Zhang 2004). However, in recent years state higher educational systems in Ohio, Florida, and elsewhere have begun to make system-wide data available to researchers. These data provide rich detail on students' experiences with adjuncts at the institutional level as well as in specific classes and departments. We use administrative data from Ohio's four-year colleges in this paper. Ohio's data include college transcripts on students' course-taking behavior and performance as well as the characteristics of the corresponding faculty member responsible for each course. In addition, the Ohio Board of Regents (OBR) provides information on each student's background, high school performance and academic interests, and college entrance exam scores.

In the research conducted to date, there is evidence suggesting that adjuncts may have both positive and negative effects. For example, recent work by Ronald Ehrenberg and Liang Zhang (which is part of this conference) shows that universities with a greater reliance on adjuncts tend to have higher dropout rates. Meanwhile, in other work (Bettinger and Long 2004), we find that students taking their introductory courses from adjuncts are more likely to take subsequent courses in the same subject in comparison to students who had full-time faculty members. This is especially true in professional

disciplines such as engineering and education suggesting that adjuncts may help foster student interest in some subjects.

Of course, analyzing the impact of adjunct instructors is not straightforward. Understanding their effects is much more difficult than just comparing the outcomes of students with and without adjuncts. As we show below, students who take courses from adjuncts differ systematically from students who do not have them, and so students may be actively trying to avoid or be assigned an adjunct instructor. For example, students in classes with adjuncts tend to have lower ACT scores and are less likely to denote interest in the subject as a potential major. This is true even within courses that offer multiple sections with different types of instructors. Additionally, there are certain departments that rely more heavily on adjuncts, and since students choose their schedules, some students may be more likely to have an adjunct instructor because of interests in a particular department. There may be other unobservable characteristics that determine who takes adjuncts and who does not, and if these characteristics are also related to educational outcomes (such as student ability), then simple comparisons will be biased.

To overcome this, we use an instrumental variable strategy. A good instrument should be correlated with the endogenous variable of interest – taking courses from adjuncts. It should also be uncorrelated with the student outcome of interest, which in this paper is student persistence from the first to second year of school. Our specific instrument relies on variation in the department composition of faculties. As we observe in our data, when professors retire, take a leave of absence, or make some other commitment, teaching loads are affected. Consequently, from year to year, there is variation in the number of full-time faculty who are available to teach courses. This variation is likely exogenous to student outcomes, but as we show below, these movements in faculty are correlated with adjunct usage. When departments face unexpected fluctuations in faculty numbers, they often fill these temporary vacancies with adjuncts.

Our basic results suggest that students who have more adjunct instructors during their first semester are less likely to persist into their second year. We also review the evidence from our earlier work which suggested that adjuncts can be effective instructors in many disciplines. Students who take courses, particularly in professional fields, take more subsequent courses in the same department. Therefore, although the use of adjuncts leads to lower overall student persistence, adjunct instructors also encourage subsequent enrollments in a subject. Our results are consistent with the conclusions of Ehrenberg and Zhang: while adjuncts may teach effectively in many fields, they do not appear to help integrate first-year students into the university.

Section 2 of the paper reviews previous research relating student outcomes to teacher characteristics and previous research on the growing use of adjuncts. Section 3 presents a brief theoretical framework. Section 4 discusses the data and empirical methodologies. Section 5 presents and discusses our key instrumental variables estimates. Section 6 concludes.

II. LITERATURE REVIEW

Little is known about how faculty characteristics affect student outcomes in higher education. In contrast, the relationship between student outcomes and teacher quality has been a perennial theme in the K-12 literature. There is a large literature that traces how teacher experience, education, college performance, gender, and other characteristics correlate with student outcomes (e.g. Ehrenberg and Brewer 1994, Rockoff 2004, Hanushek 1986). The studies find, for example, that teacher quality

positively affects students as does experience, completion of higher degrees (although not always estimated to have a positive effect), and teacher licensure. Researchers have also characterized how changes in educational policies affect teacher supply. For example, Hoxby (2002) measures what types of teacher characteristics districts value when they face strong competitive pressures. Figlio and Rueben (2001) use the test scores of education majors to gauge how tax limits affect the quality of new teachers. Each study is motivated by the assumption that the supply of different types of teachers affects student outcomes.

In terms of higher education, few papers exist that explore the link between student outcomes and faculty characteristics. However, many papers track the increased reliance of colleges and universities on adjunct instructors. 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) claims that the increased use of part-time faculty is a trend that will continue to persist.

