

23 Technology Transfer and Academic Capitalism

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This chapter stems from a book co-authored with Sheila Slaughter, *Academic Capitalism: Politics, Policies, and the Entrepreneurial University*.¹ Although technology transfer issues were central in that book, this chapter will discuss other issues, beginning with a definition of academic capitalism.² The term simply refers to college and university deployment of their only real asset, the human capital of their faculty, for the purposes of enhancing their revenues.³ In the book, we define academic capitalism as “institutional and professorial market or market-like efforts to secure external moneys.”⁴

In the United States at least, academic capitalism is an “accelerating trend” rather than a “new event.” When we conducted our initial U.S. interviews in 1991–92, the typical reaction to our inquiries could be summarized by a response made by a university hydrologist to my inquiry about entrepreneurship in his unit. “What’s new?” was his comment. In other countries, such as Australia, Canada, and the United Kingdom, one could argue that academic capitalism had its “coming out” only about a decade ago, two at the most, although of course entrepreneurial professors and academic units have existed for much longer. Now, academic capitalism seems to characterize higher education in virtually all of the OECD (Organization for Economic Cooper-

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ation and Development) countries and is expanding to central and eastern Europe.⁵

To us, the most interesting questions related to academic capitalism are why is it accelerating, and what are the impacts upon institutions of higher education (IHE)? These questions serve as the focus of this chapter.

Academic Capitalism at the Institutional Level

When we wrote *Academic Capitalism*, we devoted a chapter to exploring the first question. We had been observing changes in institutional revenue patterns in the United States for more than a decade, specifically the relative decline in state government support. What I had not known, until on a trip to Australia on a Research Fulbright (to study technology transfer between universities and the national economy, coincidentally) was that this pattern was not unique to the United States. In Australia we learned that the federal government was pushing universities to take a greater role in promoting national economic growth, in part by providing incentives for the universities to collaborate with industry and with various branches of government. Later, we became more aware that these patterns were not unique to either country.

In that same chapter, we presented both changes in revenue and expenditure patterns for institutions of higher education in Australia, Canada, the United Kingdom, and the United States over time. Consider the U.S. data for public IHE the state appropriations declined from 44.0 percent of all support in AY 1980-81 to 37.3 percent in AY 1990-91, representing a decline of \$6.4 billion.⁶ Meanwhile, support shares from tuition and fees increased, as did shares from private gifts, grants, and contracts as well as from sales and services. Clearly, U.S. public IHE had not sat idly by while revenues from their chief resource supplier, state governments, had declined in relative terms.

At about the time of our departure for Australia, my colleague, Gary Rhoades, brought to my attention Pfeffer and Salancik's *resource dependency theory* (1978), which holds that internal organizational activities are influenced primarily through the actions of external resource providers: in short, "He who pays the piper calls the tune." Degree of resource-provider influence is a function of the relative magnitude (share of organizational funds) of the exchange and of the *criticality* of the resource to the recipient (Pfeffer and Salancik, 1978; Pfeffer 1982). According to resource dependency (RD) theory, important revenue

changes destabilize organizations, which address budget shortfalls by pursuing, leveraging, and substituting other revenue sources. An important corollary of RD theory is that organizations often are shaped as much by the pursuit of marginal monies (less than ten percent of total revenues) as by much larger, base budgets.

This theory seemed to fit well with what was occurring in the United States, as well in the other three countries. State appropriations (relative magnitude) were declining and IHE appeared to be making up the shortfalls in other categories.

