



WHY UNIVERSITIES NEED INSTITUTIONAL RESEARCHERS AND INSTITUTIONAL RESEARCHERS NEED FACULTY MEMBERS MORE THAN BOTH REALIZE

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This paper provides an overview of research that I have conducted during my career using data sets collected by offices of institutional research. Many of the examples discussed in the paper deal with graduate education. The paper illustrates how valuable the data collection efforts by these offices are to academic researchers interested in helping to formulate institutional, state and national higher education policies. It concludes with suggestions for how the usefulness of institutional researchers to colleges and universities can be improved and stresses that institutional researchers and administrators would be wise to involve more faculty members in research that aids in institutional decision making and the formulation of public policy towards higher education.

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INTRODUCTION

I have been a devoted fan of college and university offices of institutional research for longer than I care to remember because data they collect has been the basis of much of my research and thus my professional reputation. I also had the great pleasure of serving as the vice president at Cornell University to whom the office of institutional research reported during part of the 1990s. Much to the surprise of our President and Provost, neither of

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whom was data driven, institutional researchers and I conducted two studies during my tenure that directly influenced decisions at Cornell and also led to two published papers, which I will discuss below.

Since my return to the faculty in 1998 and my founding of the Cornell Higher Education Research Institute (CHERI), I have continued to extensively use institutional researchers' data. Indeed, earlier this year I published a paper that made use of data from one data exchange, which I agreed not to identify, on graduate assistant stipends and working conditions, to address some issues relating to the collective bargaining for graduate assistants at public universities. Many institutional research offices have been kind enough to respond to the institutional surveys that CHERI undertakes each year, including our most recent survey requesting permission to access the information on faculty salaries by discipline that a set of universities annually report to the Oklahoma State University Faculty Salary Survey. So put simply, I owe institutional researchers a great debt of gratitude.

This paper will provide a quick tour of some of the research that others and I have conducted using data sets collected by offices of institutional research to provide an "outsider's" view of how valuable the data collected is to researchers and in framing institutional policies. Given the upcoming assessment of graduate programs that will be undertaken by the National Research Council, I will spend most of the paper discussing research relating to graduate education.¹ I will conclude with a few comments on how the usefulness of institutional researchers to universities can be improved and stress that institutional researchers and administrators would be wise to involve more faculty members in research that aids in institutional decision making and the formulation of public policy towards higher education.

OPTIMAL FINANCIAL AID POLICIES FOR A SELECTIVE UNIVERSITY

My first paper relating to the economics of higher education was published in 1984.² It presented a utility maximizing model that showed what information a selective college or university needed to determine the size of the financial aid package that it should optimally offer to different admitted undergraduate applicants. This paper, which provided the intellectual underpinnings for what is now known as "preferential packaging", required me to estimate a model of admitted applicants' propensities to accept offers of admission—in particular to determine how sensitive different types of admitted applicants' acceptance decisions were

to the financial aid packages they were offered. To estimate these models required me to merge four different types of data together:

1. Information on admitted applicants characteristics that was “owned” by Cornell’s Office of Admissions.
2. Information on admitted applicants’ families’ financial situations and the financial aid offer that was made to each admitted applicant—these data were owned by Cornell’s Undergraduate Financial Aid Office (remember admissions decisions are need blind at Ivy League universities)
3. Information from an Admitted Student Questionnaire that had been administered to all admitted applicants by Cornell’s Office of Institutional Research. This provided information on whether an admitted applicant was enrolling at Cornell or another institution, the applicant’s second choice institution if she was enrolling at Cornell and where she was enrolling if she was enrolling elsewhere, and the financial aid package that the applicant was offered at the other institution).
4. Information on characteristics (SAT scores, distance from the applicant’ home) of the institution at which the individual was enrolling if the individual was going elsewhere or of the individual’s best alternative institution if the individual was enrolling at Cornell. These data were obtained from published volumes and a geographic information system (inasmuch as this paper was written in the early 80s, the latter consisted of a map of the United States and a ruler).