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. Researchers have also examined the institutional impact of adjuncts at their particular institutions. For instance, Haeger (1998) discusses the problems and solutions associated with adjunct instructors at Towson University.

While higher education researchers have been hampered by a lack of data in determining the impact of adjuncts on student outcomes, several have speculated about their likely 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 (2002), 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 and declines 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 2000, and Fulton 2000). Given the fact that many have expressed feelings of being treated as second-class citizens, Leslie (1995) questions how their treatment affects the quality of education adjuncts are able to supply.

Two recent studies use new datasets to explore the impact of adjuncts. Ehrenberg and Ziang (2004) examine the effects of adjuncts on student dropout rates using institutional-level data from a national sample of four-year colleges. In their analysis, they relate information on the proportion of incoming freshmen who persist into their second year to data on what proportion of classes are taught by adjuncts at each college. They find a negative relationship between persistence and adjunct usage – heavy reliance on adjuncts is correlated with higher dropout rates. One concern with this study that

highlights the difficulty in estimating the effects of adjuncts is that schools with a higher proportion of adjuncts may also be more likely to have students on the margin of dropping out, and this could bias the results. For example, in the data we examine, students at non-selective institutions typically have poorer academic performance in high school and are more likely to have adjunct instructors than students at selective institutions. However, the results draw attention to the effects of adjuncts on student outcomes and provide some hint of the empirical difficulties inherent in estimating the impact of adjuncts.

In other work, we estimate the effects of adjuncts on student engagement in specific subjects (Bettinger and Long 2004). Similar to the methodology used in this paper, we use exogenous variation in the faculty available to teach in a given semester. This variation leads students to be more or less likely to take a particular course from an adjunct professor depending on the semester that the student enrolls in the course. We link these initial enrollments to subsequent course-taking behavior and major choice. Our findings suggest that adjuncts are effective in many fields in motivating students to take subsequent classes in the same subject. This is especially true in professional fields where adjuncts often have prior professional work experience, which they can share with students. Similarly we find that adjuncts can positively affect the likelihood that students major in a particular subject.

Our prior work also looks at the effectiveness of graduate student instructors. We find that these instructors are often not as proficient as either full-time faculty or adjunct professors in encouraging students to enroll in subsequent courses. Other researchers have also looked at these issues at particular institutions. For example, Borjas (2000) analyzes the impact of foreign teaching assistants on economics students' performances at Harvard, and Norris (1991) also examines the effect of nonnative English-speaking teaching assistants on students at the University of Wisconsin. While these studies focus on small samples at selective institutions, the results are similar to those found using our sample of the diverse set of public four-year colleges in Ohio.

III. THEORETICAL FRAMEWORK

In this section, we sketch two economic models to characterize the importance of knowing the effects of adjuncts on students. Additionally, we suggest reasons why students who take classes with adjuncts may differ systematically from other students.

The Demand for Adjuncts: Students' Course-Taking Behavior

One way to model the effects of adjuncts is to look at how students choose courses. Presumably, students choose the course, schedule, and faculty member that maximizes utility (current leisure/work and future educational returns), and they can either have an adjunct or tenure-track instructor. The two types of instructors may differ in several possible ways. First, teaching ability and quality may differ by type of instructor. On the one hand, adjunct teachers are not as involved in research, so to the extent that research influences teaching quality, full-time faculty may be better teachers. On the other hand, adjuncts do not have research or service requirements and can therefore specialize in teaching.

Adjunct and full-time professors may also differ in their general knowledge. Because adjuncts are typically temporary, adjuncts often do not have the same stock of information about the university as full-time professors. For example, adjunct professors may not be as effective as full-time faculty in advising students or in arranging research opportunities that may prepare students for graduate-level education and integrate them into their undergraduate studies. In the extreme case, if adjunct faculty do

not help to integrate students into the college as a whole, then one might expect students taking many courses with adjuncts to be disaffected and to withdraw. Moreover, adjuncts are often on temporary contracts and so they may not be able to develop multi-year relationships with students. 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 ex-CEO of a Fortune 500 company as compared to 28-year old new assistant professor.