What about my second question, which also was posited by resource dependency theory? Did shifting resources result in shifting activities within IHE? We already were aware of the relative decline in the allocation of institutional resources to instruction in the United States, and of the increase in the shares being allocated to administration in the other countries and in the other categories of expenditures, the connections also appeared clear: As revenue reliance shifted, so did institutional expenditures, and the shifts were in the expected directions. For example, for the United States over the same 1980–90 time period, the share of expenditures devoted to instruction declined from 35.1 percent to 33.7 percent, while the research share increased from 9.0 to 10.1 percent. Essentially, all the changes were in the expected directions.⁷

Largely from our work in Australia, but also from subsequent work in the United States and the other two countries (Canada and the United Kingdom), we reached a number of conclusions about the effects of the shifting revenue patterns upon IHE. Based upon the Resource Dependency theory we speculated about many more. By the time we finished *Academic Capitalism*, we realized that there was much more to be learned.

In 1996, Ronald Oaxaca, Gary Rhoades, and I received funding from the National Science Foundation (NSF) to explore “The Effects of Changing Revenue Patterns on Public Research Universities.”⁸ We had proposed to examine, among a sample of elite, public research universities in the United States, the effects of the revenue shifts, which had continued into the 1990s. Through the three years of that effort, we (along with graduate students) examined the effects at all three institutional levels: the university, the academic unit (department or facsimile), and the individual faculty member. The remainder of this chapter presents the results of that examination.

The Institutional Level

For her dissertation, Hasbrouck (1997)⁹ built causal models, using Higher Education General Information Survey (HEGIS) and Integrated Postsecondary Education Data Systems (IPEDS) FY1982–83 and 1992–93 financial data for 175 public four-year institutions, to test the relationships among the shifting revenue and expenditure patterns. She constructed her models not only to test resource dependency, but also to consider explanations from economic theory: viewing internal resource allocation as a means of optimizing organizational utility. In keeping with resource dependency theory, whether expressed in dollar or percentage terms, instructional expenditures—the area presumably of greatest interest to state legislators and students—consistently and strongly were predicted by state appropriations and tuition and fees, as would have been expected, but also modestly by gift, grant, and contract revenues. Primarily, however, gift, grant, and contract revenues were targeted on research, as would have been expected. In fact, in all expenditure categories, resource dependency was supported. In other words, all else held constant (*ceteris paribus*) the expenditure patterns suggested that the principal wishes of resource providers such as political leaders and students, who supply the appropriations and tuition and fee funds, were satisfied.¹⁰

Hasbrouck also considered the changes that had occurred between FY83 and FY93, that is, whether time-series results were consistent with the cross-sectional results.¹¹ Virtually all of the results were consistent.

In summarizing her findings, Hasbrouck (1998, p. 8) reinforced resource dependency explanations: “Were a particular revenue source to decline either absolutely or relatively, one would presume that expenditures for that revenue’s related activity might also decrease.” She observed, however, that some revenue substitution might occur; for example, she noted that both tuition and fees and appropriations revenues supported instruction. She also concluded that other theories no doubt play some role in determining how institutions allocate their resources internally.

The Department Level

For their dissertations Gary Ward (1997)¹² and Paul D’Sylva (1998)¹³ analyzed two different data sets to examine effects of shifting revenue

patterns at the department or facsimile level.¹⁴ This level of analysis is particularly important because this is where the production activities of IHE largely are carried out. In fact, the institution-level analyses are important primarily as background; if institution-level financial dynamics are not transmitted to the operating-unit level, one might argue that there is little organizational consequence.¹⁵

Ward and D'Sylva addressed different aspects of department-level functioning in different ways. Ward (1997) focused on whether departmental research expenditures per faculty member and as a percent of total spending varied in regard to undergraduate student credit hour (SCH) production and number of class sections offered. He examined differences by faculty status (e.g., tenure/tenure track), academic field and institutional sector, and public and private institution. The low explained-variances (about 25 percent) in his ordinary least squares (OLS) results were instructive. More noteworthy were the small effects of departmental research activity on instructional productivity: The slightly more SCH produced by research-active departments was counterbalanced by their slightly fewer class sections offered. Overall, Ward concluded that departmental instructional variables, such as percent of tenure/tenure-track faculty within the department and instructional spending variability, were far more important in explaining instructional productivity than was the volume of research activity.