While few people talked about the need for data warehouses in the early 1980s, note that the three Cornell databases that provided individual level data that were used in the study were “owned” by different offices of the university and a crosswalk had to be developed to merge the three data sets together. As will be come clear throughout the paper, although offices of institutional research do not need to “own” all of the data bases that universities maintain, they need to have access to many of them.

THE AAU/AGS PROJECT FOR RESEARCH ON DOCTORAL EDUCATION

In 1988, the Association of American Universities (AAU) and the Association of Graduate Schools (AGS) initiated a *Project for Research on Doctoral Education*. Information was collected on all applicants to Ph.D. programs in 10 fields at participating AAU institutions. Longitudinal data

sets were created that included information on admissions and enrollment decisions, types of financial aid offered to students at each institution at which they were accepted and, once a student was enrolled in a program, information on the student's progress through the program to dropout or degree.

Ultimately, the project was discontinued because of the difficulty participating institutions experienced in collecting longitudinal data on enrolled students on an ongoing basis. However, the usefulness of these data was enormous. Departments used the data to learn exactly who their competitors for Ph.D. students actually were. Perhaps, more important, the data could be used for research purposes that proved important for both individual institutions and our nation's system of graduate education.

Cornell University participated in the project and the information that Cornell's Graduate School reported to the AAU/AGS project on continuing graduate students' status and form of financial support each year had been collected (and archived in paper form) for decades by our Graduate School. After tediously converting these data to electronic form, a graduate student and I were able to use these data to estimate competing risk duration models of graduate students' propensities to drop out of their programs and their times-to-degree.³ In a paper published in 1995, we showed that after controlling for measures of student ability, students who received fellowship or research assistant support had much higher probabilities of completing their programs and slightly shorter times-to-degree than students who were supported primarily by teaching assistantships or who were self-supported.⁴ This research supported efforts by the Cornell Graduate School to obtain more resources from the central administration for first-year Ph.D. fellowships.

One issue that our nation's research universities persistently must confront is the claim that our enrollment of foreign Ph.D. students is displacing American students who otherwise might gain admission to our Ph.D. programs. Concern has been expressed, in particular, that foreign students are displacing underrepresented minority students and that this contributes to the continued under representation of minorities among the Ph.D. population. In a wonderful paper published in 1997, Richard Attiyeh, long-time Graduate Dean at the University of California—San Diego, and his son (a Ph.D. economist) used data from the AAU/AGS project to address this claim.⁵ They estimated models of the probability of students being admitted to Ph.D. study at each institution. Holding constant measures of academic ability, they found that foreign students were "discriminated against" and that underrepresented minority students

received preferential treatment in the Ph.D. admissions process. While this study does not imply that American universities are doing enough to attract underrepresented minority Ph.D. students, it did show that programs at AAU institutions were making efforts to increase the flow of minority Ph.Ds.

DOES FEDERAL SUPPORT FOR GRADUATE STUDENTS DISPLACE INSTITUTIONAL SUPPORT

Much of the data that offices of institutional research compile is done for required reports to government agencies. What many people are not aware of is that these institutional level data are often of great use to researchers conducting policy research.

For example, in a paper published in 1993, two graduate students and I used data from a number of IPEDs surveys to estimate the extent to which universities alter their internal allocation of funds to support graduate students in response to changes in external funding that the universities receive to support graduate students.⁶ We found that increases in federal support for graduate students are associated with a decline (but less than proportionate) in institutional support for graduate students, that the decline is greatest at the top research universities (which have a strong sense of the size they want their graduate programs to be) but that even here the decline is modest, and that when external support for graduate students increases in one field, institutions often divert a share of their internal funds for graduate students' support from that field to other fields. While some "diversion" of internal support to areas other than the ones that funders are supporting takes place, the magnitude of this effect is not large. Hence the diversion is not an issue that policy makers need worry about.

