Realized publicness at public and private research universities

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Abstract

Although research extensive universities in the United States produce similar outcomes – research, teaching, and service – they vary substantially in terms of the publicness of their environments. In this paper, we adopt the public values framework (Moulton 2009) to examine how regulative, normative/associative, and cultural cognitive components affect realized public outcomes by faculty. Using survey data from a random sample of faculty scientists in six fields of science and engineering at Carnegie Research I universities, we find that organizational and individual public values components are predictably associated with different realized individual public outcomes. For example, individual support from federal resources and affiliation with a federal lab (*associative*) are related to increased research outcomes, while tuition and fee levels (*regulative*) explain teaching outcomes, and perceived level of influence in the workplace (*cultural cognitive)* explains teaching and service outcomes. We conclude with a discussion of the findings.

Realized publicness at public and private research universities

Introduction

One of the oldest, and arguably most important, questions in public administration research is the distinction between public and private organizations. Early public administration scholars argued that public and private organizations are distinct because they handle problems where government action is required and markets alone fail (Dahl & Lindblom 1953; Lindblom 1977); because they produce goods or outcomes that benefit the public (Blau & Scott 1962); and because of organizational ownership and funding (Wamsley & Zald 1973). The growth of outsourcing and government-sponsored corporations and authorities, the hybridization of organizations, and the rise of non-profit organizations delivering public services have contributed to a blurring of the public and private sectors (Kettl 1993; Weisbrod 1977). In the case of public universities, the reduction of state appropriations and the rise of business-like practices such as technology transfer and endowment building have blurred the distinctions between public and private universities.

Although many scholars warn against oversimplifying the distinctions between public and private organizations (Bozeman 1987), much of the research comparing university outcomes in the United States assesses organizational distinctions and outcomes with a simple, dichotomous variable indicating whether the university is public or private – a distinction made by ownership (de Groot et al. 1991; Owen-Smith & Powell 2003). Others complement the public-private measure with measures such as land grant status and the ratio of total operating budget per student (Turk-Bicakci and Brint 2005). Geiger (1985) notes that the "public/private distinction in higher education is largely a phenomenon of the past hundred years" (387) and that many universities are better described as not-for-profit organizations, especially those which are distinct from the government sector and not primarily driven by profit-maximizing, as is the case for private universities. Unfortunately, categorizing all research universities as not-for-profit organizations does not give us a clear understanding of the ways in which origins, funding, structure, priorities, and values are related to variation in the production of public outcomes and the "publicness" of these organizations.

Because the distinction between public and private universities is complex, we suggest focusing on how dimensions of publicness affect faculty behavior and outcomes (Bozeman 1987; Bozeman & Bretschneider 1994). We take advantage of Moulton's (2009) realized publicness

framework to hypothesize how three publicness dimensions at universities – regulative, associative, and cultural cognitive – affect the production of three types of outcomes – research, teaching, and service – at Research I universities. The paper explicitly acknowledges that the relevant public for each of the three outcomes differs – knowledge produced through research and publication reaches the broadest audience while the focus of service can be external or internal to the university. By applying hierarchical modeling, we investigate how public value institutions, operationalized at both the individual and organizational levels, matter for explaining publicness outcomes as evidenced by the production and contribution of individual faculty. Results indicate that the three public value institutions have different effects on each of the outcomes.

Realized Publicness

Bozeman (1987) argues that publicness can be assessed by the degree of political and economic authority facing an organization. Other research argues that publicness can be measured by resource ties to government, political control, and influence over the organization, or dedication or ability to deliver public outcomes (Bozeman & Kingsley 1998; Bozeman et al. 1992; Heinrich & Fournier 2004; Wamsley & Zald 1973). In the case of higher education, Geiger (1985) argues that levels of regulation and political authority and the provision of public goods drive sector distinctions. Moreover, empirical research indicates that university outcomes are related to governance structures, allocation of resources, revenue sources, and the prioritization of research or teaching (Knott & Payne 2004).

Although public administration scholars typically have sought to capture publicness through easily operationalized measures such as percent of government resources and ownership, Moulton (2009) argues that they fail to capture the full spectrum of publicness. Building on Scott (2001), Moulton proposes an alternative framework to predict public outcomes which centers on two components: "(1) realized publicness, or the realization of public values demonstrated by organizational behavior or outcomes; and (2) institutionalized public values as influences of publicness (public value institutions), including regulations, associations, and cultures in an organization's environment (including but not limited to government) that embody public values and thus influence the organization toward realized public outcomes" (2009, p. 891).

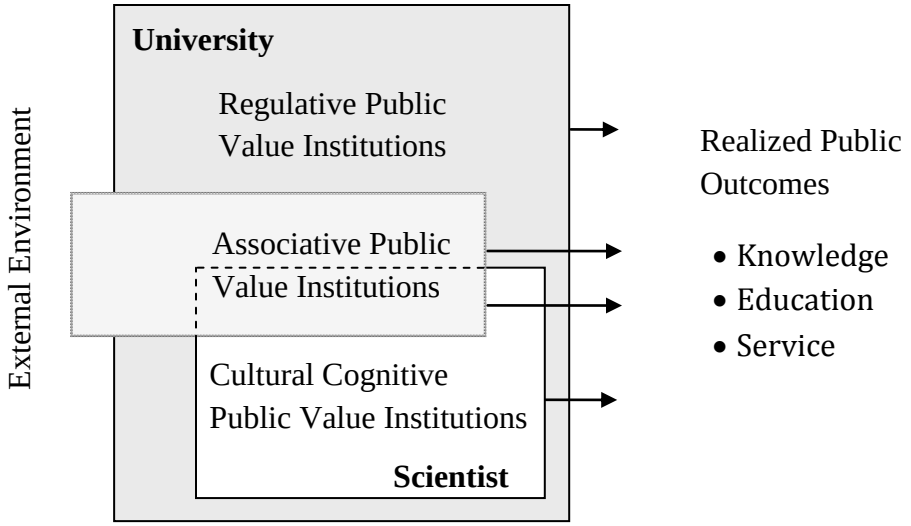
Regulative public value institutions are formal institutions such as political constraints, economic controls, and legal ownership. Associative public value institutions are morally

grounded and driven by "the creation of expectations that introduce a prescriptive, evaluative, and obligatory" (Scott 2003, 880) dimension of organizational life and behavior including participation in networks (Heinrich & Fournier 2004), associations and memberships, interorganizational relationships (Bozeman et al. 1992), and ties to the community (Moulton & Feeney 2010). Cultural cognitive public value institutions concern the shared concepts that develop among individuals within the culture of organizations, such as mission publicness (Golstein & Naor 2005; Scott 2003).

