Three Essays on Bureaucracy at American Research Universities

by

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ABSTRACT

The three essays in this dissertation each examine how aspects of contemporary administrative structure within American research universities affect faculty outcomes. Specific aspects of administrative structure tested in this dissertation include the introduction of new administrative roles, administrative intensity (i.e. relative size of university administration), and competing roles between faculty, administrators, and staff. Using quantitative statistical methods these aspects of administrative structure are tested for their effects on academic grant productivity, faculty job stress, and faculty job satisfaction. Administrative datasets and large scale national surveys make up the data for these studies and quantitative statistical methods confirm most of the hypothesized relationships.

In the first essay, findings from statistical modeling using instrumental variables suggest that academic researchers who receive administrative support for grant writing and management obtain fewer grants and have a lower success rate. However, the findings also suggest that the grants these researchers do receive are much larger in terms of dollars. The results indicate that administrative support is particularly beneficial in academic grant situations of high-risk, high-reward. In the second essay, ordered logit models reveal a statistically significant and stronger relationship between staff intensity (i.e., the ratio of faculty to staff workers) and faculty stress than the relationship between executive intensity (i.e., the ratio faculty to executive and managerial workers) and faculty job stress. These findings confirm theory that the work of faculty is more loosely coupled with the work of executives than it is with staff workers. A possible explanation is the increase in administrative work faculty must take on as there are fewer staff

workers to take on administrative tasks. And finally, in the third essay results from multi-level modeling confirm that both role clarity and institutional support positively affect both a global measure of faculty job satisfaction and faculty satisfaction with how their work time is allocated. Understanding the effects that administrative structure has on faculty outcomes will aid universities as faculty administrative burdens ebb and flow in reaction to macro trends in higher education, such as unbundling of faculty roles, unbundling of services, neoliberalism, liberal arts decline, and administrative bloat.

DEDICATION

To Breezy, without her this dissertation may not have happened.

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TABLE OF CONTENTS

Page

LIST OF TABLES vii

LIST OF FIGURES viii

CHAPTER

1 INTRODUCTION: A FOCUS ON UNIVERSITY BUREAUCRACY 1

The Structure of University Bureaucracies 4

Contributions 16

2 ESSAY 1: ADMINISTRATIVE SUPPORT AND GRANT OUTCOMES 21

Introduction 21

Background and Motivation 23

Literature 28

Hypotheses 30

Data 34

Analysis 38

Discussion and Conclusion 44

3 ESSAY 2: ADMINISTRATIVE INTENSITY AND JOB STRESS 47

Introduction 47

Literature 50

Hypotheses 53

Data and Analysis 57

Conclusion and Further Research 66

4 ESSAY 3: ROLE CLARITY AND JOB SATISFACTION 70

CHAPTER Page

Introduction 70

Literature 72

Hypotheses 76

Data 83

Measurement and Analysis 85

Discussion and Conclusion 93

REFERENCES 96

APPENDIX

A SUPPLEMENTAL MATERIAL FOR ESSAY 1 115

B SUPPLEMENTAL MATERIAL FOR ESSAY 2 146

C SUPPLEMENTAL MATERIAL FOR ESSAY 3 153

LIST OF TABLES

Table		Page
1.	Summary Statistics, Administrative Support and Grant Outcomes	35-36
2.	Modeling Results, Administrative Support and Grant Outcomes	42-43
3.	Summary Statistics, Administrative Intensity and Job Stress	59
4.	Survey Questions of Focal Variables Administrative Intensity and Job Stress	62
5.	Ordered Logit Models Predicting Stress from Admin. Responsibilities	64-65
6.	Summary Statistics, Role Clarity and Job Satisfaction	84-85
7.	Survey Items of Focal Variables, Role Clarity and Job Satisfaction	86-87
8.	Multi-level Models predicting Global Job Satisfaction	90-91
9.	Multi-level Models predicting Satisfaction with Time Allocations	90-92

LIST OF FIGURES

Figure Page

1. Number of Proposals per PI before One Award 27
2. Characteristics of Grant Applicants 29
3. Basic Relationships Tested in the Analysis 39-40
4. Illustration of Two-Stage Process of Modelling 40-41
5. Empirical Model and Summary of Hypotheses 89

CHAPTER 1

INTRODUCTION: A FOCUS ON UNIVERSITY BUREAUCRACY

One simple definition of bureaucracy explains it as the existence of a specialized administrative staff whose function is to service and maintain the organization itself (Scott & Davis, 2006, p. 48). Over recent years, there have been disparate complaints by faculty at American research universities regarding bureaucratic problems that have come about not because of malice or direct intent by one actor or another but because of pathological policies and organizational processes, bureaucratic drift, and shifts in human resource allocations because of changes in funding. Some faculty complain of insurmountable administrative burdens in academic grant management (National Science Board, 2014). Others complain of huge amounts of 'shadow work' – work shifted to them from others originally hired for those purposes (Flaherty, 2016a). Still others complain of ambiguous work roles and weak administrative power (Finkelstein, Conley, & Schuster, 2016). Each of these complaints centers on a common subject: the working relationship between university faculty and non-teaching administrators and staff at universities, or what I call the faculty-administration exchange.

Issues regarding the faculty-administration exchange have been overlooked, both in practice and in the academic literature, because of other pressing issues in higher education that, in many ways, rightly focus on student costs, student outcomes, and job obtainment (Besharov & Call, 2009; Conner & Rabovsky, 2011). However, some of the commonly assumed causes of these student issues – that the *size* of university bureaucracies are too large (Archibald & Feldman, 2008) and that the existing *structure* of higher education organizations as we know it are outdated and need to be innovated

(Craig, 2015; Carey, 2015; Crow & Debars, 2015) – also affects those working in universities. The three essays in this dissertation aim to provide a better understanding of how a few aspects of contemporary university administration – specifically the introduction of new administrative roles, the relative size of university administration (i.e., administrative intensity), and the competing roles between faculty and administrators – affect faculty productivity and organizational behavior outcomes like job stress and satisfaction. The hope is that these essays will bring richness to the current meta-dialogue by addressing both the concerns of critics and the concerns of faculty members as well as add to the academic literature on university management.