THE 1995 NRC RATINGS OF DOCTORAL PROGRAMS

The 1995 NRC Ratings of Doctoral Programs was published while I was supervising Cornell's Office of Institutional Research.⁷ Unlike previous doctoral program ratings that had been undertaken, data were also presented in the published volume on objective measures of each program (faculty size, publications, citations, receipt of research grants etc.). While faculty raters of programs were not provided this information at the time they made their ratings, it dawned on me that we could act "as if" they knew this information and thus could estimate models of how their subjective ratings were related to objective measures of faculty size and productivity. We could then use these estimates to understand why the

programs at Cornell that were not rated in the top 10 in the nation in their fields were not rated at that level.⁸ Was it because they were too small—ratings are known to correlate with faculty size? Or was it because the faculty members in the program were simply not as productive as their colleagues in top departments—as measured by things like publications per faculty member and citations per faculty member?

The methodology that Peter Hurst and I developed, and then applied to data from Cornell University, was published in a paper in 1998 to illustrate to researchers at other institutions how they could similarly apply our methodology to evaluate the reasons for any of their departments' failures to be ranked highly.⁹ Without going into the details of the methodology, as I have described elsewhere, our approach had an impact on at least two graduate fields at Cornell.¹⁰

Our sociology department was one of the lowest ranked social science departments at the university and the dean of the College of Arts and Sciences was contemplating withdrawing support from it. However, our analyses suggested that faculty in the department were every bit as productive as faculty at top 10 sociology departments in the nation; their low ranking was primarily due to their small size. As a result, the dean decided to increase, rather than decrease, funding for the department. Today it is a much-improved department, perhaps the best social science department at the university. In contrast, the size of our faculty was seen not to be the major cause of our relatively poor rankings in biology and, after the mandatory period in which faculty members blame the university administration for all the bad things that have happened to them, our biology faculty got together and constructively planned ways to improve what they were doing.

This research illustrates that institutional researchers should be opportunistic. They should take advantage of data that others have collected and the methodologies that others have developed and applied to help guide decision-making at their universities.

CONFRONTING THE END OF MANDATORY RETIREMENT AND FACULTY PRODUCTIVITY IN SUPERVISING GRADUATE STUDENTS

During the time that I supervised it, the Office of Institutional Research was involved in a project that related to the end of mandatory retirement. Although the law ending mandatory retirement for tenured faculty members effective January 1, 1994 had been passed in 1987, Cornell, like many other institutions, had not seriously thought about what the end of the law would mean for it.

When we began our research in 1997, Cornell had two years of experience living with the end of mandatory retirement. Simply inspecting the data on faculty retirement patterns we found that the vast majority of Cornell faculty were continuing to retire in advance of age 70—this suggested to us that expensive buy-out plans that paid faculty to retire prior to age 70 would be a very costly way to influence faculty retirement behavior. We also found, however, that a large share of those faculty members hitting age 70 were now staying on rather than retiring.

The Office had previously developed a faculty flow model—a Markov chain model of the flows of faculty into and out of different age groups each year—and we used this model to predict what the impact of changes in the retirement behavior of those faculty still employed at age 70 would be. We found that postponement of retirement, even by this relative small share of our faculty, would substantially reduce the rate of new faculty hires at the university and would also reduce the size of the salary pool that becomes available for continuing faculty salary increases when departing senior faculty are replaced by lower paid junior faculty. This led to the appointment of a joint faculty/administrative committee, which I chaired, that developed a set of proposed changes in Cornell's policies that were ultimately adopted by the institution.

Our study and the changes made in Cornell's policies are described in an article published in 2000.¹¹ One thing that we did not consider in that article was how changes in the age distribution of Cornell faculty would influence graduate education at the university. In a forthcoming paper, two undergraduate students of mine obtained data on the faculty members who supervised each Cornell Ph.D. dissertation over a 7-year period from the Cornell Graduate School.¹² They found that even at a major research university, many faculty members had no graduate student supervisory responsibilities during the period and also that the distribution of responsibilities was much more heavily concentrated among a relatively small number of faculty members in the social sciences than it was in the physical sciences.

