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Albert Y. Liu
Cornell University

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Albert Yung-Hsu Liu[*]

Cornell University

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Abstract

To inform the ongoing debate over graduate student unionization, the author tests for the presence of union-related premiums among teaching and research assistant stipends using data from The Chronicle of Higher Education's survey of departments in six fields in 2000, 2001, and 2003. Ordinary least squares and instrumental variables methods reveal union and union threat premiums among teaching assistant stipends. There is little evidence of union-related premiums among research assistant stipends. Specifications controlling for union composition or using employment weights reveal that the teaching assistant only union premium is positive for teaching assistant stipends and negative for research assistant stipends. This suggests that collectively bargained contracts may yield benefits for teaching assistants at the expense of research assistants when the latter are excluded from the bargaining unit. There is a positive premium to joint teaching and research assistant unions for teaching assistant stipends and no effect for research assistant stipends.

1 Introduction

The National Labor Relations Board (NLRB) recently issued its ruling against graduate student unionization at Brown University, a reversal of its landmark ruling in *New York University* in 2000. In contrast, union organizers at public institutions have been increasingly successful in securing collectively bargained contracts beginning with the University of Wisconsin, Madison, in 1969. Graduate student unionization may have non-trivial economic effects on the stipends received by graduate students and the research and instructional labor costs paid by universities. A well-informed debate on the issue demands an understanding of these economic consequences and has implications for administrators and graduate student voters considering unionization.

The graduate student unionization movement stems largely from student dissatisfaction with increased teaching demands without commensurate increases in stipends. Cutbacks in state and federal appropriations have forced institutions of higher education to reduce instructional costs by shifting teaching burdens away from tenured faculty members toward relatively cheaper graduate students and adjunct faculty (Ehrenberg and Zhang 2005). These increased teaching demands may contribute to the well-documented rise in time to degree for doctoral students (Bowen and Rudenstine 1992). Indeed, many graduate students are motivated by this line of reasoning: a case study indicates that increased time to degree is among the primary reasons cited for seeking union status (Julius and Gumport 2002).

This paper draws on the union wage gap and union threat literatures. Several papers have focused on the union wage differential in higher education in particular. For example, Monks (2000) finds that faculty unionization is associated with a 7 to 14 percent wage premium, and Klaff and Ehrenberg (2003) find evidence of a modest union effect on higher education staff salaries. While there is a growing literature on the legal context of graduate student unionization and case studies of its economic effects, I contribute to the literature by providing the first estimates of the union wage effect for graduate student unions in a multivariate panel data setting.

This paper also utilizes a novel measure of union threat to estimate its impact on stipends. Previous empirical research typically uses union density in a cross-industry or cross-region framework as the measure of union threat (e.g. Neumark and Wachter 1995). This paper measures union threat using data on organizing activity from the Council of Graduate Education Unions, an organization that supports graduate student unions. Colleges and universities face a union threat when ununionized graduate students have organized in conjunction with

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established unions such as the United Auto Workers or the American Federation of Teachers or have secured a graduate student body vote on unionization.

In this paper, I estimate union-related premiums separately for teaching and research assistant stipends using a survey of graduate departments administered by The Chronicle of Higher Education. Survey respondents in biology, economics, English, history, mechanical engineering, and sociology departments provided data on stipend levels for teaching and research assistants for 2000, 2001, and 2003. The primary independent variables of interest are union and union threat. The baseline specification is an ordinary least squares approach controlling for department rank, institutional wealth, cost of living, employment size, and contract conditions along with field and year fixed effects. Using data collected from union contracts, I also estimate reduced-form models identifying unions as teaching assistants only or both teaching and research assistants. To purge the estimates of union-related premiums from the biasing effects of endogeneity, I estimate instrumental variables specifications using public status, the share of workers in the state represented by unions, and their interaction as instruments for union-related activity. Lastly, because error terms among departments in a given institution may be correlated, I estimate a set of seemingly unrelated regression models.

2 The Process of Graduate Student Unionization

The typical process of unionization begins with a movement to secure a graduate student body vote on unionization. This organizing effort often comes with the assistance of established unions such as the United Auto Workers and the American Federation of Teachers. If the student body votes to unionize, typically by majority vote, then the academic institution may choose to recognize the union as a collective bargaining unit. Should the institution recognize the union, the two parties then negotiate over an employment contract for all students covered by the collective bargaining agreement.

The unionization process is subject to legal constraints imposed by state legislatures and the National Labor Relations Board. The legal debate focuses on determining whether teaching and research assistants are primarily students or primarily employees. As subdivisions of the state, public colleges and universities are exempt from laws requiring union recognition (Pollack and Johns 2004). However, many states have passed legislation permitting graduate students to form unions and collectively bargain for wages and benefits. Public institutions

in states where graduate students are designated as primarily students are not required to recognize a student body vote on unionization or any union association formed among students.

Successful graduate student unions have taken on issues beyond stipends such as fringe benefits and institutional governance. For example, the Graduate Employees Organization at the University of Massachusetts claims responsibility for securing free health insurance, tuition and fee waivers, reasonable workload standards, grievance procedures, childcare, sexual harassment policies, and dental insurance (University of Massachusetts GEO 2005). This behavior is consistent with union effects on work conditions and fringe benefits in more general settings (Freeman 1981). Despite these purported gains for graduate students, student support for unions is not universal. For example, graduate students at the University of Minnesota voted against unionization three consecutive times (Jaschik 2005).

The legal constraints at private institutions are markedly different from their public counterparts. Legal precedent by the NLRB viewed graduate students at private institutions as students rather than as employees, a view typically supported by administrators at colleges and universities. Despite this legal environment, Yale University's Graduate Employee Student Organization went on strike in 1995 in an unsuccessful attempt to compel the university to recognize it as a union (Cage 1995). Over the next several years, graduate students at other prestigious private institutions made headway in the process to unionize. These efforts peaked when a case on the legality of graduate student unionization at New York University reached the NLRB. The case attracted significant national attention and included amicus briefs from prominent educational organizations and highly ranked colleges and universities. In *New York University* (332 NLRB No. 111 2000), the board reversed almost thirty years of precedent by ruling in favor of the union organizers. Notably, research assistants were judged to be working on research that would relate to their dissertations and thus were not serving primarily as employees.