Figure 1 presents a stylized depiction of the influence of organizational and individual public values institutions on publicness outcomes. In general, all three public values institutions create organizational conditions, to varying degrees, encourage the production of a mixture of public outcomes. Regulative public value institutions set the formalized controls that constrain or catalyze the production of public outcomes at the organizational level. Associative public value institutions determine the relational characteristics that organizations and individuals develop with other entities. Cultural cognitive public values institutions are manifested through the collective understanding of the organizations goals, expectations, and intentions. These institutions will further affect the production of public outcomes. For example, organizations that have stronger relationships with the community groups may engage in greater local service educational or civic activities.

Public value institutions affect the production of public outcomes through at least two key routes: by conditioning the behavior of the members of the organization to conform to institutional norms and by attracting individuals who are particularly capable of or amenable to producing the desired mix of outcomes (Heinrich and Fournier 2004). Associative and cultural cognitive public value institutions may vary among individuals within the same organization. For example, within the same university, some scientists may have stronger collaborative ties with researchers in government. Additionally, there are significant differences in norms or practice across disciplines of science. The norms that prevail within these relationships and groups may explain differences in production of articles. Similarly, within the same organization, individual perceptions of shared values may vary depending upon the specific work task, experiences, and colleagues. Hence, cultural cognitive value institutions may vary among individuals within the same organization.

Figure 1. Conceptual Model of the Relationship between Public Value Institutions and Realized Public Outcomes at Research Universities



Desired Public Outcomes at Research I Universities

While American universities come in all shapes and sizes, most – if not all – share the mission of creating knowledge and training and educating the public. The first universities established in the U.S. were private, elite institutions that sought to train the *Renaissance man*. With the passage of the 1862 Morrill Land-Grant College Act, which established publicly funded land grant universities in each state, university activities became tied to public goals such as training agricultural, mechanical, and engineering experts. More recent policies, such as the GI bill and the Federal Pell Grant Program, have sought to make higher education more accessible to veterans, minorities, women, and middle and lower-income students. Universities continue to expand their missions and influence in society to include activities such as technology transfer. According to Duderstadt and Womack "The American university is more deeply engaged in society than ever before, playing an increasingly critical role in shaping the economy, culture, and sense of national well-being" (2003, 2). In sum, modern universities are responsible for producing a wide array of public goods.

Carnegie designated Research I (RI) universities are distinguished from other types of universities because of their extensive engagement in research activity.[1] Most RI universities have a threefold mission: research, teaching, and service. Outcomes under this rubric include respectively knowledge creation, training and education, and service activity. Faculty are evaluated and rewarded based on their performance in these three areas. Researchers interested in the outcomes of higher education activities regularly operationalize knowledge creation as the number of publications and citation rates (Levin & Stephan 1991), patent production (Bozeman 2000; Owen-Smith & Powell 2003), and collaborative activities (Pfeffer & Langton 1993). Training and education outcomes include number of graduates, PhDs granted, course credits completed, and prestige. Service outcomes include service to the department and university, to the field and discipline, and to the external community.

It is important to note that these three categories of realized public outcomes are not necessarily relevant to the same publics. For example, a journal article, to the extent that it advances knowledge, represents an outcome that has value to a broad public (academic researchers, practitioners, citizens, the media, students, etc.), while committee work is relevant more locally, primarily to the university. The target public for teaching lies somewhere in between - it advances student training and the university's contribution to society, but attending a college course requires enrollment in the institution and is not broad in the same way that published knowledge is publicly available. Second, it is important to note that research universities and their faculty are charged with advancing all three of these outcomes. While some may produce more research and knowledge outcomes as compared to teaching or service, it is not the case that they can solely advance one. However, it is possible that some universities treat these three missions as complements, while others treat them as substitutes (Del Rey, 2001).

Linking Public Values with Realized Public Outcomes

[1] The Carnegie Classification aims to enable researchers to distinguish between the 4,400 degree-granting colleges and universities in the U.S. Note that this research uses the Research I category of Carnegie Classification (n=151), because the data were collected under that system, which defined RI universities as offering a full range of baccalaureate programs, granting more than 50 doctoral degrees each year, giving high priority to research, and receiving more than $40 million dollars in federal support annually. As of 2005, doctorate-granting universities are now defined as awarding at least 20 doctoral degrees per year and are described as RU/VH: Research Universities (very high research activity) (n=96); RU/H: Research Universities (high research activity) (n=103); and DRU: Doctoral/Research Universities (n=84). (Sources: 2005 Carnegie Classification; National Center for Educations Statistics, IPEDS Fall Enrollment (2004) and http://www.carnegiefoundation.org/classifications/index.asp?key=805

In the following section, we discuss the components of the public values framework in greater detail and offer eleven hypotheses in order of the three framework components: regulative, normative/associative, and cultural cognitive.

Regulative. Indicators of regulative public values institutions at universities can include measures such as federal laws, state regulations, laws, and policies, land-grant status, ownership, and financial resources. Two indicators that are often used in research examining differences among universities are whether the university is private or public and land-grant status. While these measures are indicators of regulative publicness, alone they are not sufficient because universities vary significantly in their reliance on state, federal, and private resource allocations. Moreover, a simple public-private distinction does not capture the complexities of federal funding since both private and public research universities rely on extensive amounts of federal grants and contracts and accept federal aid and subsidies for students (e.g. Pell Grants).

A common measure of university capacity is federal, state, and industry R&D funding (Fairweather 1988; Tornquist & Kallsen 1994; Turk-Bicakci & Brint 2005). We distinguish between the amount, goals, and priorities associated with different types of financial resources. Research indicates that federal funding for R&D activities may displace the need for public universities to rely on state appropriations and federal student financial aid as a source of income, which can result in reduced emphasis on the mission of educating local residents (Slaughter 1998; Fain 2009). Federal resources are typically tied to research grants and contracts (allocated based on faculty competition and merit) and financial aid to students (allocated based on student need and merit). The former resource is likely to be related to faculty outputs, in particular publications, while the latter is likely related to student outcomes. The balance of these two types of aid can help us to differentiate between universities that are differently committed to these two public outcomes. We expect the following:

> *H1: The level of federal R&D funding at universities will be positively related to knowledge outcomes.*
>
> *H2: The level of federal student financial aid at universities will be positively related to education outcomes.*

At the state level, appropriations to research extensive universities include R&D funding, financial aid, operating costs and capital expenditures. State appropriations to public universities

are tied to state commitments and the understanding that the university is obligated to produce public outcomes including an educated public, training to local communities, extension services, and expertise to the state. Today, the distinction between public and private universities is blurring as state appropriations substantially vary. For example, SUNY Buffalo and SUNY Binghamton report more than 50% of their revenue coming from the state, while the universities of Michigan, Vermont, Oregon, and Illinois at Chicago (UIC), report 7%, 9%, 15%, and 18% of their respective revenues coming from their states (Grain 2009).