From the faculty data base that is maintained by our Office of Institutional Research, they were given access to each faculty member's age, gender, field, rank, date of receipt of Ph.D. and whether the faculty member came to the university directly with tenure. The students were able to merge the Graduate School data with the data on the characteristics of faculty members to estimate, among other things, how supervision of graduate students varies over faculty members' careers. On average, they found that the number of Ph.D. students that a faculty member supervises tends to peak at about 20 years after he or she receives the

Ph.D. and that the number declines thereafter. Whether this pattern will be altered as the age distribution of our faculty changes is an open question, but it should lead the university to worry about whether an aging faculty will have an adverse affect on graduate education.

COLLECTIVE BARGAINING BY GRADUATE ASSISTANTS

The first graduate student union to be recognized as a collective bargaining agent was at the University of Wisconsin in 1969. By 1999, teaching assistants at 18 public Research and Doctoral Universities were covered by collective bargaining agreements and in some cases these agreements covered research assistants at the same campuses. Since the start of 1999, 16 additional major research universities and doctoral universities have recognized graduate student bargaining agents, including all the campuses of the University of California and NYU, which in 2001 became the first private university at which collective bargaining for graduate assistants takes place.¹³

Most universities that have been faced with graduate student unionization campaigns have vigorously opposed them, including many universities that have long had collective bargaining agreements with faculty or staff unions. The reasons for this opposition have included the belief that a system of shared governance is preferable to one of confrontation, the fear that graduate student unions might try to get involved in academic decisions that are more properly left to faculty and administration, and the fear that graduate student unions will impose financial costs on universities that will force the universities to make cutbacks in other areas and/or to increase tuition by more than they otherwise would prefer to do.

Surprisingly, as of 2002, there had been no studies undertaken of the effects of graduate student unions on economic variables. Data from a data exchange conducted by a set of major universities allowed me to conduct some preliminary analyses of this question. Under the condition that I would not divulge the name of any individual institution participating in the exchange, or even the name of the data exchange, I was granted access to five years of data on the salaries, compensation, and costs of teaching and research assistants at a set of public universities.

In a paper that three undergraduate students and I coauthored, we grouped these universities into three groups.¹⁴ The first consisted of 16 institutions that have never had a collective bargaining relationship with graduate assistants. The second group consisted of eight institutions that had collective bargaining agreements with their graduate assistants before 1995 and two more institutions that first began bargaining with graduate assistants in 1995 or 1996. The final group consists of seven institutions

that first began bargaining with their graduate assistants during the 1999–2001 period. For simplicity, I restrict my attention to teaching assistants in what follows, but the data for research assistants yielded very similar results.

In our paper, we presented tabulations of the mean values, across institutions in each group, of a number of economic variables for five academic years, 1996–1997 through 2000–2001. The variables we looked at were

1. Average academic year teaching assistant stipend.
2. Average academic year stipend minus in-state tuition and fees that teaching assistants had to pay.
3. Average teaching assistant stipends for summer teaching.
4. Average stipends deflated by cost of living measures (either housing prices, or assistant professor salaries).

In each case we compared the changes in the mean values that occurred during the period for those institutions that were either organized before the start of the period, or became organized in 1995 or 1996, to the changes in the mean values for those institutions that were never organized, or that became organized at the end of the period. On balance, we found no evidence that becoming organized during the period, or being organized before the period began led to a greater growth in academic year stipends during the period. Whether this reflects the inability of graduate student unions to win large salary increases for their members, differences in the tightness of the state budgets between the states in which institutions in which graduate students were organized are located and the tightness of budgets in states in which institutions with graduate students that are not organized are located, or a concerted effort by nonunion schools to raise stipends to try to encourage graduate students not to think about organizing, could not be determined from our analyses.¹⁵