The ruling precipitated a new wave of graduate student organizing. The NLRB issued similar rulings allowing union elections to take place in Columbia University and Tufts University (Case No. 2-RC-22358 2002; Case No. 1-RC-21452 2002), and new votes were scheduled for Yale University and Brown University. However, union support by graduate students at private institutions has not been universal. While organizers at Cornell University were able to secure a vote, the graduate student body voted against unionization by 1,350 to 580 (Smallwood 2002). Similarly, Yale University graduate students rejected unionization by 694 to 641 (Greenhouse 2003).

Four years later, a newly appointed NLRB heard arguments from graduate students and administrators in *Brown University* (342 NLRB No. 42 2004).[1] The board reversed its previous ruling and designated teaching assistants as primarily students who receive financial aid rather than as workers who receive compensation for services rendered. Graduate students at private universities are no longer employees and are thus not eligible to unionize and collectively bargain for stipends and benefits. The institutional response to *Brown University* has been swift. Regional boards of the NLRB overturned an earlier ruling allowing a union election at Tufts University (Case 1-RC-21452 2005). In August, 2005, the administration at New York University declared that it would no longer recognize the graduate student union, and the former graduate student union responded with a general strike starting in November (Arenson 2005, Finder 2005).

3   The Data

The primary goal in this paper is to estimate the magnitude of union-related premiums among graduate student stipend levels. To test for evidence of these premiums, I construct a panel dataset with the department-year as the unit of analysis. The Chronicle of Higher Education surveyed graduate departments on teaching and research assistant compensation for academic years (AY) 2000, 2001, and 2003.[2] In 2000 and 2001, the sample consisted of 45 institutions and was expanded to 83 institutions in 2003. The survey provides data on teaching and research assistants on stipend levels, contract length in months and expected hours of work per week, and student and family health insurance for biology, economics, English, history, mechanical engineering, and sociology departments.

I merge institution–year expenditure data on instruction, research and public service, academic support, student services, instructional support, operation and maintenance, scholarships and fellowships, and transfers from the Integrated Post-Secondary Education Dataset (IPEDS). The sum of these categories divided by the number of full-time equivalent students is the measure of institutional wealth. The proxy for cost of living is the

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[1] Again, myriad groups weighed in with amicus briefs including American Council on Education, National Association of Independent Colleges and Universities, American Association of University Professors, American Federation of Labor-Congress of Industrial Organizations, Committee of Interns and Residents, National Right to Work Legal Defense Foundation, Trustees of Boston University, and a joint brief by Harvard University, Massachusetts Institute of Technology, Stanford University, George Washington University, Tufts University, University of Pennsylvania, University of Southern California, Washington University in St. Louis, and Yale University.

[2] The data are available on the newspaper's online website, http://www.chronicle.com. Throughout the paper, I refer to an academic year by the year of the fall semester. For example, 2003 refers to academic year 2003-2004.

estimated cost to an undergraduate for room, board, and other expenses for an off campus apartment without a family. Data from the National Research Council's rankings of doctoral programs by field are included as a control variable (National Research Council 1995). I also incorporate data from the Survey of Graduate Students and Postdoctorates in Science and Engineering on the number of teaching assistants and the number of research assistants for biological sciences, economics, mechanical engineering, and sociology department-years.

[Table 1. Union-Related Activity by Institution]

My measures of union-related activity at each institution come from the Council of Graduate Education Unions, Julius and Gumport (2002), and other sources including news coverage in the press. Table 1 lists the institutions in the sample and identifies the academic years graduate student unions first earn university recognition and first negotiate a contract through the collective bargaining process. There are 25 institutions with graduate student unions as of AY 2004. Columns (4) and (5) indicate whether teaching assistants and research assistants are members of the collective bargaining unit from 2000 to 2004. I use data from the Council of Graduate Education Unions to identify institutions where although graduate students formed an organization with support from an established local union or held a student body election on unionization, they are unrecognized by the institution. Departments in these institutions are subject to union threat. Six of the 14 institutions under union threat are private institutions. Figure 1 shows the cumulative number of institutions with collectively bargained contracts from 1969 to 2005. The spike in 1993 corresponds to the system-wide contract at the State University of New York, and the activity in 2001 coincides with the NLRB ruling in *New York University* and the contract agreement at the University of California campuses.

[Figure 1. Cumulative Number of Institutions with Collectively Bargained Contracts: 1969 to 2005]

I provide descriptive statistics of the pooled dataset in Table 2. The dataset contains teaching assistant stipend levels for 805 department-years and research assistant stipend levels for 591 department-years. All monetary figures are in 2000 dollars. The mean stipend levels paid to teaching and research assistants are \$12,340.03 and \$13,271.77 respectively, and a standard t-test rejects the hypothesis that the difference between the two means is equal to zero. The average rank for both types of graduate assistants is approximately 43, although it is

important to note that rankings are an ordinal measure, not a cardinal measure.[3]

[Table 2. Department Sample Descriptive Statistics]

I designate a department-year as unionized if stipend levels in the year are determined through a collective bargaining process and a department-year as under union threat if the graduate students have organized with the support of an established union or held an election on unionization without recognition by the institution in that year. A subset of department-years face recognized unions without collectively bargained contracts. I experiment with categorizing them as union threat in the strict definition of union (threat1) and as unions in a weak definition (union2). Using the strict definition, 24.1 percent of the teaching assistant department-years and 22.5 percent of research assistant department-years are unionized. According to the weak definition, these shares are 29.7 percent and 28.6 percent respectively. The shares of department-years subject to union threat under the strict definition are 23.2 percent for the teaching assistant sample and 26.4 percent for research assistant sample. Disaggregating the union sample by collective bargaining unit composition reveals that teaching assistants are always covered by graduate student unions, but there is variation in whether research assistants are included. 19.9 percent of the teaching assistant department-years face a teaching assistant only union and 4.2 percent face a joint teaching and research assistant union. The comparable shares for the research assistant department sample are 17.9 percent and 4.6 percent respectively.