State-serving, public universities adopt different mechanisms for funding the remainder of their budgets, including increasing grants and contracts, tuition, and business-like activities to fund operating budgets. For example, the Universities of Oregon and Vermont raise nearly 40% of their budgets through tuition and fees. In fact, among the 99 public R1 universities in this study, 30 generate more revenue per full time equivalent student (FTE) from tuition and fees than from state appropriations. In comparison, UIC and the University of Utah generate less than 15% of their revenue from tuition and fees and instead rely heavily on grants and contracts. Increasingly, public universities are behaving like private institutions, developing endowments, raising revenue through tuition, private capital, and commercialization activities, and taking other measures to protect themselves from the ebbs and flows of state budgets (Priest & St. John 2006; Slaughter 1998) or what University of California President Yudof calls an "unreliable partner" (Fain 2009).

Shifting revenue sources at state universities may be shifting outcomes away from state-centered training, services, and teaching. Some argue that raising revenue through endowments and development detracts from public universities ability to produce public outcomes, in particular service (Conley & Temple 2006). States are also increasingly turning to out-of-state tuition for revenue, thus taxing out-of-state residents. While the proportion of in-state students in public universities is nearly the reverse of that at private universities, with about 79% of the first year students enrolled at RI universities being in-state residents compared to 27% at private universities[2], there are increasing enrollments of out-of-state students at higher tuition rates. For example, the gaps in tuition for out-of-state and in-state students can range from $4000 at the University of Minnesota to as much as $22,669 at the University of California-Santa Cruz. In

[2] http://collegesearch.collegeboard.com/search/index.jsp

sum, declines in state appropriations may result in lowered commitments to producing realized public outcomes for in-state residents.

Thus, state appropriations to public universities are not only an indication of changing commitments to universities, but also leave universities to make important decisions about generating revenue. We expect that the balance of funding from sources including in-state and out-of-state tuition and fees, grants and contracts, and other activities such as operating hospitals and medical facilities will affect the types of public outcomes universities generate. As state funding decreases, universities make decisions about how to replace lost revenue. These choices not only represent regulative value choices, but they also create regulative values within the institution that determine faculty production of realized public outcomes. Because federal funding represents regulative values that promote the provision of the general public outcomes (knowledge) and the other funding choices (e.g increase tuition) represent regulative values that generally promote education and service public outcomes, we expect the following relationships:

H3: Tuition will be positively related to education and service outcomes.

H4: Levels of state financial support will be positively related to education and service outcomes.

Normative/Associative. Normative and associative public value institutions at both the individual and organizational levels can influence public values outcomes. Associative public value institutions refer to the organization's associations and norms and also the individual's associations and norms. Associative public value institutions vary at the university level –unstated expectations, reputation and visibility, or opportunities and constraints – and result in shared organization-level norms (Moulton 2009; Powell 1990; Scott 2003). Universities have a number of associations that create a normative environment. Similarly, the individual will have associations with departments, labs, research groups, and other organizations, which will shape her norms. For example, faculty that affiliate with research centers will have additional commitments, which may complement or compete with department goals. Thus the dimensions of an individual scientist's funding sources, professional associations, and experience and commitments to department and university associations will shape individual outcomes.

At the organization level, universities and scientists can associate with one another and the community in a number of ways including formal associations. The Association of American Universities (AAU) is an association of 62 leading research universities in the U.S. and Canada. AAU membership is by invitation and is determined by the university's scholarship and excellence in research and education programs. Past researchers have used membership in the AAU as an indicator of university prestige (Slaughter 1993; Turk-Bicakci & Brint 2005).

The National Academies of Science (NAS) represents another associative indicator. NAS is an honorific society that recognizes scholars engaged in exemplary scientific, engineering, and technological research. NAS membership is a prestigious recognition and limited to about 2,100 individuals. In the literature, the number of NAS members at a university is used as a proxy for a university's level of prestige and distinction in research and achievements in discovery and the advancement of knowledge (Krimsky et al. 1991). Both AAU membership and the number of NAS members at a university are a signal of the university's level of prestige and research reputation and thus represent associative public values institutions. Since researchers are attracted to universities that share their value set, we expect the following:

H5: University membership in high reputation academic associations will be positively related to knowledge outcomes.

Additionally, organizational-level indicators can measure university public value institutions such as normative commitments to diversity. These types of measures include racial diversity and diversity of in-state and out-of-state students. One might also measure commitments to diversity in the range of programs and degrees offered. Researchers note that the presence of liberal arts programs, which are not typically funded through research activities, indicates a commitment to a diversity of disciplines and students seeking that training (Slaughter 1998). Slaughter (1998) goes on to note that fields that are farther away from research activities and income generation are typically the departments that house larger numbers of women and minority faculty. Because diversity is an indicator of the university's normative public value institutions we expect that these will affect the activities of individual faculty.

H6: Organizational-level commitments to diversity will be positively related with education and service outcomes.

At the individual level, it is critical to include the relationships between professional and informal associations and norms and publicness outcomes. Associative relationships include scientists interacting with other researchers and organizations that do not have formal authority over them, but that can affect individual behavior (Moulton 2009; Powell 1990; Scott 2003). We can capture the ways in which professional networks affect behavioral outcomes by measuring the types and frequency of interactions between individuals (Burt 1992; Granovetter 1973). For example, scientists that report large numbers of government or private industry employees in their collaboration networks might be expected to produce more applied research or private sector-relevant outcomes (e.g. patents). We might also expect that individuals who have more extensive collaboration networks may produce more public knowledge outcomes.

H7: Individual associations with non-academic groups (government collaborators) will be negatively related to knowledge outcomes.

H8: Collaboration network size will be positively related to knowledge outcomes.

Scientists can also have associations through research centers. Prior work suggests that center-affiliated university researchers perform "double duty" engaging in research activities and other academic duties (Bozeman & Boardman 2003), publishing more, but not reducing their other department commitments (Corley & Gaughan 2005; Blumenthal et al. 1996). Given this prior work, we expect that affiliation with a federal lab and a greater proportion of individual research funds coming from federal grants and contracts will be related to increased research outcomes and either stable or declining outcomes related to teaching and service (Blumenthal et al. 1996; Bozeman & Boardman 2003).

H9: Federal support or affiliation will be positively related to knowledge outcomes.

Cultural Cognitive. Cultural cognitive public value institutions are indicated by organizational culture and values and are usually best measured by assessing the perceptions and beliefs of individuals in the organization. In the case of R1 universities, one might describe cultural cognitive public value institutions as efforts to increase service to undergraduates,

commitments to diversity, and beliefs that the organization's values can shape public outcomes. For example, faculty perceptions of shifting university priorities toward commercialization and department incentives to patent may affect faculty commitments to traditional university activities such as publishing and teaching and shift faculty outcomes (Bozeman 2000; Huang, Feeney, Welch 2010). Faculty may also respond to private market demands and university commitments to increase university-industry partnerships, at the expense of the production of public goods (Slaughter & Leslie 1997). In sum, the ways in which faculty interpret the priorities of the university, the department, and their research labs and the ways in which they set their own priorities can serve as indicators for cultural cognitive public value institutions.