As was the case for Ward, what drove D'Sylva's study (1998) was the popular concern that "university faculty devote too much of their human capital to research at the expense of teaching." (p. 15) In seeking explanations for resource allocation, D'Sylva (1998) compared departmental "rates of return"¹⁶ to instructional productivity, research productivity, and departmental quality with the income production (allocation) function of departments. His reasoning was as follows:

If changes in the institution's resource dependencies drive internal resource allocations, then the rate of return [sic] for these variables should reflect the priorities of those upon whom the universities are dependent. Alternatively, if internal factors drive this process, then the optimization of inputs with respect to the utility function of the institutions will dictate the relative return for the outputs of teaching, research, and departmental quality. (p. 91)

D'Sylva's *overall* result was that departmental returns to teaching exceeded those to research. Among the four fields of science, the findings

for two years showed greater returns to teaching productivity, compared with research productivity, in five of eight cases. Mean “returns” were 108 percent and 40 percent for teaching and research, respectively. Only in the life sciences did his results show a greater return to research than to teaching; the margin of difference favoring returns to teaching over research was greatest within the social sciences and the physical sciences. D’Sylva was led to conclude that “The perception that instruction has been displaced by research as the priority in the allocation function of public universities was not supported by the results.” (p. 165) In other words, departments could and did increase their revenues by teaching more. In his discussion D’Sylva pointed out that, although apparently secondary to instruction, research effects were important to departments, as reflected in the contribution of research to unit revenues. The 40 percent return rates in both years of his data support this view.

The lack of evidence found by Ward in regard to the effects of variations in research activity on instructional productivity plus D’Sylva’s results generally showing much greater “returns” to instruction than to research bring into question the common perception that research universities favor research over instruction, at least at the department level. Coupled with the fact that variations in revenue changes at the university level can be connected causally with expenditure changes, the Ward and D’Sylva findings suggest that departmental dynamics may be somewhat unique among the three university levels.

Our field work gave us several important insights into the apparent discrepancies. For example, interviews with department heads revealed that there is substantial and consistent cross-subsidization of activities at the department level. Apparently, departments act in ways to mitigate external influences. Also, institutional leaders often attempt to insulate or buffer production units from external forces. Interviews with faculty members revealed that some faculty simply refuse to be leveraged into entrepreneurial behavior. Next, when we review our results for individual faculty members we will both gain additional insights and learn of additional incongruities (between the findings for departments and for their individual faculty members).

The Level of the Individual

Although our field work included collection of additional department expenditure and productivity data from the universities directly

plus interviews with department heads regarding departmental resources and related productivity issues, most of our data about individual faculty members were obtained from Time Budget Analysis interviews.¹⁷ We believe the data from those interviews to be unusually valid. (See the Appendix.)

Faculty member time allocations were divided first among teaching, research, and service; then among the various subcategories of each. (See the codes in the Appendix.) Joint-production time allocations were recorded in cases where an activity served more than one purpose. *Time allocations were controlled for quality.* We reasoned that the amount of time spent on an activity had no value independent of the quality of the effort. Our control for instruction was teaching-evaluation data; for research the controls were publications and external grant funding; for service we used seniority at one's institution. Our research questions centered on the interrelations among faculty time allocations. For example, is there a relationship between time spent on research grants and on instruction?

Our best estimate is that the average faculty work week is about 57 hours.¹⁸ An average academic work day entails 4.2 hours spent on instruction, 3.2 hours spent on research, and a balance of 2.5 hours spent on service (including "administration" and "colleagueship"), for a typical work day of nearly ten hours. Including weekends, this works out to approximately 57 hours for a typical academic work week. When we "double count" to include joint-production time, the work day expands to almost 11 hours. This "extra" hour of joint-production time allocates approximately 0.4 hours each to instruction and research, with a residual 0.1 hours or so going to service. Thus the bulk of joint-production time is spent integrating research and teaching activities. Perhaps most notable is the finding that on average faculty spend considerably more time on instruction (4.25 hours, or 43 percent of their typical day) than on research (3.1 hours, or 31 percent of their typical day).