The types of instructor students have for a given subject may also influence their choices. For example, students may choose their courses (and majors) based on their comparative advantage in a given subject (i.e. students choose to take classes and/or major in subjects in which they have a strong foundation of knowledge). If a student takes a course from a particular type of instructor and gains additional knowledge in a subject, then that could change the subject in which the student has a comparative advantage. This could be particularly important due to general education requirements that force students to take classes in multiple subjects. Exposure to different kinds of instructors in those required courses could change a students' comparative advantage to an unexpected subject. Likewise, if early exposure in an intended major results in little information being acquired, the student might change to another field. This might especially be the case if knowledge in one course affects students' success in subsequent courses. These patterns of encouraging new majors or losing intended majors could have serious implications for departmental enrollments and, at many places, institutional funding.

Finally, students' beliefs of the relative effectiveness of full-time versus adjunct instructors could impact their course selection. Regardless of the truth, beliefs about the relative quality of the different types of instructors along the dimensions described above could prompt students to sort across classes and sections in nonrandom ways. If the students who exercise instructor choice based on beliefs differ from other students, the match of instructors to students will suffer from selection. To the degree that the student characteristics are also related to educational outcomes, comparisons of students with and without adjunct instructors will be biased. Our results below highlight that students of higher ability appear to avoid adjunct instructors.

The Supply of Adjuncts and Specialization within Departments

We could also model the interaction between students and adjuncts from the supply-side. Assume universities and departments attempt to maximize student outcomes, faculty research, and other outputs 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 are perfect substitutes in terms of educational quality, then part-time faculty (i.e. adjuncts) can help reduce or maintain smaller class sizes without any loss of quality. However, if part-time and full-time faculty are imperfect substitutes, then the university suffers a cost. These costs may be the loss of prestige associated with a reduction in quality, an increase in student dropouts, and decreases in student enrollments or the number of student majors in a given department.

We can make similar comparisons in terms of student advising. If part-time faculty are not as effective advisors as full-time faculty, then an increased reliance on adjuncts may impose costs on the university. There may also be administrative costs to managing a faculty with more adjuncts. For

instance, positions with adjunct instructors tend to suffer from frequent turnover. As a result, administrators have to continually locate, hire, and manage a changing workforce. Departments may be able to minimize costs by employing full-time faculty instead of adjuncts in places where the marginal cost of an adjunct 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.

Once we include research products from a university, the cost-benefit analysis changes. If part-time and full-time faculty are complements, then part-time faculty might facilitate greater specialization and increased research productivity among the full-time faculty. Since departments enjoy a cost savings with adjunct faculty, they have surplus that can be reallocated to full-time faculty. This surplus could take the form of teaching buyouts, research funds, or other items that enhance research productivity. The result could be increased research productivity. As before, there may be substantial heterogeneity amongst 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.[1] While department chairs may also care about these objectives, an additional concern is enrollment in their field. 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 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 discussions of 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 adjuncts on enrollment is important in assessing the costs of adjuncts.

IV. EMPIRICAL STRATEGY AND ISSUES

The Data

The paper focuses on full-time, traditional-age, first-time freshman who entered public, four-year colleges in Ohio in Fall 1998 or Fall 1999. 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.

The most important sources of information for this project are the students' transcripts which detail every course in which a student enrolls.[2] From these data, we know the following information for

[1] 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.

[2] For schools on quarters rather than semesters, OBR converts the hours to semester hours.

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.

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 from 1998-2003). 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 who attend private schools in Ohio are excluded from the sample.[3] Additionally, students who transfer from Ohio public institutions to institutions located in other states are indistinguishable in the data from students who drop out 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. Furthermore, these data do a much better job at tracking students than previous work.

Table 1 shows characteristics of students in our sample. The first two columns show data for all full-time students who entered one of the 13 main university campuses in 1998 or 1999 for the first-time. We restrict ourselves to traditional age students (i.e. students entering as freshman between 18-20 years of age). The first column shows characteristics of all Ohio students while the subsequent columns describe characteristics of students at the five selective colleges in Ohio and the other eight open admission four-year colleges respectively.[4]

About 6 percent of students at selective colleges are African-American while 11.1 percent of students at non-selective colleges are African-American. 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 54 percent of the student body at non-selective colleges.

Table 2 shows the distribution of adjunct usage across universities in Ohio. To maintain the anonymity of institutions (as part of our agreement with the Ohio Board of Regents), we mask the names of the institutions. The average first-year student takes between 18 and 42 percent of courses during their first semester from adjuncts. There are 5 campuses where students take at least 30 percent of courses in their first semester from adjuncts. There is much more variation in students' exposures to graduate students. The average first-year student takes between 1 and 40 percent of courses during their first semester from graduate students.