The mean cost of living is $8,808.78 for the teaching assistant sample and $8,910.10 for the research assistant sample. Contracts for research assistants are on average longer than those for teaching assistants. The mean department-year employs 34.96 teaching assistants and 73.11 research assistants in each respective subset of biology, economics, mechanical engineering, and sociology department-years.

4 Empirical Methodology

The baseline empirical approach is to estimate a typical program evaluation reduced-form specification by regressing the natural log of the stipend level on institutional and department characteristics.[4] The empirical

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[3]This implies that differences between rankings not uniform and that comparisons between fields may not be appropriate.

[4]Lewis (1986) provides an excellent survey on the estimation of union relative wage effects.

specification is:

$$\ln Y_{ijt} = X_{ijt}\beta + Z_{jt}\gamma + m_i + n_t + \varepsilon_{ijt} \tag{1}$$

In equation (1), Y_{ijt} is the stipend for department i at institution j in year t, and X_{ijt} consists of department level characteristics including the time invariant National Research Council department rank in its field, the number of teaching (or research) assistants employed by the department, and the contract length in months. Department rankings pose a methodological problem because rankings are an ordinal measure and not comparable between fields. Consequently, the specification includes dummy variables for department j being ranked in the first ten departments and for being ranked in the second ten departments. Institution level characteristics in Z_{jt} consist of dummy variables for union and union threat, the natural log of total expenditure per full time equivalent student, and the natural log of the estimated cost of living. The specification also includes field fixed effects, m_i, year fixed effects, n_t, and a error term ε_{ijt}. I run regressions separately for teaching assistant stipends and research assistant stipends after a Chow test revealed structural differences in the baseline ordinary least squares model.[5]

Because stipends for graduate students may not vary by student-level characteristics such as education or experience, I estimate union-related differentials under the assumption that all teaching (or research) assistants in a given department j in institution i in year t are identical. This allows me to use employment size as a frequency weight for the subset of biology, economics, mechanical engineering, and sociology departments for more precise estimates at the cost of a reasonable assumption.

Union-related activity may be endogenous because departments that pay lower stipends may be prone to union-related activity. A standard approach to treat this endogeneity is to employ an instrumental variables method. Descriptive and legal research on the presence of graduate student unions have identified public institution status, legality of public sector unionization, and the degree of unionization statewide as predictors of union status (Julius and Gumport, 2002). Unfortunately, state variation in the legality of public sector unionization is perfectly correlated with union status in this sample. The empirical results using either the share of employees that are members of unions and the share of employees represented by unions are qualitatively similar, and my preferred

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[5]The Chow test is an F-test for differences in coefficients (Chow, 1960). The test statistic in the baseline specification is 2.63 and the critical $F_{20,\infty} = 1.57$ at the 5 percent level.

specification uses the latter, the public status of the institution, and an interaction term as the instruments for union activity.

The errors terms across departments and within an institution may be correlated. I estimate seemingly unrelated regression models after a Breusch-Pagan test suggests that the error terms in each equation are correlated. This may not be surprising because departments that pay more than their predicted stipend levels may be at institutions that systematically pay generous stipend levels for all departments. Department level variation within an institution comes from variation in rankings and contract lengths. I use the numerical value of the department rank in these estimates instead of the dummy variables for first and second ten ranked departments.

5   Results

Table 3 presents the results from the baseline reduced-form specification using the strict definition of union.[6] All subsequent comments in this section refer to coefficient estimates that are statistically significant at the 5 percent level unless otherwise noted. Column (1) uses department-level teaching assistant stipends as the dependent variable. Relative to sociology departments, teaching assistant stipends in biology departments are 5.6 percent greater. Teaching assistant stipends are not statistically different across the three ranking categories. I find evidence of a 4.7 percent union stipend premium and a 6.6 percent union threat premium, suggesting that departments facing union activity pay their teaching assistants higher stipends, all else equal. The sign of the coefficient estimates for institutional wealth and cost of living are of the expected sign. Stipends for teaching assistants increase 0.10 percent and 0.19 percent for every 1 percent increase in the expenditure per full time equivalent student and cost of living respectively. The estimate of the coefficient on employment size is statistically significant and positive but of magnitude close to zero.

[Table 3. Ordinary Least Squares Results (Dependent Variable: Natural Log Stipend)]

The estimates using department research assistant stipends as the dependent variable are provided in column (3). There is substantial variation in stipends between fields. Biology and mechanical engineering departments pay higher stipends and English and history departments pay lower stipends relative to sociology departments.

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[6]Results using definition 2 and estimates using numerical rank instead of the top ten and second ten dummy variables are qualitatively similar and are available from the author upon request.

To the extent that the distribution of research assistant stipends is equal to the distribution of stipends of teaching assistants without unionization, this is consistent with evidence that graduate students in the sciences are more often opposed to unionization relative to those in arts and humanities (Julius and Gumport 2002). The greater variation across subjects among research assistant stipend levels may reflect more pervasive union wage compression among teaching assistants. There is no evidence of any rankings premium among research assistant stipends in this specification and no evidence of any union or union threat effect. Departments with higher levels of expenditure per full time equivalent student pay greater stipends at the ten percent significance level, but higher costs of living are not associated with stipends, all else equal.