The first essay examines whether the existence of an administrative support role for academic grant writing and management has an effect on faculty grant productivity. Research administration is a relatively new role in universities that has proliferated over the last three decades or so. This role and others in university bureaucracies have grown, in part, as a result of the arms race for students and resources. In a time when state resources are increasingly constrained, public universities look to other sources of revenue such as international students, out-of-state students, Federal title IV funding, and competitive research grants to maintain fiscal health. To remain competitive for grants, universities have created this specialized work role that focuses entirely on helping faculty members obtain and manage grants. Universities now expect faculty to bring in grant money to support their research where in many fields this was once just a suggestion. The hope is that this change in administrative configuration from previously more slim or nonexistent configurations of academic grant management will pay off in the form of more competitive grant applications. The first essay seeks to test the efficacy

of this administrative role, indirectly measuring whether universities are actually getting a return on their investments in administration and contributing to understanding as to whether these roles are fulfilling their intended function.

The second empirical essay examines whether administrative intensity (i.e., the ratio of faculty to administrative and staff workers) has an effect on faculty administrative stress levels. As previously mentioned, a common call among critics is that over the last few decades university bureaucracies have become too bloated (J. P. Greene, Kisida, & Mills, 2012). A key aspect of this issue is the functional overlap in the administrative job duties between faculty and staff members. As the relative size of university administrations grow or decline, administrative job duties necessarily fall upon or are taken away from faculty members. This situation can lead to 'shadow work' as faculty members must fulfill administrative tasks that require little training or expertise that were once the domain of workers hired to do those tasks. The third essay demonstrates that faculty do indeed feel higher levels of stress from administrative activities as the relative number of staff decreases.

The third empirical essay tests whether clarity about the roles and authority of faculty and administrators affects faculty job satisfaction. Because faculty members teach, research, and also do service and administrative work I argue and demonstrate that their satisfaction levels are subject to the clarity of their role and authority as it relates to administrative workers. As explained in greater detail later in this introduction, critics have called for 'unbundling' of job roles of faculty members. An unbundling of faculty duties would result in 'para-academics' who would focus solely on one of teaching, research, service, or administration or a subset of those. This proposal is a far cry from

tenure-track faculty roles as they stand now, and the existing wide range of faculty duties also creates some tensions as to how their overall role relates to the work of staff and administrators. Despite the many studies that have examined the various antecedents of faculty job satisfaction, very few or none have examined whether role clarity and some of its organizational complexities, like institutional support for faculty leaders, affect faculty job satisfaction. This third paper seeks to fill that gap as well as speak to issues regarding the role of bureaucracy in universities.

This introduction proceeds as follows: The next sections describe current theoretical and practical issues regarding the structure of university organizing, as well as a theoretical explanation as to why current administrative structures in universities will be slow to change and remain largely as they are for the foreseeable future. The aim of these sections is to set the scene in which faculty-administrative exchanges occur, which is the basis for all three essays. These sections are followed by explanations for how the essays contribute both theoretically and practically with regard to the dialogue on university administrative structure. The introduction ends with limitations of the studies as well as ideas for future research.

THE STRUCTURE OF UNIVERSITY BUREAUCRACIES

Size

The size and efficiency of university bureaucracies are central aspects to an ongoing question facing higher education in the United States: whether the organizational structure that has defined universities for decades (or even centuries) will continue to stand the test of time. At odds are the traditional model of higher education and the need to appear innovative. While innovation is not inherently good nor bad, in the public arena

innovation is seen as a positive sign of the health of public institutions (McLendon, Heller, & Young, 2005). Innovation means that leaders and policy makers are responsive to new ideas as it has been found that a state's innovativeness may influence the public perceptions about the responsiveness of elected officials and the quality of services (Berry, 1994). State innovativeness is important for the postsecondary education sector, where escalating college costs for students have increased criticism over the efficiency and productivity of higher education (McLendon et al., 2005).

Many argue that the rise in costs in higher education is due to administrative bloat. On one side of the argument is the "revenue hypothesis," the basic argument being that universities spend everything they get, making revenue the only constraint on costs (Bowen, 1980). Oppositely, the "cost disease" theory is not unique to higher education but refers to personal service industries of which higher education is an example (Baumol, 1967). The "cost disease" theory argues that in industries reliant on personal services of highly educated labor, such as dentistry or higher education, rising costs are directly related to rising salaries for highly educated labor relative to the less educated labor force (Archibald & Feldman, 2008). In higher education, both faculty and administration have traditionally been positions that require high levels of education. Furthermore, the personal service industries most affected by the "cost disease" are the ones that least benefit from advances in productivity from technology. Whereas in some industries like manufacturing technology makes the average worker more productive, but in industries such as dentistry filling a cavity requires relatively the same amount of highly trained labor as always (Archibald & Feldman, 2008). Like dentistry, higher education is an industry that has yet to find great productivity improvements from

technology the way manufacturing has. While it is true that technology in higher education has improved tremendously, at this point no serious effort to fully cost online programs within traditional colleges has been done, so any report on large scale quality increases per dollar that comparing online to face-to-face education is only speculative and hopeful (Means, Bakia, & Murphy, 2014, p. 170).

Another explanation for rising costs in higher education is the cuts in state funding for higher education during the Great Recession (Webber, 2016). After the great recession of 2007-2009, states cut higher education at the same time that enrollments were rising as unemployed workers went back to school (Mitchell, Leachman, & Masterson, 2016). Coincidentally, Arizona's students were the hardest hit seeing an 87.8% increase in average tuition at four-year public colleges adjusted for inflation from 2008 to 2016. Over the same time period, state spending per students dropped 55.6%. The steep state cuts also led to eliminations of staff positions and academic programs (MItchell et al., 2016). The 'balance wheel' model predicts that higher education funding will be cut more than other budget items in hard economic times and will receive larger increases than other budget items during good economic times (Hovey 1999). Previously just theoretical, the functional form of state higher education funding does follow Hovey's balance wheel model (Delaney & Doyle, 2011).

Further complicating the issue is the fact that most universities are multi-unit, non-profit organizations. Since non-profits are not expected to produce a profit if revenues exceed costs in any given unit, resources can be shifted to another unit where costs exceed revenues. For example, revenues from undergraduate or master's degree programs can support administrator perks, the teaching of doctoral students, or even

sports teams (Winston, 1999), so it is hard to follow the trail of where any extra resources are going. The complexity of university finance, coupled with resource shifting within multi-unit non-profits such as large universities, does not alleviate concerns about administrative bloat.