Cultural cognitive public institutions can be captured through surveys of individual perceptions and behavior. For example, we can ask faculty about commitments to diversity in hiring faculty and recruiting students. We can also ask about the climate and treatment of minority and women faculty. In addition to faculty perceptions of the work environment, we can assess the ways in which individual activities and collaborations demonstrate commitments to research, teaching, and service. Because, individual faculty continually interpret and respond to the cultural environment in the workplace, we expect that faculty committed to producing knowledge and research outcomes will respond to trends and cues related to research funding. For example, in science and engineering, multidisciplinarity approaches are often a required component for funded research. Additionally, Goldstein and Naor (2005) describe taking on teaching activities at hospitals as being a direct response to the hospital's culture. If faculty perceive teaching as an important component of promotion and tenure in the department, they will be more likely to commit their efforts to teaching. Faculty that perceive stronger institutional requirements for grant proposals will respond by producing those outcomes.

An individual's perception of their ability to influence research, teaching, and service priorities in the department will also be an important predictor of the types of publicness outcomes produced. Individual's that operate in contexts where they are able to influence departmental policies will behave in ways that enhance the production of all three public outcomes to satisfy teaching, service and research outcomes necessary for success. Because individual perceptions and beliefs about the organization are indicative of the organization's

culture and values, we expect that perceptions about the multidisciplinarity of the work environment and perceived influence over setting priorities will affect public values outcomes.

> *H10: Individual perceptions of a multidisciplinary work environment will be positively related to research outcomes.*
>
> *H11: Individual perceptions of influence in their work environment will be positively related to research, teaching, and service outcomes.*

Data and Method

The data for this paper come from two primary sources: a national survey of academic scientists in six fields and institutional data from the US Department of Education's Integrated Postsecondary Education Data System (IPEDS).

Individual-Level Survey Data. The individual level data come from a 2006 national survey of academic scientists and engineers in U.S. Research I universities. The survey collected data on individual career experiences, research activities, teaching and committee responsibilities, productivity, satisfaction, and detailed demographic characteristics. The survey was implemented online using Sawtooth Software®. Individuals were invited to the survey via traditional mail with a series of personalized email follow-ups. Each of the invitations provided individually assigned userid and passwords. The survey took between 30 and 45 minutes to complete.

A random sample of 3,667 participants stratified by sex, rank, and discipline was developed from the population of academic scientists and engineers in six disciplines in 150 Carnegie-designated Research I universities. The disciplines were selected based on the level of female representation (low, transitioning, and high fields). Equal proportions of participants were selected from each discipline and the distribution of rank in the sample was approximately proportionate to that found in the population. The final sample size was 1,598.[3] The overall response rate was 45.8% (AAPOR 2009). Post survey analysis showed that the distribution of responses were no different than those selected in the random sample. Sample weights were calculated using the inverse of the probability of selection and employed in calculating all results presented below (weighted response rate was 43%). Hierarchical Linear Modeling (HLM)

[3] Of the 1,774 completed surveys, 197 were removed because of ineligibility or incomplete response.

regression analysis was used to estimate the models in this paper. Missing values for four of the independent variables were imputed using the SPSS linear interpolation method.

Institution-Level Data. Institution-level data were collected for all universities in the NETWISE data set. Although IPEDS was the primarily source from which data were collected, USNews[4] and the College Board[5] provided data on medical schools and a measure of the difference between in-state and out-of-state tuition, respectively. Descriptions of all variables are presented in Table 1.

[Insert Table 1 about here]

Dependent Variables. We operationalize the three individual-level dependent variables – research, teaching, and service – using survey data. Research is measured as the number of peer reviewed journal articles accepted or published in the previous two academic years. This variable, called **Journal Articles**, is a categorical response variable with seven categories: zero, one to two, three to four, five to six, seven to nine, 10 to 14, and 15 or more. Teaching is measured as the **Number of Courses** taught or co-taught in the past academic year. Service to the university community is measured as the number of department and university committees served on in the previous academic year. The variable is named **Number of Committees**. Table 2 lists the descriptive statistics for all variables.

[Insert Table 2 about here]

Independent Variables. Independent variables are categorized in terms of their publicness characteristics – regulative, associative, and cultural cognitive – and level of analysis: individual or university.

Regulative Measures. **Public Service Expenditures FTE** includes university expenditures per full time equivalent (FTE) student for several types of activities that are targeted to constituencies outside of the university, (e.g. non-instructional services including community service programs, patient care services, and cooperative extension services). **Student Services Expenditures FTE** indicates university expenditures for activities and programs that contribute to student well being including student health services, career planning and placement services, mentoring, student government and student organizations, and recreational and intramural

[4] http://colleges.usnews.rankingsandreviews.com/best-colleges/national-universities-rankings
[5] http://collegesearch.collegeboard.com/search/index.jsp

programs. These two variables capture the institutional regulative determinants of the different public outcomes, especially as they relate to more localized public outcomes (service).

We include three university revenue variables: total **Endowment Assets**, **Government Grants and Contracts FTE**, and **Tuition and Fee Revenue FTE**. In addition, we include a variable that captures the dollar amount **Difference between In-state and Out-of-state Tuition**. **State & Local Appropriations** is a continuous variable indicating state and local appropriations per FTE. We also include two measures for the percent of the students who receive state and local aid, **%State Support**, and the percent who receive federal aid, **%Federal Support**. Some of the variables were modified (shown in table 2) by dividing by a factor of 1,000 or 10,000 so that coefficients would not appear to be non-zero. The dummy variable, **Land Grant,** indicates if the university is a land grant institution.

Associative/Normative Measures. University-level associative measures include the number of individuals who are members of the National Academy of Sciences (**#NAS Members**), whether or not the university is a member of the American Association of Universities (**AAU Membership**), and the percent of undergraduate students enrolled at the university that are white (**%White Undergraduate**).

The individual associative measures in the model include measures of networks, funding ties, association memberships, and ties to collaborators outside of academia. Three of the variables capture associations with government. **Proportion of Grants Federal** is a measure of the proportion of all grants awarded in the previous two years that are from federal sources. **Federal Lab** is a discrete variable indicating whether or not the respondent is affiliated with a federal laboratory. **#Government Collaborators** is a count of the total number of individuals in the respondent's network that work for government. In addition, two variables provide broader indicators of association. **Collaboration Network Size** is a count of the total number of close collaborators named by the respondent and **#Association**s is the total number of professional association memberships named by the respondent.

Cultural Cognitive Measures. Most research capturing the cultural cognitive aspects of organizations relies on self-reported survey data, with employees in the organization reporting about the culture of their work environment and the organization's values (Moulton 2009) or the ways in which the organization emphasizes the achievement of public outcomes (Lynn et al.

2001). Much of the data collected in the survey does not lend itself to application in this study. Nevertheless, we include two independent variables as measures of cultural cognitive public value institutions. **Work Environment Multidisciplinary** is the linear combination (alpha=0.77) of responses to three survey items (see table 1). **Level of Influence Perceived** is the linear combination (alpha = 0.78) of responses to four items (see table 1).