For our estimates of various relationships among faculty time use and associated outcomes, we employed a variety of econometric models, all of which control led for other variables in the equations; that is, all results are for the "all else equal" case.¹⁹ One question of particular interest to faculty members is how their time allocations, controlled for quality of effort, impact their salaries. Overall, the only two statistically significant time-use variables are the interactions of research time with published articles and published chapters in books. An additional hour

(of average quality) spent each academic day for the academic year on research raises the annual salary by \$665.85. This contrasts with an additional hour spent on instruction (of average quality), which *reduces* one's annual salary by \$118.77 or on service (of average quality), which raises the annual salary by \$373. While these last two estimates are not statistically significant, these figures do support a common suspicion about the relative ranking of the rewards for instruction, research, and service. (Although the return to *quality* of teaching was positive, as measured by the student evaluations of teaching, the relationship was not statistically significant.)

Some of the most interesting findings relate to differences among the five fields of science. For example, other things equal, being in an engineering department is associated with more time spent in instruction and less time spent in research, compared with physical sciences departments. A faculty member in engineering spends 1.5 hours more per day on instruction and 0.8 hours less per day on research than a comparable colleague in a physical sciences department (the "comparison group"). Differences in patterns of instructional "production functions" emerged as we conducted our interviews. Generalizing, physical science professors tend to teach fewer and larger classes in a "lecture" format, compared with engineering professors, who appear to spend more time working out solutions to problems assigned to students and problems in examinations, and in grading examinations.

External grant and contract funding has a negative and statistically significant effect on time spent in instruction, and positive and statistically significant effects on time spent on research and on service. Having an external grant leads to a reduction of about one hour per day spent on instruction and an increase of about one hour on research and 0.8 hours on service, yielding a net increase of about 0.8 hours per academic work day. These results for individuals certainly are consistent with RD theory and with Hasbrouck's (1997)⁹ central finding that expenditure patterns are largely predictable from revenue patterns.

Planning to retire within five years has a negative and statistically significant effect on time spent on research. Of course, all results are for the "all else equal" condition, so this result holds constant a counter-effect of academic rank: *ceteris paribus*, relative to assistant professors, full professors are far more likely to spend *more* time on research. In our interviews we find not only that those planning for or contemplating retirement within five years engage in less research and publication,

on average, but that they often agree to do more teaching in order to let their younger colleagues spend more time on the research activities that will benefit them and their units in the long term.

The presence of external grant or contract funding has a positive and statistically significant effect on the probability of engaging in joint production, supporting the notion of the interrelatedness of teaching and research, since this is the most common form of joint production. In fact, from our results one could go so far as to say that academic research often *depends upon* joint production, especially upon the education of graduate students. At the sample mean, having external grant or contract funding increases the probability of joint production by 19.9 percentage points.

Discussion

Although resource dependency appears to be an important concept at the university and at the individual faculty-member levels, resource dependency effects appear somehow to be mitigated at the department level. We think that the department or “unit” level is the most interesting and is the most important to policy because this is where the production activities, the instruction, the research, and the service of the university, largely are produced. On the one hand, the unit-level results are consistent with the major finding at the institutional level: Primarily, money appears to be expended for the purposes intended by the resource provider. However, the internal dynamics of department-level expenditures are far more complex in their understanding. Our interpretation of our results, *en toto*, is that, within the constraints demanded or generally “expected” by resource providers, departments possess and exercise substantial discretion in how the various resources are deployed, with that discretion being exercised in ways that further enhance revenue streams and accomplish the central work of the department. This “work” is broadly defined by departments and their faculty. To be sure, it includes meeting the terms of grants and contracts, but it begins with serving students and serving them well, not simply because university resources are allocated in some correspondence with the quantity of teaching performed, but more so because of a strong sense of professional and personal responsibility to students. These conclusions were especially clear from our interviews. Faculty work also includes providing substantial service to the department, the college, the university, and the academic profession of which faculty are a part.