Columns (2) and (4) provide the results after controlling for union coverage. Surprisingly, the bulk of the union premium for teaching assistants takes place at departments subject to joint teaching and research assistant unions. There is no evidence of any union premium when the department is covered by a teaching assistant only union. In contrast, there is a –8.4 percent return to having a teaching assistant only union on research assistant stipend levels. This is the first piece of evidence suggesting that departments subject to teaching assistant only unions reduce the stipend paid to research assistants.

[Table 4. Ordinary Least Squares Results with Employment Weights (Dependent Variable: Natural Log Stipend)]

Under the assumption that all teaching or research assistants in a given department-year are paid the equally, I weight the sample by the employment size for a subset of fields. After dropping English and history departments, the sample consists of 17,200 teaching assistants and 29,242 research assistants. The results in Table 4 for department premiums are similar to the unweighted sample for teaching assistants. However, teaching assistants at departments ranked in the top ten of their field receive 2.4 percent more than those at departments ranked beyond twenty. Teaching assistants at departments ranked in the second ten make 1.3 percent less than those ranked beyond twenty. These results are similar to Rees' (1993) evidence that faculty salaries at better ranked institutions are paid higher salaries. There is evidence of a 6.0 percent union wage premium and a 2.9 percent union threat premium for teaching assistants. In column (2), I find positive premiums among teaching assistant stipends for both teaching assistant only unions and joint teaching and research assistant unions, and the larger premium comes from unions composed of both types of graduate student assistants.

The results for research assistants in the weighted sample are similar to those in the unweighted sample. Notably, there is a weak negative effect of unions on the whole for research assistants, but when controlling for composition, there is evidence of a –2.8 percent effect of teaching assistant only unions and a 6.8 percent effect of joint teaching and research assistant unions. This suggests that while both teaching and research assistants in unions that cover both types of assistants receive positive wage premiums, teaching assistants under teaching assistant only unions receive higher stipends while research assistants receive *lower* stipends. In both specifications, departments facing the threat of a union pay greater stipends to research assistants.

[Table 5. Selected Instrumental Variables Results for (Dependent Variable: Natural Log Stipend)]

Table 5 presents selected coefficient estimates and standard errors for the instrumental variables specifications using institutional public status, the share of state employees represented by unions, and the interaction between as instruments for the unweighted sample. Columns (1) and (3) present estimates instrumenting for both union and union threat. Among teaching assistant departments, there is no evidence of any union premium but strong evidence of a 30.5 percent union threat premium. For research assistant departments, there is weak evidence of a negative effect of having a union. In columns (2) and (4), I instrument for any union activity defined as either having a union or under union threat. In this specification, there is evidence of a 7.3 percent premium to union activity for teaching assistants and no evidence of any premium for research assistants.

[Table 6. Ordinary Least Squares Results with Contract Experience Control (Dependent Variable: Natural Log Stipend)]

Barbezat (1989) and Rees (1993) use similar reduced-form models to estimate the union wage differential among faculty salaries but control for the length of time the department has been subject to the collective bargaining process. Estimates in Table 6 include the time since first contract as a control, and the time for department-years without contracts are coded as zero. For teaching assistant departments, an additional year subject to collective bargaining decreases the stipend paid to teaching assistants by 0.4 percent. There is evidence of a 5.1 percent return to teaching assistant only unions and a 22.0 percent return to joint teaching and research assistant unions. In contrast, an additional year subject to collective bargaining increases the stipend paid to research assistants by 0.5 percent. However, there is a –13.8 percent return to teaching assistant only unions and

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no effect of joint coverage unions. This provides additional evidence that collectively bargained contracts where research assistants are excluded from the bargaining unit are associated with premiums for teaching assistant stipends and a penalties for research assistant stipends. Moreover, teaching assistant stipends diminish and research assistant stipends rise with union experience.

[Table 7. Seemingly Unrelated Regressions Results (Dependent Variable: Natural Log Stipend)]

Lastly, using the within institution variation in department ranking and length of contract, I estimate a series of seemingly unrelated regression models. Although the sample size decreases dramatically to only include institution-years that have data for all six departments, the Bruesch-Pagan test on the reduced sample suggests that the error terms across equations are correlated. The results of this specification are provided in Tables 7 and 8. The top panel provides selected coefficients and standard errors for the teaching assistant department sample. Although the sample sizes are small, there is evidence of returns to department rank for mechanical engineering departments and weak evidence for English departments. That is, better ranked departments in these fields pay larger stipends to their teaching assistants. Moreover, there are positive returns to union threat in English and sociology departments and weak evidence for economics and history. The bottom panel provides the results for research assistants. Again, the sample size decreases dramatically as only 28 institution-years provide data for all six departments. There is evidence of positive union and union threat effects for biology and sociology departments.

[Table 8. Seemingly Unrelated Regression Results (Dependent Variable: Natural Log Stipend)]

Table 8 presents the results controlling for collective bargaining unit composition. There is weak evidence that better ranked departments in English and mechanical engineering pay higher stipends to teaching assistants. There is no evidence of a teaching assistant only union premium in any field and positive returns to joint coverage unions for biology, English, history, and mechanical engineering. Union threat is associated with an increase in stipends in English, history, mechanical engineering, and sociology. The bottom panel for research assistants indicates that better ranked history and mechanical engineering departments pay higher stipend levels. Surprisingly, there is a positive return to teaching assistant only unions among mechanical engineering and sociology departments. I find positive effects of joint coverage unions in biology, English, and sociology departments, and

evidence of a union threat premium in mechanical engineering and sociology departments.

6 Discussion

The primary objective is to test for the presence of union and union threat premiums using data from a survey of biology, economics, English, history, mechanical engineering, and sociology departments administered by the Chronicle of Higher Education. I find that there are indeed returns to union-related activity among stipend levels. Evidence of positive union and union threat premiums among teaching assistants is robust across a variety of estimation techniques. In contrast, there is less evidence of a union premium on research assistant stipends and often of negative sign when weakly statistically significant. I do not find a union threat effect for research assistant stipends. Controlling for union composition, there is consistent evidence of a negative return to teaching assistant only unions among research assistant stipend levels and a positive premium among teaching assistant stipends.