Controls. We control for field of science, rank, salary, and citizenship. Field of science is measured using six dummy variables: **biology, chemistry, computer science, earth and atmospheric sciences, electrical engineering**, and **physics**. Rank is measured using the following three binary variables: **assistant**, **associate**, and **full professor**. **Salary** is a continuous variable indicating faculty salary. **Citizenship** is coded one if the respondent is a US citizen (by birth or naturalized). **Log Number of Undergraduates** is a control for university size. We include a dummy variable for whether or not the university has a **Medical Program**. Finally, for each of the three models (predicting **Journal Articles, #Courses, #Committees**), we include the other two production variables. For example, in the model predicting Journal Articles, we include Courses and Committees as control variables

As noted earlier, just as simplified distinctions between public and private organizations fail to advance our understanding of hybrid organizations, distinctions among universities are not easily captured by a binary measure of public and private. We ran a simple correlation between the university-level variables in the model and a dummy variable indicating whether or not the university is a "public" institution, as defined by ownership or charter. The blurring of the sectors, or dimensions of publicness, is strongly apparent. "Public" is moderately positively correlated with undergraduate enrollment (0.63), differences between in-state and out-of-state tuition (0.78), and state and local appropriations (0.57), and moderately negatively correlated with tuition and fees and endowment assets (70.78) - relationships expected to be indicative of public institutions. However, these correlations are not as high as one might think and vary substantially in strength. Other variables in the list, such as percent of students on State and Federal Support and Public Services Expenditures are not strongly correlated with whether or not the institution is "public". Hence, there is a need to go beyond simplistic institutional approaches to publicness, using multi-level modeling and multiple dimensional measures of public values institutions.

The hierarchical linear modeling (HLM) method applies maximum likelihood estimation to a nested structure of equations to explain individual- and group-level variance. HLM estimated two equations simultaneously, one at the scientist-level that assesses within university determinants of *Realized Public Values*, and one at the university-level that assesses between-university effects. The empirical model is:

Equation 1: "individual scientist" model:

$Y_{jk} = ß_{0k} + ß_{1k}$ (Federal Grant Proportion)$+ ß_{2k}$ (Federal Lab)$+ ß_{3k}$ (#Government Collaborators)$+ ß_{4k}$ (#Associations)$+ ß_{5k}$ (Collaboration Network Size)$+ ß_{6k}$ (Work Environment Multidisciplinarity)$+ ß_{7k}$ (Level of Influence Perceived)$+ ß_{8k}$ (Assistant Professor)$+ ß_{9k}$ (Associate Professor)$+ ß_{10k}$ (Citizen)$+ ß_{11k}$ (Salary)$+ ß_{12k}$ (Biology)$+ ß_{13k}$ (Chemistry)$+ ß_{14k}$ (Computer Science)$+ ß_{15k}$ (Electrical Engineering)$+ ß_{16k}$ (Physics)$+ ß_{17k}$ (Journal Articles) $+ ß_{18k}$ (Number of Courses) $+ ß_{19k}$ (Number of Committees) $+ R_{jk}$

Equation 2: "university" model:

$ß_{0k} = \gamma_{00} + \gamma_{01}$ (Land Grant)$_k + \gamma_{02}$ (Tuition and Fee Revenue FTE)$_k + \gamma_{03}$ (Difference In/Out State Tuition)$_k + \gamma_{04}$ (Government Grants/Contracts Revenue FTE)$_k + \gamma_{05}$ (State/Local Appropriations FTE)$_k + \gamma_{06}$ (Endowment Assets)$_k + \gamma_{07}$ (Public Service Expenditures FTE)$_k + \gamma_{08}$ (Student Service Expenditures FTE)$_k + \gamma_{09}$ (%Student Federal Support)$_k + \gamma_{10}$ (%Student State Support)$_k + \gamma_{11}$ (Medical Program)$_k + \gamma_{12}$ (AAU Membership)$_k + \gamma_{13}$ (#NAS Members)$_k + \gamma_{14}$ (%White Undergraduates)$_k + \gamma_{15}$ (Log Number Undergraduates)$_k + U_{0k}$

In the level 1 model, $ß_{0k}$ is the university specific intercept where the 19 named variables are the scientist level covariates and $ß_{ik}$ is the associated coefficient signifying the partial effect of each variable on *Realized Public Values* associated with each respondent in university *k*. R_{jk} is the random error (independently distributed with a constant variance) associated with the scientist. To ensure that the level 1 model captures within-group variation only, we center all variables at the university's means. In the level 2 model, γ_{00} is the adjusted mean *Realized Public Values*, and the other 15 γ coefficients indicate the effect that variation in the university variables have on scientist level coefficients in equation 1. U_{0k} is the random error (independently distributed with a constant variance) associated with the university. Normal continuous regression was used to estimate the two normally distributed dependent variables, **#Courses** and **#Committees**, and Poission regression was used to estimate **Journal Articles** because that variable is highly skewed to the left.

Hierarchical linear modeling requires that a distinction be made between fixed and random effects. Fixed effects are coefficients that do not vary across groups, while random effects vary across groups. In this case, the level 2 group (university) intercept, $ß_{0k}$, is designated to vary around its overall mean, while the other variables in the equations are fixed. Finally, HLM provides estimates of the variance component associated with level 1 (scientist) and level 2 (university) residuals. The variance component enables the comparison of total variance explained to understand the proportion of within- and between-level variation explained.

Results

The results for the three models are presented in table 3. The level 1 (scientist) and level 2 (university) variables are presented separately and organized within those two groups as regulative, associative/normative, cultural cognitive, and controls. We find that 19% of the within university variance and 49% of the between university variance in knowledge production (journal articles) can be explained by the variables in our model. The second model predicts 14% of the within university variance and 42% of the between unit variance in teaching activity among faculty at R1 universities. Fourteen percent of the within university variance and 21% of the between unit variance in service outcomes is explained by the third model.

[Table 3 here]

Next, we discuss the results as related to the three types of publicness institutions outlined in the paper's framework and the findings as related to our hypotheses. In general, we find support for the general expectation that each of the three publicness institutions matters for the realization of public values outcomes. However, we find that regulative, associative, and cultural cognitive institutions are differently related to each public values outcome.

Regulative. The models indicate that regulative publicness institutions are significantly related to publicness outcomes at research-intensive universities. The first four hypotheses in this study are concerned with regulative public value institutions including federal R&D funding, state and local appropriations, federal and state financial aid, and tuition and fees. The models indicate support for H1; increased federal R&D funding is significantly and positively related to increased knowledge outcomes. We also confirm H2 that universities that receive higher levels of federal

student financial aid realize higher levels of teaching outcomes. Thus both regulatory measures for federal support are related to increased public outcomes of knowledge and teaching.

