



When inputs are outputs: The case of graduate student instructors



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ABSTRACT

We examine graduate student teaching as an input to two production processes: the education of undergraduates and the development of graduate students themselves. Using fluctuations in full-time faculty availability as an instrument, we find undergraduates are more likely to major in a subject if their first course in the subject was taught by a graduate student, a result opposite of estimates that ignore selection. Additionally, graduate students who teach more frequently graduate earlier and are more likely to subsequently be employed by a college or university.

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1. Introduction

There are few cases in economics where inputs into the production function are also outputs in the production function. However, such is the case in the production of doctoral students. Doctoral students are essential inputs to significant outputs in higher education. They provide research support, generate peer effects on each other, and often teach undergraduate students. Doctoral students are also an important output in education. Graduate programs define and often rank themselves by the quality and quantity of doctoral students they produce. Moreover, among those who go on to work in higher education, the productivity of graduate students in their subsequent careers is another important "output" of doctoral programs in that it increases the prominence of the doctoral-granting organization, increases the status of the doctoral adviser, and

contributes to the subsequent education of new scholars in the field.

To date, there is very little research on the productivity of graduate students and on the relationships between their graduate activities and subsequent careers, particularly with regards to their teaching responsibilities while enrolled in school. What research there is with regards to the teaching function of graduate students, however, suggests that undergraduates that have a graduate student as their instructor, particularly non-native English speaking graduate students, suffer worse outcomes than comparable students that have faculty instructors (e.g., [Borjas, 2000](#)). Moreover, there exists no evidence on how graduate students' teaching experiences contribute to their subsequent careers.¹

¹ In an earlier NBER working paper ([Bettinger and Long 2004](#)), we reported on the productivity of graduate students and adjuncts in undergraduate teaching. That analysis was the precursor to two separate analyses. Given the different nature of adjunct usage (i.e. largely focused on cost considerations) from graduate student usage, we focused the final version solely on adjuncts ([Bettinger and Long 2010](#)). In this paper, we return to the issue of graduate students with a different sample, a

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This paper examines graduate student teaching as an input to two production processes: the education of undergraduates and the development of graduate students themselves. As such we attempt to answer two related research questions. First, we quantify the effect of graduate student instructors on the academic outcomes of the undergraduate students they teach. As outcomes we examine students' choice of major, course taking, and credits earned. While graduate students participate in several facets of knowledge production and instruction, this is perhaps the most common avenue for their participation. In this paper, we are distinguishing between the roles of being a teaching assistant (i.e., course support) versus serving as the primary teacher of a course (i.e., the instructor); our analysis focuses on the latter. About 46% of undergraduate students at four-year colleges take courses that have graduate students as their primary instructors,² and in 2000, over 70% of graduate students had some teaching responsibility. At issue is whether using graduate students as instructors relative to other possible types of instructors (faculty or adjuncts) is a good way to allocate resources as measured by the outcomes of undergraduate students.

Second, we examine how teaching experience contributes to graduate students' subsequent academic careers. One of the justifications for using graduate students as instructors is that it provides essential training for their subsequent careers. We measure the relationship between teaching experiences and the subsequent academic outcomes and career choices of the graduate student. We examine the likelihood the graduate student completes their doctorate and is later employed at a college or university.

For our analysis, we use administrative data from Ohio's public universities. To answer the first question, we track the outcomes of undergraduate students who initially enrolled in college in the fall of 1998 or 1999. We identify the first course (e.g. Introductory Economics) that an undergraduate student took in a specific department (e.g. Economics) and observe whether these courses were taught by graduate students as opposed to full-time or part-time faculty. Using exogenous variation in faculty availability, we estimate the causal impact of graduate student instructors on undergraduate students' subsequent course-taking behavior.

To answer the second question, we study students who began their graduate program in 1998 or 1999, and who subsequently taught at least one course. We link university administrative data with data from the Ohio Department of Jobs and Family Services (ODJFS). ODJFS tracks employment outcomes throughout the state, and these data allow us to measure graduate students' subsequent earnings and location of employment, so long as they stay within the state. We use the combined data to relate the

number of teaching opportunities graduate students experience to their subsequent academic and professional outcomes (within six years of starting graduate work). Although our data are limited to observing subsequent behavior in Ohio alone, six years after the start of their graduate program, we find 82.5% of graduate students in either our employment data (52.6%) or university administrative data (29.9%, [Table 4](#)). Therefore, we believe we are observing subsequent outcomes for the vast majority of students. Moreover, while limitations remain, this is the first large-scale study to shed light on the relationship between teaching and outcomes after graduate school.

Our research questions are fraught with concerns about selection. Graduate students are unlikely to randomly choose to teach a course, and other work suggests that undergraduates may actively shy away from taking courses taught by certain kinds of instructors ([Bettinger & Long, 2010](#)). We use multiple strategies to deal with these issues. To address the fact that students may sort non-randomly across courses, we present the results using (a) course-by-department fixed effects, which limits the identifying variation to students who took the same course at the same institution but from different instructor types, and (b) course-by-department-by-term fixed effects, which limits identification to students who took the same course at the same time but from different instructors. Additionally, we estimate the results using an instrumental variables approach that capitalizes on the natural fluctuations from term to term in the faculty available to teach. In terms of whether a graduate student chooses to teach, we use department fixed effects to look within departments. However, there may be residual selection bias and so we caution about the interpretation of the results. Still, using a variety of assumptions about the size and direction of this bias, we still believe these results shed light on this understudied issue.

Our results suggest that graduate students are effective instructors relative to faculty members—at least as judged by the measures of their student's subsequent academic progress we can observe. Undergraduates taught by graduate students in a given subject are more likely to subsequently major in the subject compared to their peers who take the same course from full-time faculty. However, we find no statistically significant differences in the number of subsequent credits earned in the subject. Given that we use random variation in students' exposure to graduate students, we argue that our estimates suggest causal relationships. Second, graduate students who teach more frequently are more likely to complete their doctoral degree in a timely manner and more likely to be employed subsequently by a college or university. Regardless of whether we interpret these as causal or selection, the results suggest graduate student teaching benefits the sector. If our results only reflect selection, that selection, at least in our sample, identifies and incorporates effective future faculty into undergraduate production. By contrast, if our results reflect causality, then they suggest that undergraduate instructional experiences positively impact the short-run, academic job prospects of graduate students.

In the next section, we discuss existing academic literature on graduate student teaching. In [Section 2](#) we describe

revised empirical strategy, and additional information on tracking academic and job market outcomes of the graduate student instructors themselves. Given the distinction in the labor market considerations between graduate student employment and adjuncts, the mechanisms and institutional considerations behind our results may shed light on the underlying economic and policy considerations in graduate student education.

² Authors' calculations based on BPS 2003/2009 Sample.

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