Returning to the important resource dependency question, we found only modest evidence of major *departmental* destabilization. In a word, most departments “coped,” without the necessity of major internal change. Among the 165 departments in the sample, there was a substantial number of departments characterized by a dynamic environment; the life sciences were the best example. Generally, these departments tended to be notably more entrepreneurial and closer to the market than were departments in the other four fields of science. However, this life sciences dynamism appeared to be more a matter of entrepreneurial *opportunity* than of departmental resource destabilization and necessity. Only in scattered departments in other fields of science was financial stress clearly noted. Most often these were departments that viewed themselves as being at risk because their functions relatively were not central to the university mission. For example, some education departments stood out in this regard; in contrast units such as mathematics, and economics departments appeared to consider themselves secure because of their central role in providing service courses and in offering “core” majors.

All this is not to say that departments fail to respond to the changing resource environment; those responses were widespread and existed in several forms. Most directly, departmental substitutions of self-generated funds for state funds were evident in the majority (62 percent) of cases. Our questions as to whether substantial revenue reductions in state support had effected the substitution yielded several solid examples, with substitution values amounting to 2.3 percentage points for a ten percentage point reduction in state support.

Units were quite selective in how and where they chose to compensate for declines in their budget bases (i.e. block-grant support from the state). For example, departments were *less* rather than more likely to subsidize such costs as their operating budgets, travel, and secretarial support when budget bases were eroded. *Negative* elasticities were almost twice as large in these areas (4.5 compared to the 2.3 above). Departments were, however, willing to draw upon self-generated revenues to support shortfalls for equipment and support for graduate students, suggesting perhaps that the determining factor in providing self-support was *ability*, not willingness. Grant and contract agencies often permit, even encourage, the use of grant and contract funds to purchase these items and provide support in these areas.

Although our stated purpose in our proposal to NSF was to examine the effects of revenue changes upon academic departments, we found it necessary to examine the institutional and individual levels as well. By considering all three levels, we gained many important understandings about the operations of public research universities in a period of fiscal flux, understandings that we would have missed with the single focus. Our sense is that academic departments are adaptive organisms; even the effects of external markets are not clearly and consistently translated into incentive structures and internal resource allocation patterns promulgated by deans and central administrators. Academic departments are also responsive organisms. We saw evidence of departmental responses even to *perceived* but nonexistent university policy changes; we saw overwhelming departmental response to very minor financial incentives, strongly supporting Pfeffer and Salancik's (1978) "rule of ten percent." We saw little that concerned us about the effects of the changing revenues of research universities, save the effects of the decline in shares coming from state governments in block-grant form.

Departments do not appear to be shifting their emphases away from teaching and toward research, when viewed *en toto*. In fact, many institutions and departments evidence a marked increase in attention devoted to undergraduates, instruction, and curriculum reform. Nevertheless, as shares of state support decline, departments, colleges, and institutions are forced (or decide) to cross-subsidize activities from other sources (e.g., instruction from research grants and contracts). In many ways this is not a healthy situation for either the research or the instruction functions. In the long run, the patterns we observed may compromise the quality and integrity of research and instruction in public universities.

Appendix

Time Budget Analysis

Time Budget Analysis (TBA) is a powerful technique for gaining accurate assessments of how individuals spend their time. Because the TBA interviewees are not aware of the researcher's purposes and because interviewees who misrepresent their activities soon find themselves in webs of inconsistencies, it is very difficult for them to falsify their answers. A brief overview of how TBA is conducted will illuminate.