We did find evidence, however, that graduate students who were at institutions in which bargaining was in place either at the start of the period, or began during the period, saw their required tuition payment go up by a smaller amount during the period, which suggests that graduate student union may be able to influence tuition remission decisions. Similarly, we found evidence that summer teaching stipends for graduate students increased by more at the institutions in which bargaining was in place either at the start of the period or began during the period. However, the magnitude of each of these “effects” was small. Hence, although these results to not take into consideration other factors that may influence these outcomes, such as changes in state appropriations and changes in

graduate tuition levels, they do suggest that graduate assistant unions have not had major impacts on the finances of public universities.

Other comparisons that we reported in the paper attempted to control for differences in the change in cost of living in different areas during the period. We did so in a number of ways, including simply looking at graduate assistant stipends relative to the average salaries of assistant professors at the institution. When we did this, we found little support for the proposition that graduate student unions increase the salaries of teaching assistants relative to the salaries of assistant professors. This finding should not be too surprising—several of the graduate student contracts specify that the salary increase that their members are to receive will be equal in percentage terms to the increases granted to the faculty.

Taken together our findings suggested that the impact of graduate assistant unions on economic outcomes has not been very large and the fear that graduate assistant unions will impose substantial financial costs on universities may well be overstated.¹⁶ Indeed, attracting and retaining top graduate students is an important objective of faculty at all research universities and so the faculty is often supportive of increased stipends for graduate fellows and assistants. Concern about graduate assistant unions, for the most part, is an administrative, not a faculty concern.

The conditions governing my gaining access to these data limited the sophistication of the analyses that I could conduct with them. CHERI currently has a survey in the field asking graduate deans at public research and doctorate institutions to provide us with a longer historical data series on teaching assistant stipends, tuition remission policies and health insurance coverage (which was missing in the data to which I was granted access). These data will be merged with other publicly available institutional data sets and information on the date that collective bargaining coverage began, if ever, for graduate assistants at each institution. The merged data will then will be used by a doctoral student who is seeking to explain the historical pattern of the growth of collective bargaining coverage for graduate assistants and to analyze more precisely what the effects of collective bargaining coverage have been on graduate assistants' stipends, tuition remission policies and health insurance coverage.

CONCLUDING REMARKS

Space does not permit me to discuss a major evaluation CHERI is conducting for the Andrew W. Mellon Foundation on the effectiveness of their *Graduate Education Initiative*. This initiative provided over \$80 million dollars of financial support over a decade to 50 humanities and associated social science programs at ten AAU institutions to improve

their doctoral programs. Data were collected annually for all students who entered both these programs and a set of control programs that were located at the ten institutions and at number of other institutions. Students were followed each year until attrition or degree completion, with information being reported on their status each year and the types of financial support they were receiving. That these data have been collected suggests that the factors that caused the cancellation of the earlier AAU/AGS data exchange have been overcome.

I mention this evaluation because I suspect that many of the offices of institutional research at universities that have departments that are either “treatment” or “control” departments in the study are unaware of both the Mellon Program and the evaluation that we are undertaking. I make this conjecture because one of the problems that institutional researchers at many institutions face is that they are not aware of all of the different data bases that are being collected and maintained on their campuses.

If we are serious about using offices of institutional research to improve decision-making at our institutions, the development of a data warehouse at each institution that includes all of the institution’s databases is absolutely essential. So too is educating administrators at these institutions about the usefulness of institutional research. I take it as a personal failure that when I was a Cornell Vice President supervising our Office of Institutional Research I did not spend enough time trying to educate other key administrators about the importance of institutional research.

One best unnamed senior Cornell administrator often told me that a major challenge that he faced was “managing” the person to whom he reported. I suspect that this is a challenge that many institutional researchers face, how do they convey to the senior administrators for whom they work the importance of what they do if these senior administrators are not “data driven” people themselves? Perhaps pointing out to the administrators how institutional research at other institutions has informed decisions is a useful strategy. Perhaps simply illustrating how existing cross-institutional databases have aided institutional decisions at one’s own institution is another route to follow.