There is also a clear differentiation between colleges that rely on customer-inputs (i.e, students who pay tuition) and colleges that rely on donations (i.e., alumni contributions). Those universities with large endowments from donations can subsidize their product with contributions and ostensibly provide a better education, which in turn attracts better prepared students from wealthier families who eventually become rich themselves and make larger donations, creating a situation where the rich get richer. The elite universities that benefit from this cycle are most often private non-profits, while the universities that educate the masses, public universities, do not.

The small group of Ivy League universities and elite liberal arts colleges can and should usually be ignored in discussions regarding higher education policy for the masses because their financial situation is so different from the vast majority of post-secondary institutions both in terms of faculty issues and student issues. However, higher education is a highly institutionalized field subject to strong isomorphic pressures and the elite universities are the model setters for all the others to follow. Thus, bloated university administrations may be a result of non-elite universities following the administrative model of elite universities even when financially the situations are quite different. This situation for public universities is exacerbated by cuts in state funding (Rizzo, 2004) as previously explored. Again, while much of the hand-wringing over administrative bloat is about student costs and outcomes, conspicuously missing from this dialogue is an

understanding of how administrative sizes affect faculty outcomes like stress levels, satisfaction, and productivity.

Service and Role Bundles

Similar to the issue of administrative size, a related problem for many universities is the existing structure of academic work, the structure of academic services, and the entire value proposition of how higher education outputs are delivered. For many, the catch all fix for these structural issues is "unbundling." For some, unbundling in higher education refers to splitting up the traditional tripartite role of university faculty who teach, research, and do service (Macfarlane, 2011), while for others unbundling refers more to breaking apart the seemingly superfluous services and degree programs provided by universities (Craig, 2015).

The morphing of faculty roles from the all-rounded faculty member to para-academics who focus directly on specific aspects of teaching, research, or service has implications for the quality of student experiences and the sustainability of academic citizenship (Macfarlane, 2011). Forces potentially driving these changes include: massification of national systems, the application of technology in teaching, increasing specialization of academic roles to support a more centralized and performative culture (Macfarlance, 2011), administrators and political leaders seeking to reduce faculty power by eliminating tenure lines (Flaherty, 2016b), and cost cutting by hiring contingent, part-time instructors who do not have power (Ott & Dippold, 2017). The use of part-time, teaching only instructors has been growing steadily in traditional research universities for forty years (Weissmann, 2013). And, an organizational structure filled almost entirely with para-academics has been in place at for-profit institutions for many years (Kinser,

2002) but with largely questionable results of success (Cellini, 2012; Cellini & Chaudhary, 2014).

Organization wide experiments in faculty role unbundling are not limited to for-profit colleges. For example, at Western Governors University, a non-profit organization and an early mover in the competency based education model, even the role of teaching has been further split into several separate positions. There, curriculum development, teaching, and assessment work are separated. Content experts can focus on their expertise while evaluators refine their assessment role and build efficiencies. Unlike for-profit universities, Western Governors University is largely considered a success compared to for-profits (Blow, 2014; Hembree, 2017), and thus the case for faculty role unbundling is far from closed.

The unbundling of faculty roles has cost considerations that are often overlooked. For example, in online education as faculty roles become more distributed the cost of providing instruction and instructional support also go up. (Tucker & Neely, 2010). Still, others argue for a model in which there are more faculty members with administrative appointments and less full-time administrators. Administrator-faculty would be hired with specific administrative and teaching roles but no expectations around conducting research. Such a model would make university administrations more connected to students (Greenwald, 2017), potentially lower costs, build institutional memory, and would densify campus networks since adjunct instructors' connections to university networks are often quite weak (Cripps, 2014)

In addition to unbundling faculty roles, there are also arguments against service bundles in universities. Wang (1975) argued that the basic structure of traditional higher

education violates section I of the Sherman Antitrust Act, which condemns agreements by a party to sell one product or service on the condition that a buyer also purchase a second product or service. According to Wang (1975), higher education ties together four distinct products that consumers cannot purchase separately: impartation of information (instruction), accreditation (assessing educational attainment), coercion (pressure placed on students to perform), and club membership (the social and economic advantages that come with alumni status). In sum, including these four services or goods together is a bundle that violates free trade like any other antitrust violation.

More contemporary arguments also argue against bundled services, but rather than making legal arguments, critics of the current system worry about the inefficiencies or chunkiness of bundled services at universities (Craig, 2015). The worry is that current university structures only exist because of isomorphism or imitation, not the typical functionalism that guides for-profit organizations. Unlike in business, universities gain prestige based on the four R's: rankings, research, real estate, and rah! (sports) (Craig, 2015). All four of the R's are easier to measure and simpler to communicate to alumni and other interested parties than student outcomes. The result is isomorphism as regional and public universities attempt to mirror prestigious universities across the four R's. However, because they are not elite, these universities waste resources towards the four R's rather than use resources to directly improve the quality of teaching and learning (Stange, Jacob, & McCall, 2017). While Craig (2015) is critical of the current university structure, Craig and Williams (2015) envision and suggest a new bundle for students. The 'full-stack' model vertically integrates a job placement and education into one organization. Thus, a fully-stacked education company might not even look like a

traditional university, rather it might look more like an employer, a lender, a school, and a recruiter all in one (Fishbein, 2014).

In contrast, there are some who would argue for more tightly bundled educational programs. Stronger bundled programs help students make intentional connections between different disciplines and experiences. Being trained in a bundled system builds the ability to draw from a broad range of knowledge, skills, and frameworks as one tackled complex problems. Because civic and professional life's challenges are often complex, only broad but bundled programs and not specific unbundled programs can prepare one for the unpredictability of complexity. Knowing only one discipline or one set of discrete technical skills will not help with these sorts of problems (Mayer, 2015). Another strong argument against unbundling is that it pits the uneducated early student as their own curriculum advisor. While employers continually seek for employees that can problem solve, work in teams, and communicate well the prototype of the unbundled education is to create technicians, not critical thinkers (Mayer, 2015).