After the passing of pleasantries, the interviewer asks the respondent, in this case the faculty member, to recall what he or she was doing "at this time yesterday." Usually, the respondents begin slowly, trying to remember where they were and what they were doing. But with a few cues from the interviewer, invariably the respondents recall the events. Suppose the faculty member responds, "Oh yes, I come in later on Tuesdays; I had just dropped off my daughter at school and was on the way into the office." From this, the interviewer begins to develop with the interviewee a mind-set of care as to details. The interviewer will follow up by saying something like, "Are you sure? What time did you arrive? Does that confirm your sense of the timing?" Most often, the faculty member will continue with something like the following: "I arrived about 8:15, stopped by the department office, and then came right up to my office." To this the interviewer would say, "Okay. Let's be more specific. I need you to be sure of the timing. Was it 8:15 or might it have been 8:05 or 8:10 that you arrived? And how long were you in the department office? Did you speak with anyone? How long did you spend there? What did you do there? After you left that office, did you stop anywhere else? Did you see anyone else on the way up to your office?" Then, "If you saw someone or stopped to do something else, who or what was it? What was involved? What was the nature of that interaction or action?"

The interviewer is attempting to accomplish two primary objectives. S/he is seeking to develop a sense on the part of the faculty member that accuracy and detail are important, that the faculty member should use

precision as s/he continues to describe his/her activities of the previous 24 hours. The interviewer also is seeking to obtain information about the specific nature of the faculty member's activity. For example, our first level of categorization of faculty time allocation is among instruction, research, and service; however, we are interested in finer discriminations as well, such as whether a research interaction with a student deals with the student's own research or with a research project that is a joint effort of the faculty member and the student, and whether the student is an undergraduate or a graduate student. Let's assume that the student is a graduate student and that the interaction is about a research project for which the faculty member has NSF funding and on which the graduate student is assisting. We classify the faculty member's time "Instruction, grad, out-of-class (IGO)." However, joint production is involved, because from the faculty member's perspective his/her own research is involved; therefore, the time is classified also as "Research, Public Funded (RXPu)."

Ordinarily, with the early cues as to care and detail, the faculty member requires few additional cues or prompts to yield valid responses at the level of specificity required.

Faculty Interview

Time Budget Analysis Codes & Introduction

1. INSTRUCTION

- a. IG—Grad, in-class
- b. IU—Undergrad, in-class
- c. IGO—Grad, out-of-class
- d. IUO—U-grad, out-of-class
- e. IGC—Contact, Graduate
- f. IUC—Contact, Undergrad

2. RESEARCH

- a. RAD—Administration
- b. RD—Departmental
- c. RXPu—Ext Spt, Public
- d. RXPvt—Ext Spt, Private
- e. RI—Internal Supported
- f. RP—Procurement

3. SERVICE

- a. SCP—Consulting Pvt
- b. SCG—Consulting Gvt
- c. SP—Public Service
- d. SO—Other

Introduction: Faculty Interviews

Introduction: I am _____. I am a _____ at the University of Arizona. I am here to interview you regarding a National Science Foundation project dealing with science policy. To avoid the possible biasing of your responses, I would prefer not to say more; however, if you have questions, at the end of the interview I will be happy to answer any questions. Okay?

This interview usually takes a little less than 1 hour and is in two parts. The first part is a time budget analysis; the second part involves 6 or 7 specific questions.

Before beginning, it is important that I say that the information will be used for statistical purposes only. The anonymity of the respondents and of their departments and their universities will be strictly respected.

Two other matters. May I have a copy of your vita? (The long version! Must get grants listed!) Perhaps you would want to start printing it while we talk. Also, again assuring you of total confidentiality, may we have your permission to obtain your teaching evaluations? (Get signature on form.)

Note to interviewer: If this interview occurs on Monday, obtain data beginning 24 hours previously (Sunday). At the end of the 24-hour Time Budget Analysis, ask: Would you please give me just a brief overview of your work-related activities for Friday night and Saturday?

Note to interviewer: You must probe for “joint production” activities. The most common type is when a faculty member interacts with students about research. Usually, the time is coded both RX and IGC or IUC. Also, make notes about any “new type” of entrepreneurial activity.

Given that, it is now _____ o'clock. What were you doing at this time yesterday?