While there is much variation across campuses, students' experiences within campuses also exhibit much heterogeneity. Depending on students' schedules, students may have substantially different

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[3]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 1998). In the 2002 version of US News & World Reports' college rankings, Miami ranks in the second tier (53rd-131st) of national universities with doctoral programs. Other high ranking institutions in Ohio (e.g. Oberlin) are private colleges.

[4] We define selective institutions as the "competitive" institutions defined by Barron's Educational Guides (Barrons 1998). These include Bowling Green State University, Miami University, Ohio State University, Ohio University, and Youngstown State University.

experiences with adjuncts. We demonstrate this in Table 3 by showing how adjunct usage varies across departments in Ohio. The sample here includes all instructors teaching between 1998 and 2003. Column 1 shows the distribution within selective colleges, while Column 2 shows the distribution at non-selective colleges. Columns 3 and 4 show reliance on graduate students. As the table illustrates, there are difference both across departments and across selective and non-selective campuses. Generally, non-selective colleges rely more heavily on adjuncts. Additionally, there is substantial adjunct representation in computer science, business, and education. In these professional fields, adjuncts tend to have work experience. The biological and physical sciences, political science, and sociology departments employ fewer adjunct instructors. Hence, a student majoring in these fields will be less likely to take adjuncts. Additionally, professional fields such as business also have heavier reliance on adjuncts then other classes.

Empirical Strategies

We focus on the student as the level of observation. By doing so, we can measure the effect on outcomes such as persistence. The key dependent variable is the percentage of courses that students take from adjunct faculty during their first semester. We can relate this to outcomes such as dropout rates and likelihood of transferring to other schools. We will estimate equation (1) in these models:

(1) $$y_i = \alpha + \beta Adjunct_i + \gamma X_i + C_j + P_{ij} + \varepsilon_i$$

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. The P_{ij} is a series of "portfolio" effects. These portfolio effects are a series of dummy variables which control for the unique mix of classes that a student takes. We motivate their inclusion and discuss them in greater depth below.

Student Selection Issues

As we show in Tables 2 and 3, there is substantial heterogeneity across institutions and across departments. There is also substantial heterogeneity in adjunct usage both within universities and within departments at specific universities. In fact, the distribution of students across courses taught by adjuncts and full-time faculty members may not be random at all. This may be due to a combination of supply and demand issues. For example, if adjuncts are more likely to teach in particular departments or during evenings or weekends, then certain 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 raw comparisons of students with adjuncts to students without adjuncts may be biased. Hence, OLS estimates of equation 1 may be biased.

Table 4 demonstrates the relationship between adjunct usage and student characteristics. The dependent variable is the proportion of credits taken from adjuncts during a student's first semester (either Fall 1998 or Fall 1999). We regress this against students' ACT scores, race, gender, state of residence,

age, and campus fixed effects. As the coefficient on ACT demonstrates in the first column, students with higher ACT scores take a smaller proportion of adjuncts. The relationship is statistically significant over a 95 percent confidence interval. In the case of race, gender, state of residence, and age, we do not find any statistically significant relationships.

In the second column of Table 4, we perform the same regression except we include "portfolio" effects. The portfolio effects are a series of dummy variables representing every possible schedule that students may have taken in their first semester. For example, one portfolio may include English, math, biology, and economics. Another portfolio may include English, physics, math, and a foreign language. By including portfolio effects, we are comparing students across campuses and years who took a similar selection of courses. As the coefficient on ACT score shows, even among students with similar schedules, students with higher ACT scores are less likely to take adjuncts during their first semester. In this second regression, it also appears that men take fewer courses from adjuncts, although this relationship is only marginally significant.

There are a number of reasons why ACT and adjunct usage may be negatively related. Some universities allow students with high ACT scores to register for classes sooner than other students. If these students prefer to take full-time faculty or are more likely to choose a known commodity (e.g. Professor Smith) over an unknown commodity (e.g. STAFF), then one would expect a negative relationship between adjuncts and ACT scores. Similarly, if departments assign adjuncts to classes at times of the day that are less likely to attract top students (e.g. night classes), then we would expect a negative relationship between adjuncts and ACT scores. However, regardless of the reason, the relationship between adjuncts and ACT scores is problematic to simple comparisons of students taking adjuncts and not taking adjuncts.