Alternative Structures

Other examples of a radical alternative to the way universities are organized is competency based education and massive online open courses (MOOCs). Instead of focusing on traditional semesters and seat time, competency based education favors a structure that creates flexibility and allows students to progress on their own time as they demonstrate mastery of academic content. Strategies for competency-based education include online and blended learning, dual enrollment and early college in high school, project-based and community-based learning, and credit recovery (U.S. Department of Education, n.d.).

Massive online open courses (MOOCs) were believed to be the panacea for the financial sustainability of higher education and also proposed an alternative structure. MOOCs would provide a cheap alternative to educate the masses and alleviate poverty. Buy-in from elite American universities gave MOOCs a trusted name and badge of quality that all but ensured their success to promoters. However, research suggests that MOOC's may not be, at least for now, the panacea for higher education. A survey by the provost's office of one of the elite university adopters, the University of Pennsylvania, suggests that those without access to higher education in developing countries, those who the MOOCs were supposed to help the most, are underrepresented in the early adopters (Christensen et al., 2013). MOOC students were found to be mostly from developed countries, highly educated, young, male, employed, and with main reasons for enrolling in the MOOC being advancing in a current job and curiosity (Christensen et al., 2013). While both of these new forms have their champions within the field, as of yet neither has taken on more than a peripheral role in how most universities organize themselves.

Slow Change to Bureaucratic Sizes and Structures

In many ways, arguments over administrative size and structure at universities are just rehashes of an age-old argument in higher education between those who would maintain existing university structures and those who would promote job preparation and innovate university structures. When considered as a private good, college is seen as workforce preparation with the ultimate goal being to get students a good job. When considered as a public good, higher education generally entails promoting the critical thinking learned through the liberal arts with the ultimate goal being to prepare students

to be good citizens and live fuller lives, as well as to think critically as workers (Labaree, 1997).

In traditional higher education at least four factors maintain current organizational structures, these factors include: 1) strong and deeply rooted institutions, 2) internal organizational characteristics such as loose coupling, 3) diverse funding sources, and 4) adherence to external entities such as accreditation agencies, athletic conferences, ranking systems, or coordinating bodies and associations such as the AAU that provide legitimacy.

Universities have long been identified as being highly institutionalized (Meyer & Rowan, 1977, 357), which has been a maintenance force for university structures despite some outside pressures. Indeed, there is wide difference between the goals externally placed upon universities and their internal goals, which partly stems from academic leaderships' disdain for managerial corporatism (see Winter, 2009). Much of the struggle over university structures actually occurs with underlying shifts in the institutional logics, which are slowly shifting towards corporate logics that have been creeping into universities through mundane innovations such as admissions management and managerialism (Kraatz, Ventresca, & Deng, 2010). Despite these slow shifts, organizational structures have remained relatively similar over the decades, or even centuries.

Regarding their internal organizational structures, universities have been termed 'organized anarchies' (Cohen & March, 1986) and described as 'loosely coupled' (see Weick, 1976; Weick, 1982). Weick (1976) defined loose coupling as occurring when elements in the organization are responsive to one another but preserve separateness and

identity as is the case with university departments. Loosely coupled departments, each with different goals and identities, create goal ambiguity when a university is observed as a single organization but have also allowed university structures to perpetuate by creating internal goal ambiguity as various actors compete within the university.

Unlike for-profit businesses and corporations where the need for profits often determine innovations in structure (see Milgrom & Roberts, 1992) non-profit universities derive funding from various sources including government subsidy in the form of direct appropriations as well as indirect student grants and research support, charitable donations from private citizens, tuition revenue from students, and income from auxiliary operations, such as bookstores, food services, hospitals, and sporting programs. These diverse funding sources make changing structures more difficult. In a study of 115 Federal US agencies Chun and Rainey (2005) found that agencies with higher levels of financial "publicness", operationalized as the proportion of financial resources that come from government sources (Bozeman, 1987), have a harder time evaluating and prioritizing their goals. Such is also the case for non-profit universities both public and private. Because there is no single one funding source for universities, no single funder can mandate changes to organizational structure.

Finally, much like universities obtain funding from diverse sources, universities also obtain legitimacy from various sources, meaning that any one stakeholder does not have strong influence over how universities are organized. Scott (2013) notes that universities are loosely coupled systems, "in part because they must relate to many different environments" (p. 192). For example, universities must answer to educational accreditation agencies, professional disciplinary associations, federal agencies, athletic

associations, local planning and regulatory bodies, state governments, and students, each clamoring for accountability. Certification or accreditation is often a prime indicator of legitimacy (Dowling & Pfeffer, 1975; Ruef & Scott, 1998). An organization's legitimacy is affected by the number of sovereign authorities over it and by the diversity and inconsistency of how they think the organization should act (Meyer & Scott, 1983, 202). Legitimacy is more than just a goal; like oxygen is for breathing it is as fundamental to social existence (Scott 2013, 72).

Even ranking systems have not been able to alter organizational structures. Rather, ranking systems perpetuate existing organizational structures by providing strong models for isomorphism by universities that are always at the top of rankings. Only a small few ignore rankings and try to innovate with structure. Patterson (2001) counsels universities to determine the minimum amount of goal specificity to satisfy external demands and internal policy planning in order to preserve their fundamentally creative character and purpose. In 1995 the distinctive Reed College pulled itself from the *US News and World Report* rankings because it saw the magazine's methodology as hopelessly flawed. Instead Reed College argues that the value of an education is the degree of intellectual engagement in the classroom, something that rating systems cannot measure ("Reed College Admission Office," 2014). Similarly, some college presidents and academics push back against rating systems. Many argue that no rating system, and thus no explicitly measureable goal, can accurately measure what happens at a good university no matter how thoughtful the criteria (see Shear, 2014; Kelderman, 2014). Despite the disdain for ranking systems, universities are beholden to them for legitimacy and prestige.