The model indicates that state regulatory institutions are related to publicness outcomes, but possibly not in the ways that we would expect. First, greater state and local appropriation is negatively related to knowledge outcomes while it has little effect on teaching and service outcomes. This contrasts with findings on federal funding and may indicate that state investments in higher education are allocated to a range of different types of investment in higher education, such as plant and equipment that enable the work of universities to take place. Additionally, we do not confirm H3, which predicted that the price of tuition would be related to higher realized education and service outcomes. Instead, we find that increased tuition and fees are related to decreased teaching outcomes. We also find that as the difference between in-state and out-of-state tuition increases, so do knowledge and teaching outcomes. As expected in H4 state financial aid to students is significantly related to increased service outcomes, but contrary to expectations this variable is associated with decreased teaching outcomes.

Policy advocates argue that students are paying more and getting less (Fain 2009). However, the literature indicates that these forms of funding should also be related to increased outcomes that are student-centered (Slaughter 1998), in particular teaching outcomes. Our findings paint a somewhat more complex picture. While the percent of students receiving federal financial aid support is strongly associated with faculty teaching loads, increased state financial aid to students is negatively related to teaching. Faculty teach more courses in universities that have a lower percent of state financial aid for students; a higher difference between in and out of state tuition; lower tuition and fees; are more reliant on federal sources of income to support students; and spend less on student services. While this sounds like a traditional public teaching institutional context, it is also important to note that state support of students and state and local appropriations are not significantly related to teaching outcomes, while public service expenditures is negatively related to teaching outcomes. Hence, although states may fund education less and depend upon student tuition and fees more, across universities, a range of different regulatory institutions contribute to teaching outcomes and it is not necessarily true that education has become a fee for service operation. These findings also demonstrate the danger

associated with a narrow conceptualization of publicness and the importance of identifying specific and even alternative public outcomes.

With regard to the effect of regulative public value institutions on public outcomes, the percent of students who receive state financial aid is the only university level regulative public value institution associated with the amount of reported faculty committee service. We interpret this to mean that greater dependency on the state may indicate a higher local service ethic or a stronger demand for faculty contributions to organizational governance issues. We also find that land grant universities produce significantly more journal articles than non-land grant universities, but that land grant status is not significantly related to faculty teaching or service outcomes.

***Normative/Associative*.** The models include eight variables measuring associative public value institutions. There were three university-level associative measures: AAU membership, NAS members, and the percent of white undergraduates. The models include five measures for individual-level associations: federal funding ties, collaborative network size, association with a federal lab or center, the number of professional associations, and external collaboration networks with government. Hypotheses five through nine concern associative public values institutions.

Overall, our models indicate support for hypotheses eight and nine. Specifically, we find that faculty who have larger collaboration networks produce more journal articles than those with smaller networks (H8). A larger network may be an indicator of research capacity, strong interest in the production of knowledge, or greater reputation of the researcher. Hypothesis nine expected that increased associations with federal funding and research at the individual level will increase knowledge outcomes. The proportion of federal grants that an individual receives is positively related to journal articles, negatively related to course loads, and not related to committees. Lab affiliation is positively related to journal articles, but not related to courses or committees. This finding confirms previous research that has found that lab-affiliated faculty report increased publications and no change in teaching commitments (Blumenthal et al. 1996) and increased research activities but no reduction of other department commitments (Corley & Gaughan 2005).

We find mixed support for H5 which predicted that university membership in high reputation academic associations will be related to increased knowledge outcomes. AAU membership is positively related to knowledge outcomes, but the number of NAS members is not. We also see that both AAU membership and number of NAS members at a university are related

to decreased teaching outcomes. AAU membership and the number of NAS members at a university are often used as proxies for prestige at research universities (Krimsky et al. 1991; Slaughter 1993; Turk-Bicakci & Brint 2005). Thus, we find that increased prestige at R1 universities is partially associated with greater knowledge outcomes and reduced teaching.

We do not find a significant relationship between organizational-level commitments to diversity and individual production of public outcomes (H6). While there is no relationship between our measure of the racial diversity of undergraduates and knowledge, teaching, and service outcomes, it is possible that our measure is a poor proxy for this concept. We also find no support for H7, that the number of government collaborators in the scientist's network is related to knowledge and teaching outcomes. We find that only two of the individual-level associative public value institution measures, proportion of federal grant funding and number of associations, are related to public outcomes. Proportion of federal grant funding is negatively related to number of courses taught and number of associations is positively associated with committee service.

***Cultural Cognitive*.** We find mixed support for hypotheses that individual level cultural cognitive public value institutions are significantly related to variation in public outcomes. First, we fail to confirm H10 that perceiving a multidisciplinary work environment will be positively related to research outcomes. However, we do find that increased perceptions of a multidisciplinary work environment are positively related to teaching and negatively related to service outcomes. Multidisciplinarity may indicate a more cosmopolitan (Bozeman & Corley 2004) view of the scientific world or a more open perspective on the development of new knowledge, which may be packaged and communicated through new courses.

We find some support for H11. As expected, an increase in the level of perceived influence in the work environment is positively related to the number of journal articles produced and service on committees. However, it is negatively related to the number of courses taught. We suspect that this indicates that scientists who recognize the opportunity to affect the local environment are more likely to engage in efforts to affect internal governance. Similarly, individuals who have less influence may be required to teach more. Thus we find that individual measures of cultural cognitive public value institutions are related to variation in realized public outcomes at RI universities, but these relationships are neither uniformly positive nor negative.

Limitations and Control Variables. There are several limitations of this study. Universities are large complex organizations that are affected by multiple factors emanating from the environment. This paper is only able to operationalize a portion of these factors based on available data. Additionally, the survey of academic scientists used in this study was not designed to address the topic of publicness, resulting in the use of a restricted number of individual-level variables. Moreover, it is important to note that universities produce a number of diverse outcomes and this research focuses on only three of those outcomes, and these are quantity not quality measures. Alternative or additional measures, if available, would have improved the model specification and reduced potential measurement or omitted variable problems. As a result, it is necessary to recognize that the findings presented here are subject to further testing and improvement, and interpretations should be made with caution.

It is with this in mind that we provide some discussion of the control variables. There may be some important relationships between rank, field of science, citizenship, and the balance of work responsibilities and demands. First, assistant professors are significantly less likely to produce all three types of public outcomes, as compared to full professors. Second, there is significant variation in public outcomes by field of science. For example, chemists and physicists produce significantly more journal articles than the reference group, earth and atmospheric scientists (EAS), while computer scientists produce significantly fewer journal articles. Chemists and biologists report significantly more committee service and significantly fewer courses taught as compared to the reference category (EAS). Third, the control variable for citizenship indicates that US citizens produce significantly more journal articles as compared to non-citizens, while non-US citizens serve on significantly more committees. Fourth, although the presence of medical programs is often used as a measure of cost structures at R1 universities and a proxy for the expanding roles of universities (de Groot et al. 1991; Owen-Smith & Powell 2003), we find no significant relationship between having a medical school and public outcomes.