Despite department rank playing a role in faculty compensation (Rees 1993), it is only modestly associated with graduate student stipend levels. In the weighted specification, top ten departments pay higher stipend levels relative to departments ranked beyond twenty for both teaching and research assistants. Teaching assistants in the second ten ranked departments receive lower stipends and research assistants in the second ten receive higher stipends relative to those beyond twenty. While the seemingly unrelated regression specifications suffer from small sample size, I find evidence that higher quality departments in some fields pay greater stipends even after controlling for institutional wealth and cost of living.

These findings suggest that union organizers have been successful at raising stipend levels for their teaching assistant members. However, stipend increases for teaching assistants may come at the expense of research assistants unless the latter are included in the collective bargaining unit. This result is consistent with anecdotal evidence that science and engineering graduate students, predominantly research assistants, often oppose unionization. Joint composition unions are also not associated with stipend increases for research assistants. Union threat is associated with stipend increases for teaching assistants, perhaps because institutional administrators raise stipends to stave off attempts to organize graduate students into a union. There is less evidence of a union threat effect for research assistant stipends.

These estimated union-related premiums yield voting predictions for graduate students considering unionization. Assume that students vote on stipends only, union-related premiums are those estimated in columns (2) and (4) in Table 6, the stipends paid to teaching and research assistants in the absence of unionization are equal, and students who are indifferent abstain and write their dissertations or teach instead. Consider the restrictive case where students are assigned to either teaching or research assistantships for the entire duration of graduate study. At institutions where graduate students vote on a teaching assistant only union, the estimated premiums predict that teaching assistants vote in favor and research assistants against it. Unionization passes by majority vote when there are more teaching assistants than research assistants. When considering a joint coverage union, the results predict that teaching assistants vote for unionization and research assistants are indifferent. Unionization passes whenever there are teaching assistants at the institution.

Alternatively, consider the more realistic case where students switch between teaching and research assistantship positions over the course of their graduate careers. Assume graduate students vote by comparing the expected sum of their stipend levels with and without unionization. Because the loss to research assistants is larger in magnitude than the gain to teaching assistants, the results predict that teaching assistant only unionization passes when more than half of the graduate students are teaching assistants for at least 73 percent of the time.[7] The estimated premiums predict that unionization for joint coverage unions always passes whenever students spend positive time as teaching assistants.

What about the labor costs paid by institutions? In the case where assistantship assignments are fixed, institutions face greater labor costs when they contract with a teaching assistant only union and at least 73 percent of the students are teaching assistants. Labor costs for joint coverage unions unambiguously rise when there are any teaching assistants. When students switch between teaching and research assistantships, labor costs rise when at least 73 percent of the graduate students are teaching assistants in a given period. Institutions with negotiated contracts with joint coverage unions have unambiguous increases in labor costs. These back of

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[7]Let x be the number of semesters as a teaching assistant and T be the time to degree. Then a student votes for unionization if

$$x1.051 \ln w + (T - x)(1 - 0.138) \ln w \quad > \quad T \ln w \tag{2}$$

$$\frac{x}{T}0.051 \quad > \quad \left(1 - \frac{x}{T}\right)0.138 \tag{3}$$

$$\frac{x}{T} \quad > \quad 0.730 \tag{4}$$

the envelope calculations suggest that joint coverage unions are more likely to win majority approval by graduate students but result in higher labor costs for the institution. Teaching assistant only unions may cost the institution less, but as the probabilty of winning majority student support rises, institutional resistance increases.

Stipends, however, are not the only issue of concern to graduate student unions. Subsequent empirical research should explore the union effect on fringe benefits such as institutional support for student and family health insurance. Studies can also explore whether union membership reduces time to degree for graduate students. Institutional expenditure and the quality of instruction for undergraduate students are additional factors that may be affected by unionization and deserve attention as administrators, graduate students, and lawyers debate the merits of graduate student unionization.

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Table 1. Union-Related Activity by Institution[a]

Institution	AY. Recogn.	AY Contract	TA Union	RA Union	Union Threat
Arizona State University					
Boston University					
Brandeis University					Yes
Brown University					Yes
California Institute of Technology					
Carnegie Mellon University					
Clemson University					
Colorado State University					
Columbia University					Yes
Cornell University					Yes
Duke University					
Emory University					
Florida State University					
Georgia Institute of Technology					
Harvard University					
Indiana University at Bloomington					
Iowa State University					
Johns Hopkins University					
Kansas State University					
Kent State University					
Lehigh University					
Louisiana State University at Baton Rouge					
Massachusetts Institute of Technology					
Michigan State University	2000	2003	Yes	No	
New York University	1999	2001	Yes	Yes	
North Carolina State University					
Northeastern University					
Northwestern University					
Ohio State University					Yes
Oregon State University	1999	2000	Yes	Yes	
Pennsylvania State University at University Park					Yes
Princeton University					
Purdue University					
Rice University					
Rutgers University (Newark)	1972	1972	Yes	Yes	
Saint Louis University					
Southern Illinois University at Carbondale					
Southern Methodist University					
Stanford University					
State University of New York at Albany	1992	1993	Yes	No	