CONTRIBUTIONS

While changes to how universities organize may be on the horizon, if the history of the longevity of higher education institutions is any indication, existing structures will be around for the foreseeable future. In recent years, two different sets of literatures have shed light on contemporary university structures and management. One literature examines how changes in university administrative structures and management affect student outcomes (e.g, Rabovsky, 2014; Rutherford, 2015). Another literature examines the effects of administrators' leadership styles on faculty job experiences and outcomes (e.g. Bateh & Heyliger, 2014; Jeevan Jyoti & Sonia Bhau, 2016). This dissertation bridges the gap between these two emerging literatures and examines how facets of university administrative structures affect outcomes of importance to the central workforce and lifeblood of these organizations – faculty members.

This dissertation contributes both theoretically and practically to the issues regarding the size of university administrations and university structures. The first essay tests whether the introduction of a new university administrative role affects productivity outcomes at universities, directly addressing conversations in practice regarding the necessity of growing university administrations. The second paper tests how administrative intensity affects faculty job stress, again addressing questions about the ideal relative size of administrations within universities. The third paper examines how role ambiguity and institutional support affect faculty job satisfaction which speaks to faculty expectations regarding both their work role and the role of the institution in providing them support at a time when the traditional bundle of faculty roles is increasingly in question.

Limitations

This dissertation is not without limitations. First and foremost, there is no comprehensive data that directly addresses how administrative issues affect faculty outcomes. As such, the only way to get at the present research questions is to use piecemeal data, which in this case comes from multiple surveys and administrative datasets. Because these data were not collected to directly address the present research questions there were methodological issues that may have been avoidable had the data been collected for the research at hand. Nevertheless, as each paper explains, efforts were made to address stumbling blocks. The main stumbling blocks in these essays were measurement issues, endogeneity issues, and common method bias.

For example, early versions of the first essay did attempt to use longitudinal data to parse out the endogeneity problem inherent in the relationship between the administrative support role and grant outcomes, but because the data being analyzed were not collected for this purpose it proved untenable and thus cross-sectional data with instrumental variable was the cleaner approach. In the second paper, the data in use did not include a comprehensive set of questions about faculty stress and thus arriving at a factor variable based on multiple dimensions of faculty stress was not possible. This issue is abetted by the theoretical connection between stress from administrative responsibilities and administrative intensity. Furthermore, the dependent variable – stress from administrative responsibilities – correlates highly with control variables that intuitively it should correlate with, supporting the reliability of this variable. The largest issues in the third paper are common source and common method bias as all of the data for this paper came from the same set of surveys. This issue was alleviated because of the

theory connecting the idea of job satisfaction with entities like rule clarity and institutional support. That is, because the ontology of job satisfaction as an entity is different from the separate entities of rule clarity and institutional support, common source bias in these relationships is less of an issue than it would be in relating job satisfaction with things like intention to leave or burnout, which are much more similar to job satisfaction ontologically. Also, from a more pragmatic perspective, all were multi-campus/multi-institution sources.

Future Work

As is clear from the limitations of the study, future work on this subject would do well to have data directly gathered for research questions dealing with the faculty-administration exchange. Such data could come in various forms, whether survey or administrative or both. Data that is longitudinal could also address the issues of measurement and endogeneity that plague cross sectional studies. One benefit of this current research is that it tests both organizational behavior outcomes and productivity outcomes. Future work could link administrative issues with faculty organizational behavior outcomes and finally with productivity outcomes. As for productivity outcomes, this research only considers academic grant outcomes. Future work could look at other faculty productivity outcomes, such as journal articles, teaching quality, or find a way to measure service impact. Finally, a related study might even use aggregated organizational outcomes such as fiscal health or societal impact to indirectly measure the effect of administrative structures on the effectiveness of the university.

Another type of future academic work could anticipate future changes to bureaucratic sizes and structures within universities in an attempt to understand how

those differences would affect faculty or other outcomes. One way to undertake such research would be to gather data or perform case studies on higher education organizations that are pushing the limits of organizational bureaucracy or faculty job roles. As previously mentioned, research into competency based education or massive online open courses may be useful. Other organizations on the fringes of higher education may prove to be fruitful case studies. The Minerva Schools at KGI seeks to provide elite, Ivy level education for a cheaper cost than the current Ivy League Schools. In their model, students spend each semester living abroad in a different city of the world, taking online classes from remote and dedicated professors with other students in their cohort. The idea is that students will experience the great cities of the world and will have high level classes that are free from the typical lecture style or classroom or the huge costs in capital required for a physical campus. Another potential fringe case study is peer-to-peer learning that puts learners and teachers on the same horizontal plane. Maker spaces are a peer-to-peer learning culture that changes the hierarchical structure of learning. Maker spaces are shared production facilities where people come together to make things in a self-directed and horizontal structure. The recent growth of such spaces (Lou & Peek, 2016) indicates that some people would rather learn this way, instead of the traditional top-down approach that is ubiquitous at the traditional university. All of these cases – competency based, MOOC, Minerva and maker spaces – come with radically different organizational structures that could have profound effects on the way both frontline and bureaucratic workers in higher education view themselves.

For now, each essay in this three essay dissertation examines a research question that follows a uniform outline around a common theme in mainstream higher education:

the relationship between an aspect of university administration and a faculty outcome. The three empirical chapters provide an assessment of current literature and provide avenues for moving research in university management and policy forward.

CHAPTER 2

ESSAY 1: THE EFFECT OF ADMINISTRATIVE SUPPORT ON ACADEMIC GRANT OUTCOMES

Over the last few decades academic researchers have been increasingly incentivized to spend less time on actual research and more time on related administrative activities. In order to be awarded the same number of grants as in past decades, academic researchers must now send out more grant applications, spending almost half of their time preparing grant proposals and managing the administrative back end of the grants they do receive (Rockwell, 2009; National Science Board, 2014; Barham et. al, 2014). The focus of this paper is the organizational response to this situation. That is, to deal with this problem, universities have used precious resources for the deployment of an organizational position whose function it is to support academic researchers through the grant application and management process. The ostensible hope of university leaders is that providing administrative support will reduce researchers' administrative loads and improve their chances of obtaining grants. While this is the hope, to this point no systematic research has studied if administrative support actually improves grant outcomes. This study uses a large national survey of academic researchers to test the effect of administrative support on grant outcomes.