Finally, the models show that the number of journal articles published and courses taught are negatively related, while teaching and committee service are positively related, and the number of journal articles published is not significantly related to committee service. It is possible that teaching and research are serving as substitutive activities; research funds may be used to "buy-out" of teaching obligations, although course release policies vary by university, field of

science, and department. Overall, these findings point to the need to recognize that other key structural, cultural, and behavior factors within universities and fields of science help determine the realization of public outcomes. Future work should investigate this further.

Discussion

A primary contribution of this paper is that it recognizes the importance of including both individual and organization levels of analysis when explaining how public value institutions lead to realized public outcomes. At the individual level, results show that a scientist's federal funding ties and collaboration network size increase knowledge outcomes. Individual level associations are positively related to service outcomes while federal funding support is negatively related to teaching outcomes. Individual cognitions are strongly associated with realized public values. The sign shifts that occur across courses and committees for Multidisciplinarity and Workplace Influence show that beyond the regulative and associative public value institutional effects, the less obvious aspects of organizational environment matter for the willingness of individuals to invest in the realization of public outcomes.

By including both the individual and organization levels of analysis, this paper recognizes the range of public value institutions that affect public outcomes; while institutions operate at the broader organization level, individuals in any organization are embedded within multiple institutional layers that may or may not work in concert. The result is a more realistic, yet complex picture of how institutions affect public outcomes. The findings redefine the 'blurring of the sectors' discussion: public outcomes at research-intensive universities depend upon an appropriate mixture of types of regulations, associations, and cultures.

This paper also informs current policy discussions surrounding publicly funded higher education. Researchers have raised concerns that the shift toward supply-side organizational resource allocation (Slaughter 1998) and enhanced marketization, privatization, and commercialization of university activities (Priest & St. John 2006) have resulted in making higher education "a subsector of economic policy" and "a vehicle for wealth creation" (Slaughter 1998, 7) at the expense of public outcomes including increasing the pool of knowledge, training undergraduates, and engaging in service. Our research provides some support for this expectation: exposing the importance of state funding to the realization of public research outcomes and the specific allocation of tuition and fees to teaching and service outcomes. We find that decreases in

state funding are significantly related to fewer courses taught. Thus, when students pay more and the state provides more direct financial aid to students, the number of courses delivered declines. Additionally increased differences between in-state and out-of-state tuition are related to increased research and teaching outcomes.

Federal funding does not affect all types of realized public outcomes at the university level. Instead, federal financial aid for students affects the number of courses taught and federal funding for grants and contracts affects the production of science (e.g. publications). Hence, efforts by universities to backfill reductions from state dollars with grant funding does not yet appear to help realize teaching and services outcomes, though this strategy may result in greater publication outcomes.

The inflexibility of grant funding, as compared to state funding, may make it more difficult for universities to maintain the basic infrastructure and human capital necessary to produce public research outcomes. The fact that the benefits of public research outcomes accrue to a broader audience outside the state does not bode well in the current political climate for a reversal in state appropriations to universities. Even more disconcerting is that increases in public service expenditures per FTE, state financial aid to students, and tuition and fee revenue per FTE are negatively related to teaching outcomes.

Hence, the model results in this paper show that the relationships between public value institutions and outcomes are sometimes overlapping and contradictory. Regulatory, associative, and cultural cognitive public value institutions at both levels differently affect public outcomes. Organizations seeking to produce particular public outcomes must understand that policies affecting regulatory structures or associations might have unintended consequences for a variety of outcomes. For example, though it is often assumed that increases in tuition and fees (which are paid by students) will increase outcomes for students, our findings indicate that increases in tuition and fees and state financial aid are related to decreased teaching loads for faculty. Perhaps these structures result in universities seeking to minimize necessary increases by also increasing class size or employing more adjuncts and graduate students as teachers. This raises a question about the quality of instruction outcomes that cannot be addressed here.

Under fiscal constraints, universities make decisions about how to serve a variety of stakeholders, making trade-offs in regulative and associative institutions that may differentially

impact realized public outcomes (Knott & Payne 2004). This analysis shows that universities seeking to supplement budget shortcomings must consider the ways in which different inputs will differently affect public outcomes. In summary, there is flexibility even within (or as a result of) common state funding structures, which can enable policy makers to think strategically about the production of public outcomes.

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Table 1: Measures

	Variable Name	Level	Variable Description	Source
Regulative	Land Grant	U	Whether or not the university is designated a land grant institution (1/0).	APLU
	Tuition and Fees FTE	U	Revenue from tuition and fees, full time equivalent.	IPEDS
	Difference In/Out State Tuition	U	Difference between in state and out of state tuition costs ($).	USNews
	Government Grants/Contracts FTE	U	Revenue from government grants and contracts, full time equivalent.	IPEDS
	Endowment Assets	U	Dollar amount of endowment ($).	IPEDS
	Public Service Expenditures FTE	U	Public service expenditures by university, full time equivalent.	IPEDS
	Student Service Expenditures FTE	U	Student service expenditures by university, full time equivalent.	IPEDS
	State/Local Appropriations FTE	U	State and local government appropriations, full time equivalent.	IPEDS
	%Student Federal Support	U	Percent of students who receive federal grant aid (%).	IPEDS
	%Student State Support	U	Percent of students who receive state and local grant aid (%).	IPEDS
Associative	AAU Membership	U	The university is a member of AAU (Yes = 1)	AAU
	#NAS Members	U	Number of faculty at the university who are NAS members (#)	NAS
	%White Undergraduates	U	Percent of the enrolled student body that is white, non-Hispanic (%)	IPEDS
	Proportion of Grants Federal	I	Proportion of PI and CoPI grants received during the past two years (2005-2007)	Survey
	Federal Lab	I	Whether the respondent is a member of a federal laboratory (yes=1)	Survey
	#Association Memberships	I	Total number of associations named in survey responses (#)	Survey
	Government Close Collaborators	I	Number of named close collaborators who work for government (#).	Survey
	Collaboration Network Size	I	Total number of close collaborators named (#).	Survey
Cultural Cognitive	Work Environment Multidisciplinary	I	Linear combination of responses to three questions: a) interdisciplinary research is important for advancement in my field, b) Multidisciplinarity is a requirement for most of the grant proposals that I submit; c) The direction of my research has changed as a result of interdisciplinary research (strongly agree - strongly disagree, 4-point scale) (alpha=0.77)	Survey
	Level of Influence Perceived	I	Linear combination of responses to four items. Compared to the colleagues in your department/unit, how much influence do you have over the following decisions: a) selection of new faculty; b) selection of unit head; c) who receives tenure or a promotion; d) allocation of budget/departmental research funding. (Three point scale: less influence, about the same influence, more influence) (alpha = 0.78)	Survey
Controls	Assistant, Associate, Full Professor	I	Faculty rank. Only tenure or tenure track faculty in the study (1=yes)	Survey
	Biology, Chemistry, Physics, Computer Science, Electrical Engineering, Earth & Atmospheric Sciences	I	Fields of science included in the study (1=yes)	Survey
	Citizen	I	US Citizen – by birth or naturalization (1=yes)	Survey
	Salary	I	Dollar amount of salary, by 10,000s ($)	Survey
	Log Number of Undergraduates	U	Log of the number of undergraduate students enrolled.	IPEDS
	Medical Program	U	The university has a medical program (Yes = 1)	NSF