State University of New York at Binghamton	1992	1993	Yes	No	
State University of New York at Buffalo	1992	1993	Yes	No	
State University of New York at Stony Brook	1992	1993	Yes	No	
Syracuse University					
Temple University	2001	2002	Yes	Yes	Yes
Texas A&M University at College Station					
Tulane University					
University of Alabama at Birmingham					
University of Arkansas at Fayetteville					
University of California at Berkeley	1983	2001	Yes	No	
University of California at Davis	1993	2001	Yes	No	
University of California at Irvine	1998	2001	Yes	No	
University of California at Los Angeles	1994	2001	Yes	No	
University of California at Riverside	1997	2001	Yes	No	
University of California at San Diego	1992	2001	Yes	No	
University of California at Santa Barbara	1994	2001	Yes	No	
University of Colorado at Boulder					
University of Florida	1981	1981	Yes	Yes	
University of Hawaii-Manoa					
University of Houston (University Park)					
University of Idaho					
University of Illinois at Chicago	2005				Yes
University of Illinois at Urbana-Champaign	2002	2004	Yes	No	Yes
University of Iowa	1995	1997	Yes	Yes	
University of Kansas	1994	1997	Yes	No	
University of Kentucky					
University of Louisville					
University of Maine					
University of Maryland at College Park					Yes
University of Memphis					
University of Michigan at Ann Arbor	1973	1974	Yes	No	
University of Minnesota-Twin Cities					Yes
University of Nebraska at Lincoln					
University of Nevada at Reno					
University of North Carolina at Chapel Hill					
University of Oklahoma at Norman					
University of Oregon	1976	1979	Yes	No	
University of Pittsburgh					
University of Rochester					
University of Southern California					Yes
University of Southern Mississippi					
University of Tennessee at Knoxville					
University of Texas at Austin					
University of Toledo					

University of Utah					
University of Vermont					
University of Virginia					Yes
University of Washington at Seattle	2004	2005	Yes	Yes	Yes
University of Wisconsin at Madison	1969	1969	Yes	No	
University of Wisconsin at Milwaukee	1990	1991	Yes	No	
University of Wyoming					
Utah State University					
Vanderbilt University					
Virginia Commonwealth University					
Virginia Tech					
Washington State University					
Washington University in St. Louis					
Wayne State University	1997	1999	Yes	No	
Western Michigan University					

[a] The complete list of sources is available from the author upon request.

Figure 1. Cumulative Number of Institutions with Collectively Bargained Contracts: 1969 to 2005
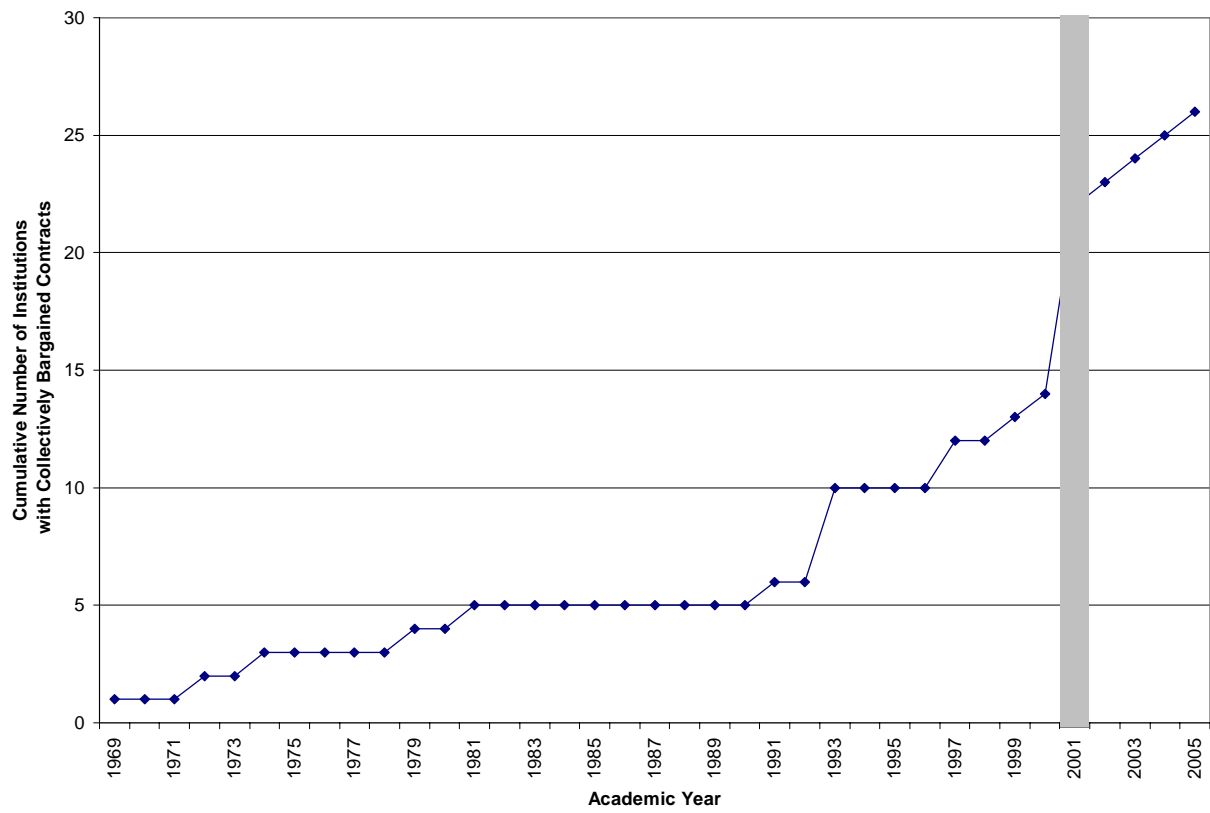
Table 2. Department Sample Descriptive Statistics