Findings from statistical modeling suggest that academic researchers who receive administrative support for grant writing and management obtain fewer grants and have a lower success rate. However, the findings also suggest that academic researchers who receive administrative support are awarded much larger grants in terms of total dollars. Despite attempts to work through an endogeneity issue using instrumental variables, the

statistical modeling approach combined with contemporary knowledge of academic grant management does not allow for strong causal distinctions based on these findings. However, the findings do suggest that administrative support exists in academic grant situations of high-risk, high-reward. That administrative support is an indicator of high-risk, high-reward grants is useful knowledge for universities that are attempting to improve their grant management and grant obtainment.

These results are idiosyncratic to academic grants in university settings, and so specific insights into grant or contract seeking behavior for other types of organizations are less clear. Nevertheless, the idea that administrative support correlates highly with grant outcomes in academia is an indication that research in other settings could prove fruitful. Thus, similar research on local governments (Congressional Budget Office, 2013) or non-profits (Pettijohn, 2013) could indicate when and how administrative support improves grant outcomes across those different situations. In a time when resources are increasingly hard to come by, achieving that strategic edge may be the difference between obtaining the money that will lead to solvency or severe fiscal pressure.

In the pages that follow I frame and motivate the study by first expanding on the situation of administrative burden in academic grant management and discussing the general organizational responses to improving chances of receiving competitive grants. I follow with a review of literature on antecedents to academic grant outcomes. Since no other research has examined the effect of administrative support on grant outcomes, I look to the role that administrative support has had on outcomes in other contexts to support hypotheses about the role of administrative support on grant outcomes. The paper

continues with a description of the data and analytical approach and ends with a discussion of the weaknesses, findings, and potential for further research.

BACKGROUND AND MOTIVATION

This paper examines the correlation of two concepts: administrative support for academic grants and academic grant outcomes. Three macro trends over the previous few decades motivate the study of this connection. These trends are: 1) increasing administrative burdens for federally funded research, 2) decreases in time spent on research and increases in time spent on research administration among academic researchers, and 3) an increasingly resource constrained environment in higher education. Various forces at play have led to these administrative burdens including: accountability with grant money, safety of research procedures, transparency with research processes and spending, rules that often drift into the realm of red tape, and increasing competition in a zero-sum game for a fixed number of grant dollars.

Administrative Burdens for Federally Funded Research

Over the last two decades there has been an increasing recognition that the administrative workload on federally funded research is out of proportion with the need to ensure accountability, transparency, and safety (National Science Board, 2014). The National Science Board (2014) report surveyed principal investigators and administrators from universities in the US about administrative burdens of federally funded research. Respondents to the survey suggested a 'culture of overregulation' associated with a perceived increase in audit risk and concerns about liability. The report also found that a combination of increased compliance costs, insufficient reimbursement costs, and a

resulting decline in institutional administrative support at some universities, has squeezed out scholars' time allocated to actual research.

Evidence from other studies support the trend. Beginning in 1999, a National Institute of Health study reported that its system of regulation in some areas was particularly burdensome (Mahoney, 1999; see also Wadman, 1999). A report by the National Research Council (National Research Council, 2012), as one of its ten actions vital to US prosperity and security, recommended reducing or eliminating regulations that increase administrative costs without improving the research environment.

Perhaps the most telling aspect of the National Science Board (2014) survey relates to the principal investigators who responded to the survey and their perceptions of the level, quality, and necessity of administrative support from their university on many aspects of federally funded research. The largest aspect for which PI's suggested they received no help or the help was poor was "administrative support for financing" (p. 64). But other aspects such as "proposals," "progress reports," "finances," "personnel," and "data sharing" all also had at least 25% of respondents report that their university help was poor or non-existent.

Research Time Allocations

A 2005 survey by the Federal Demonstration Partnership found that principal investigators of federally sponsored research spent, on average, 42% of their research time on administrative tasks associated with the funding (Rockwell, 2009). Barham and colleagues (2014) analyzed four surveys of randomly sampled faculty in agriculture and life sciences from 1,862 land grant universities over the years 1979, 1989, 1995 and 2005. From 1975 to 2005 faculty time spent on research declined from 59% of time spent

to 47% of time spent, while time spent on administrative activities doubled from about 5% to 10%, time spent on extension appointments went up from 5% to 13%, and time spent on teaching remained nearly constant at about 30%. These averages suggest that administrative and extension activities were cutting into research time. Within research time allocations, more specific data between the 1995 and 2005 surveys reveal more to the story. Within research time allocations between 1995 and 2005, grant preparation time went from up 14% to 21% of research time, administration went up from 14% to 21%, and time spent actually doing research dropped from 72% to 58%.

In response to the ever increasing administrative burdens and reduction in actual research time the federal government, along with other organizations, took efforts to address the concern. Congress held hearings and requested the Government Accountability Office conduct reviews of the regulations (Brooks, 2012). The Obama administration issued two Executive Orders aimed at reducing regulatory burden (The White House, 2011; 2012), and the Office of Management and Budget completed reforms to the administration of Federal research grant contracts (Office of Management and Budget, 2011). Despite the changes, another survey by the Federal Demonstration partnership in 2012 again found that principal investigators of federally sponsored research spent, on average 42%, of their time on associated administrative tasks (Schneider, Ness, Rockwell, Shaver, & Brutkiewicz, 2012).

Resource Environment in Higher Education

The third trend affecting scientists' administrative burdens and hindering their ability to do science is the increasingly resource constrained environment in higher education. Between 2003 and 2012, all state sources as a percentage of total university