Indeed, as an “outsider” to the institutional research community, it is worth my stressing again the real benefits that multi-institutional data bases that are available to institutional researchers can provide to both the individual academic institutions at which they are employed *and* the broader higher education community. Two more examples, will illustrate this point. First, colleagues and I have recently used institutional level data from IPEDs and NSF to analyze what the impacts of increasing institutional expenditures for research are on institutions’ student/faculty ratios, substitution of lecturers for tenure-track faculty, undergraduate

tuition levels, generation of external funds for research and annual giving.¹⁷

Second, in another paper a graduate student and I recently used institutional level panel data from IPEDs and the annual AAUP Salary Survey to trace the growing use of non tenure-track full-time and part-time faculty and to analyze the extent to which this growth could be explained by the changing relative costs of different types of faculty and by contractions in institutional budgets.¹⁸ In follow-up work we are using panel data from IPEDS and the College Entrance Examination Board's *Annual Survey of Colleges: Standard Research Compilation* to analyze the impacts of changes in the proportion of faculty at an institution that are part-time and non tenure-track full-time on the institution's 6-year graduation rate. Our analyses suggest that increased usage of both of these types of faculty members is associated with reductions in graduation rates.¹⁹ Surely both administrators and trustees at individual institutions, as well as state legislatures and governors who control state appropriations to public higher education, need to have such information in formulating their policy decisions.

One of my Cornell colleagues in institutional research recently told me that the office would never have thought to conduct many of the studies that I have conducted because they are so constrained by all of the mandatory reports that they must prepare annually for their administration and for government agencies. So my final suggestion is that offices of institutional research spend some time educating social scientists on their institutions faculty, especially those who are serving on financial policies committees, about the data bases to which the offices have access and the questions that might be addressed with such data.

While some might argue that I am unique and that it is rare to find a social scientist who is interested in conducting research on questions of relevance to higher education at his or her own institution, a glance at my web page should indicate to you that I had a very successful career as a labor economist before I began conducting any higher education related research.²⁰ Indeed, my first paper on the economics of higher education, the one on optimal financial aid policies that I described at the start of this paper, grew directly out of my work on a faculty committee that was worrying about what our undergraduate financial aid policies should be. I was able to write the paper because of the willingness of Cornell's Dean of Admission and Financial Aid and its Office of Institutional Research to grant me access to the data needed for the study. If institutional researchers and administrators think that scholars like me are hard to find, it may well be because many of them

have not sufficiently drawn on the faculty at their institutions for help and encouraged them to work on research that will be both beneficial to their institution and academically useful to the faculty members' careers.

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ENDNOTES

1. Ostriker and Kuh (2003).
2. Ehrenberg and Sherman (1984).
3. An introduction to competing risk and other duration models can be found in Wooldridge (2001).
4. Ehrenberg and Mavros (1995).
5. Attiyeh and Attiyeh (1997).
6. Ehrenberg, Rees, and Brewer (1993).
7. Goldberger, Maher, and Flattau (1995).
8. The methodology that we developed allows institutions to choose whatever comparison group they want for each department (e.g. top 10, or top 20, or top 50—and the group chosen may vary across departments at an institution). For example, if an institution wants its programs in each field to be in the top ten *percent* of all programs in the nation, it would choose a larger comparison group for fields in which there were many programs nationwide and a smaller comparison group for programs in which there were only a few programs nationwide.
9. Ehrenberg and Hurst (1998).
10. Ehrenberg (2002), chapter 4.
11. Ehrenberg, Matier, and Fontanella (2000).
12. Crosta and Packman (forthcoming).
13. In July 2004 the National Labor Relations Board reversed its NYU decision and ruled that teaching assistants at Brown University did not have the right to form a union (Smallwood 2004). This decision will likely restrict collect bargaining for graduate assistants in private universities for the foreseeable future.
14. Ehrenberg, Klaff, Kezsbom, and Nagowski (2004).