Endnotes

1. Slaughter, Sheila A. and Leslie, Larry L. *Academic Capitalism: Politics, Policies, and the Entrepreneurial University*. Johns Hopkins University Press, Baltimore, MD; 1997.
2. We are presently working on a mid-range theory of the concept.
3. See pp. 10–11 of *Academic Capitalism*.
4. See p. 8 of *Academic Capitalism*.
5. Since about 1998, the Salzburg Seminar has been bringing together U.S. and Western European academics with leaders from Central and Eastern European universities, for the purpose of “university reform” in the latter. The major instrument of reform has been seen as the generation of non-state revenues, such as tuition and private sector contracts and grants. The Western academics follow up with advisory visits to the latter’s campuses. Concomitantly, the World Bank has promoted these instruments of reform through competitive loans to these governments.
6. In other words, if the 44.0 percent share of 1980–81 had been maintained, public IHE would have received, in 1990–91, \$6.4 billion more than they did in fact receive.
7. That is, as expectations could be inferred from the implicit and explicit desires of the resource providers. For example, the increase in gift, grant, and contract revenue was associated with increasing research activity. See *Academic Capitalism*, pp. 86–87.
8. NSF Grant Number 9628325. The Government has certain rights in this material. Any opinions, findings, and conclusions or recommendations expressed in this material are those of the authors and do not necessarily reflect the views of the National Science Foundation.
9. Hasbrouck, N. *Implications of the Changing Funding Base of Public Universities*. Ph.D. Dissertation. University of Arizona, Tucson. 1997.
10. Hasbrouck also reported evidence of institutional utility maximization: the “higher” the institution’s Carnegie classification, ceteris paribus the lesser the allocation to instruction. Further, she found evidence of fungibility, or “cross-subsidization,” that is the allocation of money from gifts, grants, and contracts to instruction.
11. She employed fixed-effects regressions, again using the OLS and binary logic approaches.
12. Ward G. T. *The Effects of Separately Budgeted Research Expenditures on Faculty Instructional Productivity in Undergraduate Education*. University of Arizona, Tucson. 1997.
13. D’Sylva, A. *Examining Resource Allocation within U.S. Public Research I Universities: An Income Production Function Approach*. University of Arizona, Tucson. 1998.

14. Ward utilized the University of Delaware departmental data base developed under a grant from the Fund for the Improvement of Postsecondary Education (U.S. Department of Education), and D'Sylva employed the *Data Exchange* files of the Association of American Universities (AAU).
15. In fact, Stocum and Rooney (1997. Responding to Resource Constraints: A Departmentally-based System of Responsibility Center Management. *Change Magazine*. 29, 5: 51–57.) report that even when resource consequences are experienced at the college level, departmental consequences can be buffered departmentally.
16. D'Sylva uses this term loosely here. In our discussion of his work herein, we utilize the more general term "return," which we think will prevent possible misunderstanding among readers knowledgeable about "rate of return studies."
17. Our stratified sample of faculty members consisted of three faculty members drawn randomly from within each of three departments drawn randomly within each of five fields of science within each of eleven public, AAU universities. The universities were selected for geographic balance after choosing two of the eleven for their financial difficulties and special financial management strategies, respectively. Combined with the department head interviews, our sample was 60 interviews within each of the eleven universities.
18. To obtain a mean value for the week, we drew a sample of 29 subjects of those for whom we had Saturday and Sunday data, calculated mean values for each day, and added this time to the previously estimated 50-hour work week.
19. For a full description of the estimating techniques and the results see Larry L. Leslie, Gary Rhoades, and Ronald L. Oaxaca, *Effects of Changing Revenue Patterns on Public Research Universities*, A Report to the National Science Foundation, Grant Number 9628325, The University of Arizona, Tucson, July 1999. Copies of the report may be obtained from the University of Houston Law Center, the Institute for Higher Education Law & Governance, IHELG Monograph 99-10.