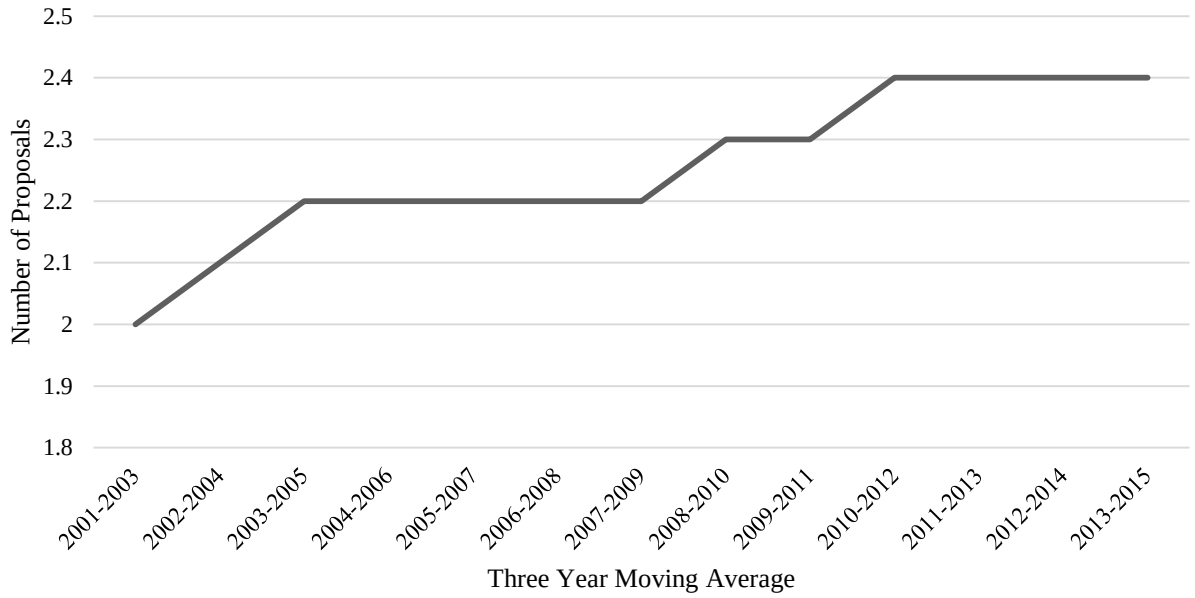
revenues dropped from 32% to 23% (Emrey-Arras, 2014), a trend that had been going on for a few decades before that. The balance wheel model predicts that higher education funding will be cut more than other budget items in hard economic times and will receive larger increases than other budget items during good economic times (Hovey 1999). Previously just theoretical, the functional form of state higher education funding does follow Hovey's balance wheel model (Delaney & Doyle, 2011). True to what the balance wheel model would predict, the already downward trend in state funding for higher education was exacerbated by the Great Recession of 2007-2009. States cut support to higher education at the same time that enrollments were going back up as unemployed workers went back to school (Webber, 2016; Mitchell, Leachman, & Masterson, 2016). These cuts meant that public universities were forced to cut corners and find resources from other sources, including increasing tuition rates, increasing the number of out-of-state and international students who pay higher tuition, federal student grant money, and federal grants for research.

The Result

As a result of the three trends, the competitive environment for academic grants is increasing and academic scientists must send more grant applications to get the same amount of grant money. As illustrated in Figure 1, principal investigators in 2001-03 seeking funding from the National Science Foundation submitted two grant proposals before receiving one award. The rate jumped to 2.4 proposals per award by 2013-15. This problem is similar to the red queen's race theory in evolutionary biology, which argues that organisms must constantly adapt and evolve not just to gain advantages in

reproduction but to survive in an ecosystem where competitors are constantly evolving in an ever-changing environment (Van Valen, 1973).

Figure 1: Number of Proposals per PI before One Award



Source: ***National Science Foundation. Reports to the National Science Board on the National Science Foundation's Merit Review Process, Fiscal Years 2013 & 2015***

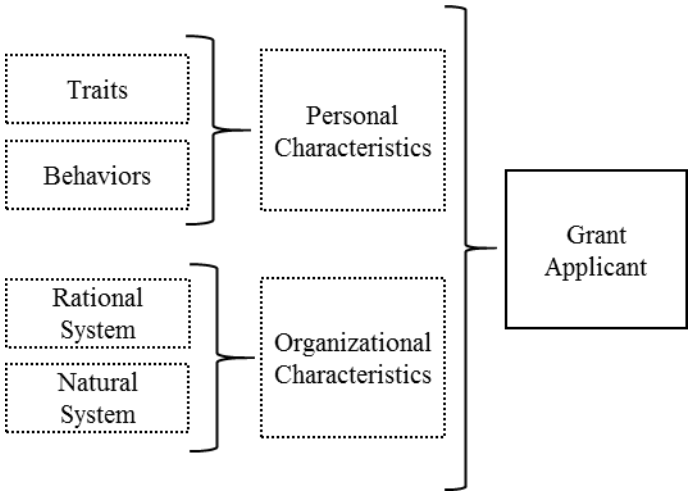
How individuals and organizations respond to an increasingly competitive and resource constrained environment is an important question. To remain competitive for federal grant money, universities have responded to the increases in competition by employing a variety of strategies including seed funding programs, targeted talent searches, and creating administrative and organizational support programs to aid researchers through the grant application and management process (the focus of this study).

LITERATURE

Predictions of grant success have been separated according to characteristics the applicant and his or her organization, and any interaction between a cross set of those characteristics. For example, an applicant with high levels of existing resources from a specific university with a history of scholarly productivity sends a strong signal to grant makers that the applicant can follow through with the promise of a grant. For the risk intolerant grant maker this very well may be the most important signal that the applicant will make good use of the grant. As Figure 2 illustrates, characteristics of grant applicants can be distinguished between personal characteristics and the characteristics of the organization for which they are a stakeholder. Personal characteristics that have been found to correlate with grant outcomes include socio-demographics such as gender (Corley, Bozeman, & Gaughan, 2003) and behaviors such as research productivity (Lee & Bozeman, 2005). Organizational determinants of grant outcomes can be differentiated according to whether the determinant is a part of the rational or natural system of the organization. Scott and Davis (2006) distinguish between these two interactive systems, whereas the rational system refers to the formal structure of the organization, the natural system refers more to the social structure that emerges organically as a result of human beings being brought together. Both rational and natural systems have effects on academic scientists' ability to apply for and obtain grants. As an example of rational systems, Gaughan and Ponomariov (2008) determined that affiliation with multidisciplinary research centers has a negative effect on grant outcomes, as traditional disciplines convey to funders a more clear research program. Haller and Welch (2014) focused on the natural system and found that strong professional social ties are related to

more grant applications and that being connected to a small network of capable collaborators leads to more grant successes.

Figure 2: Characteristics of Grant Applicants



Across many studies of grant behavior is the acknowledgement of the central role that collaboration plays in determining grant outcomes. Indeed, Lee and Bozeman (2005), Corley and colleagues (2003), Gaughan and Ponomariov (2008) and Haller and Welch (2014) all point to collaboration as integral to the grant application process - such alignment hints at the important role that joint effort plays in shouldering the administrative burden of academic grant administration. For example, strong ties positively relate to submissions, and smaller networks of strong, highly capable collaborators generally receive more awards (Haller and Welch, 2014).