	N	Mean	St. Dev.	N	Mean	St. Dev.
	TA			RA		
stipend[a]	805	12340.030	2616.997	591	13271.770	3487.058
ln_stipend	805	9.396	0.230	591	9.450	0.334
BIO	805	0.178	0.382	591	0.220	0.415
ECO	805	0.175	0.380	591	0.166	0.372
ENG	805	0.164	0.370	591	0.127	0.333
HIS	805	0.164	0.370	591	0.117	0.321
MEC	805	0.157	0.364	591	0.212	0.409
SOC	805	0.163	0.369	591	0.159	0.366
first10	805	0.109	0.312	591	0.115	0.319
second10	805	0.120	0.326	591	0.130	0.337
other	805	0.657	0.475	591	0.646	0.479
rank	714	43.064	31.702	527	42.627	32.369
r_00	805	0.294	0.456	591	0.284	0.451
r_01	805	0.247	0.432	591	0.220	0.415
r_03	805	0.458	0.499	591	0.496	0.500
union1	805	0.241	0.428	591	0.225	0.418
union1_ta	805	0.199	0.399	591	0.179	0.384
union1_tara	805	0.042	0.201	591	0.046	0.209
threat1	805	0.232	0.423	591	0.264	0.441
union2	805	0.297	0.457	591	0.286	0.452
threat2	805	0.176	0.381	591	0.203	0.403
ln_exp_fte	794	10.463	0.568	583	10.474	0.564
ln_cola	723	9.068	0.175	533	9.081	0.163
empl	492	34.959	29.200	400	73.105	101.965
contract_mo	544	9.300	0.961	371	10.164	1.439
public	805	0.684	0.465	591	0.699	0.459
reppct	805	0.156	0.065	591	0.152	0.062

[a] Stipends, total expenditure per full time equivalent, and cost of living are in 2000 dollars.

Table 3. Ordinary Least Squares Results (Dependent Variable: Natural Log Stipend)

	(1)	(2)	(3)	(4)
	TA		RA	
BIO	0.056**	0.061**	0.170***	0.172***
	[0.027]	[0.027]	[0.047]	[0.047]
ECO	-0.001	-0.001	0.015	0.013
	[0.024]	[0.024]	[0.041]	[0.041]
ENG	0.011	0.009	-0.147**	-0.150**
	[0.037]	[0.037]	[0.058]	[0.058]
HIS	-0.031	-0.032	-0.126**	-0.124**
	[0.037]	[0.037]	[0.059]	[0.059]
MEC	0.001	0.007	0.086**	0.089**
	[0.025]	[0.025]	[0.040]	[0.040]
union1	0.047**	–	-0.047	–
	[0.019]		[0.032]	
union1_ta	–	0.014	–	-0.084**
		[0.020]		[0.035]
union1_tara	–	0.191***	–	0.088
		[0.037]		[0.060]
threat1	0.066***	0.064***	0.025	0.021
	[0.020]	[0.019]	[0.033]	[0.033]
empl	0.001*	0.001**	0.000	0.000
	[0.000]	[0.000]	[0.000]	[0.000]
ln_exp_fte	0.102***	0.097***	0.051*	0.047*
	[0.016]	[0.016]	[0.027]	[0.027]
ln_cola	0.185***	0.195***	0.103	0.090
	[0.043]	[0.043]	[0.078]	[0.078]
contract_mo	0.084***	0.078***	0.072***	0.069***
	[0.010]	[0.010]	[0.012]	[0.012]
Observations	805	805	591	591
R-squared	0.28	0.30	0.30	0.31

* significant at 10%; ** significant at 5%; *** significant at 1%
Other control variables include time fixed effects, dummy variable for department ranked
in the top ten, dummy variable ranked in the second ten, and missing value flags for empl,
ln_exp_fte, ln_cola, and contract_mo.

Table 4. Ordinary Least Squares Results with Employment Weights (Dependent Variable: Natural Log Stipend)

	(1)	(2)	(3)	(4)
	TA		RA	
BIO	0.079***	0.082***	0.161***	0.159***
	[0.004]	[0.004]	[0.006]	[0.006]
ECO	0.002	0.001	0.009	0.009
	[0.004]	[0.004]	[0.007]	[0.007]
MEC	0.003	0.004	0.074***	0.073***
	[0.005]	[0.005]	[0.006]	[0.006]
first10	0.024***	0.032***	0.099***	0.107***
	[0.005]	[0.005]	[0.003]	[0.003]
second10	-0.013***	-0.010**	0.034***	0.040***
	[0.004]	[0.004]	[0.003]	[0.003]
union1	0.060***	–	-0.005*	–
	[0.003]		[0.003]	
union1_ta	–	0.038***	–	-0.023***
		[0.004]		[0.003]
union1_tara	–	0.176***	–	0.063***
		[0.007]		[0.005]
threat1	0.029***	0.030***	0.013***	0.011***
	[0.004]	[0.004]	[0.003]	[0.003]
empl	0.000***	0.000***	-0.000***	-0.000***
	[0.000]	[0.000]	[0.000]	[0.000]
ln_exp_fte	0.122***	0.116***	0.071***	0.068***
	[0.004]	[0.004]	[0.003]	[0.003]
ln_cola	0.154***	0.167***	0.082***	0.074***
	[0.008]	[0.008]	[0.007]	[0.007]
contract_mo	0.086***	0.080***	0.082***	0.080***
	[0.002]	[0.002]	[0.001]	[0.001]
Constant	5.883***	5.873***	7.109***	7.224***
	[0.084]	[0.083]	[0.065]	[0.065]
Observations	17,200	17,200	29,242	29,242
R-squared	0.33	0.34	0.45	0.45

* significant at 10%; ** significant at 5%; *** significant at 1%
Other control variables include time fixed effects, dummy variable for department ranked in the top ten, dummy variable ranked in the second ten, and missing value flags for empl, ln_exp_fte, ln_cola, and contract_mo.

Table 5. Selected Instrumental Variables Results for (Dependent Variable: Natural Log Stipend)

	(1)	(2)	(3)	(4)
	TA		RA	
union1	-0.01	–	-0.125*	–
	[0.041]		[0.066]	
threat1	0.305***	–	0.152	–
	[0.080]		[0.104]	
union	–	0.073***	–	-0.038
		[0.028]		[0.050]
Observations	805	805	591	591
R-squared	0.08	0.28	0.26	0.30

* significant at 10%; ** significant at 5%; *** significant at 1%
Other control variables include field dummy variables, department ranked in the top ten,
dummy variable ranked in the second ten, employment, natural log of expenditure per full
time equivalent student, natural log of cost of living, and missing value flags for empl,
ln_exp_fte, ln_cola, and contract_mo.