In our previous work, we found similar results when analyzing data at the student-subject level. Within departments, students with lower ACT scores are more likely to take adjuncts. Even amongst students who took the same course as their introduction to a given department, students with lower ACT scores are more likely to take adjuncts. Moreover, we found that students who expressed interest in a given subject are less likely to take courses from adjuncts.

So, how should one proceed econometrically? First, there is an open concern over whether the observed selection on ACT scores fully captures adjunct taking behavior. If so, then controlling for ACT scores should rectify the selection problem. One might also question whether the observed selection on ACT scores is economically significant and not only statistically significant. Because of our large sample sizes throughout the paper, we will often find statistically significant results that are precisely estimated. In the student level regressions, the marginal effect of a one point increase in the ACT score corresponds to a 0.3 percent decrease in the percentage of their instructors who are adjunct professors. These effects are extremely small suggesting that selection, if caused by observable ACT scores, may be quantitatively small.

The more problematic case, however, is the case where selection is based on unobservable characteristics. Underlying the observable effect of ACT scores may be a more problematic unobservable characteristic (e.g. the desire to attend graduate school). While we can control for the portion of this unobservable characteristic that ACT scores explain, we cannot be sure that we fully control for the omitted variable bias resulting from this unobservable characteristic. Since this unobservable

characteristic would likely affect student outcomes, it will bias simple OLS comparisons of adjunct takers and non-takers.

Instrumental Variables

Because OLS may be biased due to the relationship between unobservable characteristics that may affect both student success and student sorting, we rely on instrumental variables (IV) to estimate out the effect of adjuncts on student outcomes. For IV to work, we must find an instrument that is correlated with adjunct taking behavior but uncorrelated with any unobserved selection process. One such instrument is the deviation from the steady-state number of tenured and tenure-track faculty. In our data, we observe 5 fiscal years of department level faculty data. Across semesters and years, the proportion of faculty that are assistant professors, associate professors, or full professors varies. This variation comes from a number of sources such as promotions, retirements, leaves of absence, and unexpected outcomes in the hiring process.

To capture this, we estimate the deviation from the steady-state department levels of assistant, associate, and full professors for every department. We use the three different levels of faculty because there are some differences in teaching loads across faculty ranks. Variation in these proportions is correlated with the likelihood that a department relies on adjuncts to teach a course in a given term but likely uncorrelated with student outcomes. In student-subject level regressions, we can directly compare these department-level deviations to the likelihood that a student took a course from a particular type of professor in a particular department in a given semester. When we run the student-level regressions, we combine the variations from the individual departments by creating a student-level weighted average of the variations where the weights are the semester hours of the courses the students took during their first semesters.

In the student-level regressions, this still may be problematic because of the composition of students' schedules. If a student takes courses from a series of departments where the probability (given our instrument) of taking an adjunct is high, then our instrument will reflect the fact that this student had a heavy adjunct schedule; however, the instrument will also reflect potential effects from taking a schedule with this combination of classes. It may be that students with this type of schedule are predisposed to withdraw regardless of the type of instructors in the courses. Hence, from a causal perspective, it is unclear whether the use of adjuncts or the combinations of classes from particular departments influenced students' dropout behaviors.

We can fix the problem caused by aggregating our instrument by including controls for the specific schedules of the students. Earlier we mentioned "portfolio effects." The "portfolio effects" control for the different schedules. Hence, when we include these portfolio effects, we are comparing outcomes among students with the same schedule. In terms of our instrumental variables strategy, we are parsing out the effect of schedule design from our aggregated instrument. The variation that is then left in our instrument is coming from variation across campuses and years rather than across different schedules.

We present the first-stage results in column 3 of Table 4. The coefficient on the deviation from steady-state number of assistant professors is -.220. It is highly significant. The interpretation of the results suggests that if across all of the departments in which a student is taking classes, there is on average a one percent increase in the number of assistant professors relative to the steady-state number of assistant professors, the student will have about 22 percent less adjuncts in their first semester. As a

numerical example, suppose that a student takes 5 three-credit courses from five different departments. If each of those departments is above their steady-state level of assistant professors by about 1 percent and as a result will employ fewer adjuncts. Of the five courses, students will take about one fewer course from an adjunct than they might have otherwise because of the surplus of assistant professors in each of the departments. Similarly, the relationships between the deviations from steady-state