U=University; I=Individual

Table 2: Descriptive Statistics for Model Measures

Variable	N	MEAN	SD
Dependent Variables (also controls)			
Journal Articles	1588	3.82	1.70
Number of Courses	1584	3.42	1.12
Number of Committees	1567	5.65	2.10
Regulative			
Land Grant	148	0.32	0.47
Tuition and Fee Revenue FTE (in 10,000s)	148	10.60	6.29
Difference In/Out State Tuition (in 1,000s)	148	8.72	7.05
Gov. Grant/Contract Revenue FTE	148	12823.77	15503.43
Endowment Assets (in 1,000s)	148	10.16	26.18
Public Service Expenditures FTE (in 1,000s)	148	1.87	2.11
Student Service Expenditures FTE (in 1,000s)	148	2.12	2.72
State/Local Appropriations FTE (in 1,000s)	148	0.06	0.06
%Student State Support	148	29.73	21.67
%Student Federal Support	148	19.90	9.11
Associative			
AAU Membership	148	0.41	0.49
#NAS Members	148	12.07	27.07
%White Undergraduates	148	0.01	0.00
Proportion of Grants Federal	1598	0.32	0.30
Federal Lab	1598	0.08	0.27
#Associations	1598	1.90	1.15
#Government Close Collaborators	1598	0.13	0.45
Collaboration Network Size	1598	5.08	2.42
Cultural Cognitive			
Work Environment Multidisciplinary	1598	6.57	2.09
Level of Influence Perceived	1598	7.45	1.73
Controls			
Medical Program	148	0.61	0.49
Log Number of Undergraduates	148	9.54	0.92
Assistant Professor	1598	0.30	0.46
Associate Professor	1598	0.27	0.44
Full Professor	1598	0.43	0.45
Citizen	1575	1.60	0.92
Salary (in 10,000s)	1598	9.39	4.12
Biology	1598	0.17	0.38
Chemistry	1598	0.18	0.38
Computer Science	1598	0.16	0.37
Electrical Engineering	1598	0.13	0.34
Earth and Atmospheric Sciences	1598	0.18	0.35
Physics	1598	0.17	0.38

Table 3. Estimation Results

	Journal Articles			#Courses			#Committees		
Level 1 (Individual)	**Coeff.**		**SE**	**Coeff.**		**SE**	**Coeff.**		**SE**
Intercept	**1.309**	***	**0.013**	**3.555**	***	**0.037**	**5.564**	***	**0.067**
Associative									
Federal Grant Proportion	**0.110**	*	**0.051**	**-0.276**	+	**0.107**	-0.325		0.229
Federal Lab	**0.097**	+	**0.051**	0.107		0.146	-0.304		0.214
#Government Collaborators	-0.055		0.035	-0.059		0.108	-0.045		0.172
#Associations	0.007		0.012	0.027		0.032	**0.131**	*	**0.066**
Collaboration Network Size	**0.044**	***	**0.006**	-0.004		0.016	0.027		0.033
Cultural Cognitive									
Work Environment Multidisciplinary	-0.004		0.007	**0.052**	**	**0.016**	**-0.069**	*	**0.029**
Level of Influence Perceived	**0.021**	+	**0.011**	**-0.086**	***	**0.022**	**0.246**	***	**0.046**
Controls									
Assistant Professor	**-0.070**	+	**0.041**	**-0.379**	***	**0.089**	**-0.627**	***	**0.155**
Associate Professor	-0.007		0.035	0.081		0.082	-0.143		0.142
Citizen	**0.074**	***	**0.015**	-0.011		0.033	**-0.220**	**	**0.084**
Salary (in 10,000s)	**0.007**	*	**0.003**	-0.023		0.014	0.014		0.018
Biology	-0.026		0.044	**-0.594**	***	**0.140**	**0.486**	+	**0.258**
Chemistry	**0.177**	***	**0.040**	**-0.509**	***	**0.121**	**0.646**	*	**0.262**
Computer Science	**-0.232**	***	**0.052**	-0.142		0.134	-0.118		0.277
Electrical Engineering	0.021		0.047	0.128		0.154	-0.142		0.318
Physics	**0.124**	*	**0.049**	**-0.361**	**	**0.139**	0.392		0.282
Journal Articles				**-0.042**	+	**0.023**	0.038		0.043
Number of Courses	**-0.025**	+	**0.015**				**0.348**	***	**0.069**
Number of Committees	0.005		0.007	**0.102**	***	**0.019**			
Level 2 (University)	**Journal Articles**			**#Courses**			**#Committees**		
Regulative									
Land Grant	**0.050**	+	**0.029**	-0.014		0.084	0.119		0.180
Tuition and Fee Revenue FTE	-0.003		0.004	**-0.022**	*	**0.009**	-0.013		0.018
Difference In/Out State Tuition	**0.008**	**	**0.003**	**0.013**	+	**0.007**	-0.021		0.015
Gov. Grants/Contracts Revenue FTE	**0.000**	*	**0.000**	0.000		0.000	0.000		0.000
State/Local Appropriations FTE	**-0.439**	*	**0.195**	-0.033		0.557	0.294		1.115
Endowment Assets	**0.002**	*	**0.001**	0.002		0.003	-0.005		0.005
Public Service Expenditures FTE	-0.004		0.005	**-0.069**	***	**0.014**	-0.022		0.032
Student Service Expenditures FTE	-0.004		0.006	0.025		0.018	0.039		0.033
%Student Federal Support	0.000		0.002	**0.014**	**	**0.005**	-0.004		0.011
%Student State Support	0.000		0.001	**-0.006**	**	**0.002**	**0.009**	**	**0.003**
Medical Program	0.045		0.032	0.040		0.081	-0.142		0.177
Associative									
AAU Membership	**0.086**	**	**0.032**	**-0.271**	**	**0.086**	0.303		0.194
#NAS Members	0.000		0.001	**-0.004**	*	**0.002**	-0.002		0.005
%White Undergraduates	-9.297		11.882	-0.524		30.305	-69.644		49.583
Control									
Log Number of Undergraduates	**-0.029**	*	**0.014**	-0.008		0.040	-0.007		0.071
Universities in Sample	147			147			147		
Individuals in Sample	1545			1545			1545		
Within Unit Variance Explained	0.19			0.14			0.14		
Between Unit Variance Explained	0.49			0.42			0.21		

+P<.10; *P<.05; **P<.01; ***P<.001

The reference category for the fields of science is Earth and Atmospheric Sciences. The reference category for rank is Full Professor

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