Table 6. Ordinary Least Squares Results with Contract Experience Control (Dependent Variable: Natural Log Stipend)

	(1)	(2)	(3)	(4)
	TA		RA	
BIO	0.058**	0.063**	0.178***	0.180***
	[0.027]	[0.027]	[0.047]	[0.047]
ECO	0.000	0.000	0.014	0.012
	[0.024]	[0.024]	[0.041]	[0.041]
ENG	0.010	0.008	-0.150***	-0.153***
	[0.037]	[0.037]	[0.058]	[0.058]
HIS	-0.032	-0.034	-0.128**	-0.126**
	[0.037]	[0.037]	[0.059]	[0.059]
MEC	0.004	0.009	0.089**	0.092**
	[0.025]	[0.025]	[0.040]	[0.040]
contracttime	-0.004***	-0.004***	0.005**	0.005**
	[0.001]	[0.001]	[0.002]	[0.002]
union1	0.087***	–	-0.099**	–
	[0.023]		[0.040]	
union1_ta	–	0.051**	–	-0.138***
		[0.024]		[0.042]
union1_tara	–	0.220***	–	0.037
		[0.039]		[0.064]
threat1	0.061***	0.060***	0.030	0.027
	[0.020]	[0.019]	[0.033]	[0.033]
empl	0.001*	0.001**	0.000	0.000
	[0.000]	[0.000]	[0.000]	[0.000]
ln_exp_fte	0.102***	0.097***	0.051*	0.047*
	[0.016]	[0.016]	[0.027]	[0.026]
ln_cola	0.166***	0.178***	0.142*	0.13
	[0.044]	[0.043]	[0.080]	[0.080]
contract_mo	0.080***	0.075***	0.068***	0.065***
	[0.010]	[0.010]	[0.012]	[0.012]
Observations	805	805	591	591
R-squared	0.29	0.30	0.31	0.32

* significant at 10%; ** significant at 5%; *** significant at 1%
Other control variables include time fixed effects, dummy variable for department ranked in the top ten, dummy variable ranked in the second ten, and missing value flags for empl, ln_exp_fte, ln_cola, and contract_mo.

Table 7. Seemingly Unrelated Regressions Results (Dependent Variable: Natural Log Stipend)

	(1)	(2)	(3)	(4)	(5)	(6)
Teaching Assistants						
	BIO	ECO	ENG	HIS	MEC	SOC
Rank	0.000	0.000	-0.001*	0.000	-0.003**	0.000
	[0.000]	[0.001]	[0.001]	[0.000]	[0.001]	[0.001]
union1	0.005	0.033	0.025	0.043	-0.054	0.031
	[0.038]	[0.043]	[0.041]	[0.041]	[0.061]	[0.041]
threat1	0.039	0.083*	0.105**	0.085*	0.089	0.091**
	[0.045]	[0.049]	[0.046]	[0.046]	[0.066]	[0.045]
Observations	73	73	73	73	73	73
Research Assistants						
	BIO	ECO	ENG	HIS	MEC	SOC
Rank	-0.002	-0.001	0.001	-0.002	-0.005	0.000
	[0.002]	[0.003]	[0.002]	[0.001]	[0.003]	[0.002]
union1	0.530***	-0.093	0.199	0.175	0.091	0.302***
	[0.114]	[0.062]	[0.159]	[0.151]	[0.083]	[0.082]
threat1	0.409***	-0.058	0.155	0.270*	0.051	0.253***
	[0.130]	[0.065]	[0.166]	[0.156]	[0.078]	[0.083]
Observations	28	28	28	28	28	28

* significant at 10%; ** significant at 5%; *** significant at 1%
Other control variables include employment, natural log of expenditure per full time equivalent student,
natural log of cost of living, and missing value flags for empl, ln_exp_fte, ln_cola, and contract_mo.

Table 8. Seemingly Unrelated Regression Results (Dependent Variable: Natural Log Stipend)

	(1)	(2)	(3)	(4)	(5)	(6)
Teaching Assistants						
	BIO	ECO	ENG	HIS	MEC	SOC
dept_rank	0.000	0.000	-0.001*	0.000	-0.002*	0.000
	[0.000]	[0.001]	[0.001]	[0.000]	[0.001]	[0.001]
union1_ta	-0.015	0.017	0.004	0.022	-0.011	0.014
	[0.036]	[0.043]	[0.039]	[0.040]	[0.061]	[0.041]
union1_tara	0.431***	0.243*	0.344***	0.361***	-0.360**	0.238*
	[0.118]	[0.141]	[0.126]	[0.128]	[0.176]	[0.128]
threat1	0.032	0.074	0.097**	0.078*	0.108*	0.082*
	[0.041]	[0.049]	[0.044]	[0.044]	[0.065]	[0.044]
Observations	73	73	73	73	73	73
Research Assistants						
	BIO	ECO	ENG	HIS	MEC	SOC
dept_rank	0.005	0.000	-0.002	-0.002**	-0.009***	-0.002
	[0.003]	[0.003]	[0.002]	[0.001]	[0.003]	[0.002]
union1_ta	0.257	-0.082	0.126	0.117	0.198**	0.244***
	[0.179]	[0.059]	[0.155]	[0.150]	[0.077]	[0.083]
union1_tara	0.920***	0.082	0.541**	0.437*	-0.139	0.463***
	[0.261]	[0.097]	[0.272]	[0.263]	[0.127]	[0.125]
threat1	0.073	-0.052	0.132	0.275*	0.180**	0.234***
	[0.208]	[0.061]	[0.160]	[0.154]	[0.074]	[0.079]
Observations	28	28	28	28	28	28

* significant at 10%; ** significant at 5%; *** significant at 1%
Other control variables include employment, natural log of expenditure per full time equivalent student, natural log of cost of living, and missing value flags for empl, ln_exp_fte, ln_cola, and contract_mo.