15. In retrospect, we could have used published data on changes in state appropriations to public higher education institutions to address the “budget tightness” hypothesis.
16. An important concern of graduate students in many organizing efforts has been workload issues. Our analyses of the survey data found no evidence that graduate student unions had decreased their members’ workloads relative to those of graduate assistants at institutions without unions.
17. Ehrenberg, Rizzo, and Jakubson (2003).
18. Ehrenberg and Zhang (2004a).
19. Ehrenberg and Zhang (2004b).
20. See www.people.cornell.edu/pages/rge2

REFERENCES

- Attiyeh, G., and Attiyeh, R. (1997). Testing for bias in graduate school admissions. *Journal of Human Resources* 32: 524–548.
- Crosta, P. M., and Packman, I. G. Faculty productivity in supervising doctoral students’ dissertations at Cornell University. *Economics of Education Review* (forthcoming).
- Ehrenberg, R. G. (2002). *Tuition Rising: Why College Costs So Much*, Harvard University Press, Cambridge, MA.
- Ehrenberg, R. G., and Hurst, P. (1998). The 1995 NRC Ratings of doctoral programs: A hedonic model. *Economics of Education Review* 17: 117–138.
- Ehrenberg, R. G., Klaff, D. B., Kezsbom, A. T., and Nagowski, M. P. (2004). Collective bargaining in higher education. In: Ehrenberg, R. G. (ed.), *Governing Academia*, Cornell University Press, Ithaca, NY, pp. 209–234.
- Ehrenberg, R. G., Matier, M., and Fontanella, D. (2000). Cornell University confronts the end of mandatory retirement. In: Clark, R., and Hammond, B. (eds.), *To Retire or Not to Retire: Retirement Policies and Practices in Higher Education*, University of Pennsylvania Press, Philadelphia, PA, pp. 81–105.
- Ehrenberg, R. G., and Mavros, P. (1995). Do doctoral students’ financial support patterns affect their times to degree and completion rates. *Journal of Human Resources* 30: 581–609.
- Ehrenberg, R. G., Rizzo, M. J., and Jakubson, G. H. (2003). Who bears the growing cost of science at universities. In: *National Bureau of Economic Research Working Paper W9627*, National Bureau of Economic Research, Cambridge, MA.
- Ehrenberg, R. G., Rees, D. L., and Brewer, D. J. (1993). Institutional responses to increased external support for graduate students. *Review of Economics and Statistics* 75: 671–82.
- Ehrenberg, R. G., and Sherman, D. S. (1984). Optimal financial aid policies for a selective university. *Journal of Human Resources* 19: 202–230.
- Ehrenberg, R. G., and Zhang, L. (2004a). Changing nature of faculty employment. In: *Cornell Higher Education Research Institute Working Paper WP44*, January 2004 (available at <http://www.ilr.cornell.edu/cheri>).
- Ehrenberg, R. G., and Zhang, L. (2004b). Do tenured and tenure-track faculty matter? In: *Cornell Higher Education Research Institute Working Paper WP53*, August 2004 (available at <http://www.cornell.edu/cheri>).
- Goldberger, M. L., Maher, B. A., and Flattau, P. E. (eds.) (1995). *Research-Doctorate Programs in the United States: Continuity and Change*, National Academy Press, Washington, DC.

- Ostriker, J. P., and Kuh, C. (eds.) (2003). *Assessing Research-Doctorate Programs: A Methodological Study*, National Academy Press, Washington DC.
- Smallwood, S. (2004). Labor board rules against ta unions. *Chronicle of Higher Education* 50: A1.
- Wooldridge, J. (2001). *Econometric Analyses of Cross Section and Panel Data*, MIT Press, Cambridge, MA.