V. EMPIRICAL RESULTS

We present our basic results in Table 5. The first two columns show OLS estimates of the effects of adjuncts on dropout rates. These columns show no effect of adjuncts on dropout rates. The point estimate is small and the confidence intervals are tight. Even when we control for students schedules in Column 2, we find little evidence that adjuncts affect dropout rates. However, these OLS estimates are likely biased. As we showed in Table 4, students with higher ACT scores are more likely to have adjuncts. While we control for ACT scores in these regressions, there may be unobservable characteristics related to taking an adjunct that are missing from the equation. For example, suppose that "harder working" students are less likely to drop-out and that they are less likely to take classes from adjuncts. If this is the case, then OLS should be biased downward.

In Columns 3 and 4, we show IV estimates of the effects of adjuncts on dropout rates. By contrast to the first columns, the IV results suggest that as students take more adjuncts in their first semester, their likelihood of dropping out also increases. The magnitude of the coefficient in Column 3 is large implying a 1 percentage point increase in the level of adjuncts corresponds to a 1 percentage point increase in dropout rates. These results are strongly suggestive that adjuncts negatively affect student engagement at the university; however, they may be difficult to interpret because they do not control for student course selection. Column 4 shows results that correct for course selection by including portfolio effects. The coefficient on the percentage of courses from adjuncts is positive as before but much smaller in magnitude. A 1 percentage point change in the percentage of courses from adjuncts corresponds to a 0.6 percent change in the likelihood of dropping out.

Table 6 also includes a control for the proportion of graduate students that students have during their first semester. We treat this as endogenous as well and instrument for it like we do for the proportion of adjuncts. Similar to the effect of adjuncts, we find that as the proportion of courses a student takes from graduate student increases, so too does the likelihood that this student drops out.

The interpretation of these results is very straightforward and unambiguous. In the first semester of a student's academic career, it matters what types of professors they meet on campus. If they take large proportions of classes from adjuncts and graduate students (after controlling for selection bias), they are more likely to drop out of the institution. This likely validates claims that adjuncts are ill-prepared to help integrate new students into a specific college. It also may give some empirical justification for mentoring programs or other programs designed to help first-year students interact directly with full-time faculty in their initial semester at school as these programs may lessen the negative impact of adjuncts by helping to integrate students with full-time faculty members.

VI. CONCLUSIONS

Estimating the effects of adjuncts on student outcomes is an important yet difficult task. Given the recent trends towards increased usage of adjuncts, knowing their impact on student outcomes is a

first-order priority. This paper takes an important step in identifying the effects. The central contribution is twofold. First, this paper demonstrates how simple comparisons of students who take adjuncts to students who do not are somewhat misleading. Students with high ACT scores systematically avoid adjuncts. If similar sorting takes place along unobservable characteristics, simple comparisons will be biased. Moreover, students in some departments (e.g. humanities) and at some schools (e.g. non-selective colleges) are more likely to take adjuncts. Simple comparisons may not control for differences in students' schedules which may be correlated with both adjunct usage and persistence.

We present a simple instrumental variables approach to control for these selection issues. We exploit variation in faculty composition to identify shifts in the likelihood that students take adjuncts. If the proportion of faculty members with a given rank drops relative to the steady-state, then students are more likely to take adjuncts. This creates exogenous variation that we can then use to identify the effects of adjuncts on dropout rates. Our results suggest that adjuncts adversely affect student dropout rates. Even when we compare students with similar schedules, we find the same results. The results when coupled with those in our previous work suggest mixed results for adjuncts.

On the one hand, taking an "adjunct-heavy" course schedule negatively affects students. In their first semester, taking courses from full-time faculty members is important for retention. This may provide some empirical evidence to support the shifts in some colleges to full-time faculty staffing of first semester classes. Reducing the quantity of time that adjuncts spend with students and increasing interactions with full-time faculty may facilitate student engagement at the institution. On the other hand, such a solution is expensive. Adjuncts are very inexpensive relative to full-time faculty. Additionally, in many fields, adjuncts are effective teachers who can motivate students to continue studying in a given discipline. We hope that future research can shed additional light on the costs and benefits of adjunct usage.

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

	All Students	Students at Selective Four-years	Student at Nonselective Four-years
A. Student Level Data			
Female	.5471	.5513	.5413
White	.8508	.8701	.8235
Black	.0815	.0600	.1118
ACT Score (36 max)	22.41 (4.22)	23.24 (4.03)	21.25 (4.22)
Observations	43,177	25,312	17,865

Notes: Standard deviations are shown in the parentheses. Sample is restricted to first-time, full-time freshman who are of traditional age (18 to 20 years old) and entered a public, four-year college in Ohio during Fall 1998 or Fall 1999. Students must also have taken the ACT. Selective institutions are defined as "competitive" institutions by Barron's Educational Guides (1997) and include Bowling Green State University, Miami University, Ohio State University, Ohio University, and Youngstown State University.

Table 2. Percent of Enrollments with Adjuncts and Graduate Students in 1st Semester of College

	Enrollments with Adjuncts in 1st Semester	Enrollments with Grad Students in 1st Semester
A	32.15	11.38
B	26.93	7.44
C	39.89	2.70
D	33.93	30.70
E	18.53	17.43
F	22.73	24.48
G	24.00	20.46
H	42.76	5.97
I	23.71	11.49
J	39.64	1.36
K	17.98	40.80

Notes: Rows identify four-year campuses in Ohio. The average is over all first-time freshmen in the Fall semester of their first year. The sample includes students whose initial enrollment was in Fall 1998 or Fall 1999.

Table 3: The Use of Adjuncts by Institution and Subject

	Percent of Instructors that are Adjuncts (part-time)		Percent of Instructors that are Graduate Students	
	Selective Campuses	Non-selective Campuses	Selective Campuses	Non-selective Campuses
All Departments	16.81	21.76	19.92	3.44
Computer Science	41.37	50.65	20.71	1.62
Business	23.20	17.97	3.99	1.20
Education	20.09	36.38	32.22	5.63
Foreign Languages	17.97	26.09	26.93	4.73
Humanities	17.26	20.57	28.64	4.91
English	20.61	17.19	28.53	7.59
History	19.70	14.21	28.09	4.48
Journalism and Communication	17.24	19.47	8.93	0.69
Mathematics and Statistics	17.02	17.71	16.50	4.31
Engineering	15.68	5.314	4.25	0.43
Social Sciences	14.58	24.02	22.75	3.00
Economics	16.06	25.14	13.37	1.67
Political Science	5.92	10.63	22.09	2.54
Sociology	7.47	13.19	27.55	6.05
Sciences	8.10	8.58	8.83	3.93
Biological Sciences	5.67	6.55	10.26	3.97
Physical Sciences	13.15	3.67	11.57	2.94

Notes: Restricted to active faculty teaching between 1998 and 2003 at the undergraduate level. 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). The sub-groups shown under the departments are not a complete list.

Table 4. Determinants of the Proportion of Classes from Adjuncts in 1st Semester

	(1)	(2)	(3) IV-First Stage
Act Composite	-0.004** (0.00020)	-0.003** (0.0002)	-.003*** (.0002)
Black	-0.001 (0.004)	-0.003 (0.004)	-.003 (.004)
Male	-0.0003 (0.001)	-0.003* (0.002)	-.004** (.001)
Instate	0.010 (0.020)	0.011 (0.019)	.014 (.018)
Age	0.001 (0.001)	0.002 (0.002)	.003** (.001)
Average Deviation from Steady-State Level of :			
Assistant Professors			-.220*** (.0154)
Associate Professors			-.077*** (.017)
Full Professors			-.179*** (.011)
Portfolio Effects	No	Yes	Yes
Observations	40977	40977	40977
R-squared	0.491	0.591	.440

Robust standard errors are in parentheses. Regressions also include controls campus fixed effects.
* significant at 10%; ** significant at 5%; ** significant at 1%

Table 5: OLS and IV Estimates of Effects on Dropout Rates

	(1)	(2)	(3)	(4)
	OLS		IV	
Proportion of Classes from Adjunct in 1st Semester	0.004 (0.012)	0.007 (0.014)	1.15** (0.348)	0.601** (0.253)
ACT Score	-0.008** (0.0004)	-0.007** (0.001)	-0.003* (0.002)	-0.005** (0.0012342)
Proportion of Classes from Grad Student in 1st Semester			0.366** (0.118)	0.432** (0.195)
Class Schedule Portfolio Effects	No	Yes	No	Yes
Observations	40977	40977	40977	40977

Robust standard errors are in parentheses. Regressions also include controls for race, gender, state of residence, age, and campus fixed effects.
** significant at 5%