While it can be argued that grant collaboration is a part of both the rational and natural organizational systems, in most cases, collaboration among academic scientists is largely a result of natural systems within universities as well as open systems of academic networks across universities (Scott and Davis, 2006). Despite the large body of evidence

of the central role of collaboration in grant activity, no academic research has studied the role of administrative support in improving grant applications despite that fact that even more than seeking collaborations, academic scientists seek help from administrative support solely for the reason of easing the administrative burden associated with grants. And unlike collaborations, administrative support staff is a formal job role in universities. Though organic relationships within the natural structure undoubtedly influence the quality of help that administrative staff provide to grant applicants, administrative support is largely a part of the rational system. Furthermore, the specialized expertise of a staff grant managers creates a competitive advantage for researchers who expertise is in the content of grant applications, not the application process itself. In sum, scientists look to natural and open systems for collaborations as well as rational systems for administrative support for easing administrative burden associated with grants. To contribute to the literature, this paper focuses on the rational system and the role that administrative support plays in determining grant outcomes.

HYPOTHESES

Some research has studied the effects of administrative or personnel support on grant applicants but such studies examine the effects of personnel support on researchers' motivations, not their grant outcomes. For example, personnel support for preparing grant proposals has been found to be a motivator for grant activity (Boyer & Cockriel, 1997; Boyer and Cockriel, 2001; Bryan, 2010). Other studies have looked at the role of training programs in grant writing, which is predictor of the total dollar amount of grant dollars in addition to being correlated with research team size, number of proposals, and conference

attendance (Cole, 2006). Other recent work has looked at the bureaucratization of academic research policies using the perspective of red tape theory (Bozeman, 2015).

While there has been little work on the effect of administrative support on faculty grant outcomes there is a small but burgeoning stream of literature on administrative burden as it relates to an individual's ability to obtain benefits from public service organizations in other sectors, e.g., people seeking Medicaid benefits or students seeking grant aid benefits. This research stream relates to the situation of academic grant seeking because in both situations there are outsiders to an organization (e.g., citizens, academic researchers) applying for benefits from a public organization (e.g., Medicaid, NSF Grants). Most administrative burden studies examine the burden experienced by applicants by noting changes in program administration, changes in the number of administrators, changes in the application process, or changes in the number of document requests (Herd et al., 2013; Moynihan et al., 2015; Heinrich, 2015), but none of them examine how administrative support reduces administrative burdens experienced by benefit applicants.

Another related stream of research focuses on the organizational red tape that hinders employees' and clients' ability to navigate the formalized rules of an organization in order do their job or get what they need from the organization. Perhaps the closest academic overlap between red tape and the situation of academic grant seeking is Bozeman's (1993) concept of 'ordinary red tape,' which was one of four early conceptualizations of red tape. 'Ordinary red tape' is defined as rules that originate within an organization but that had their effect externally on stakeholders like citizens or clients. Despite this early conceptualization virtually all research on red tape focused on its

effects on internal employees, and little work has examined how internal organizational rules affect an organization's clients.

Despite there being no direct research on the effect of administrative support on grant outcomes in academic settings, evidence from other settings provides some insight on the effect of administrative support on other outcomes. Bettinger and colleagues' (2012) field experiment examined administrative burden by testing the role of application assistance in improving FAFSA (Free Application for Federal Student Aid) submissions, college access, and persistence and found that immediately and later in time application assistance did indeed improve outcomes. Similarly, Sendhil and Eldar's (2009) experiment on unbanked individuals found that workshop attendees who were given application assistance on the spot were 10% more likely to enroll in banking services than those who were provided a referral letter and instructions to open up a bank account. While the subjects of these studies were prospective college students and unbanked individuals, the general insight is useful for the case of this study – academic grant seeking. Providing specialized assistance for an individual as they navigate a seemingly complex application process yields better quality applications, which in turn may lead to better outcomes related to that application.

Academic scientists can still struggle with the administrative burdens of grant applications despite being highly educated. Even if education plays a role in affecting one's ability to complete an application in other settings, being highly educated does not make one immune to application difficulties if the nuances and craft required for a successful application are not known by the applicant. It is true that grant behavior is slightly different from access to benefits / entitlements in the sense that it is no longer just

a question of eligibility but is now a zero-sum game. But, competition only introduces more competitive behaviors making application craft even more necessary. In the case of academic grant seeking, the general hypothesis is that access to administrative support will make applicants more competitive by improving application quantity and / or quality. Not only will administrative assistance have a positive functional effect for the applicant, the job training and experience gained by those whose job it is to provide assistance will improve applications for individual applicants unfamiliar with the process. As this study examines multiple measures of grant activity, the main idea is that this general hypothesis holds for different measures of grant outcomes, as reflected in hypotheses 1-5.

H1: Academic scientists who receive administrative support will have a higher number of grant proposals.

H2: Academic scientists who receive administrative support will have a higher number of grant awards.

H3: Academic scientists who receive administrative support will have a higher grant success rate.

H4: Academic scientists who receive administrative support will have higher total grant dollars.

H5: Academic scientists who receive administrative support will have a higher largest individual grant in dollars.

DATA

Data for this research comes from The Netwise I survey that was deployed in the 2006-07 school year. The survey asked about collaboration and advice networks, research activities, including grant submissions and success rates, teaching and service responsibilities, attitudes and involvement in interdisciplinary research, work environment, job satisfaction, job stress, and detailed demographic and academic background questions.

The survey was implemented and completed online using Sawtooth Software®. The survey population was invited via traditional mail and a series of personalized follow-up emails. Each invitation provided individually assigned user-ids and passwords and direction to the online survey. Overall, the survey took between 30-45 minutes to complete. The population was constructed by manual retrieval of information from department and university directories from 151 universities in the U.S. that were designated as "Research Extensive" universities under the 2005 Carnegie Classification system. The disciplines (biological sciences, chemistry, computer science, earth and atmospheric sciences, electrical engineering, and physics) were selected based on the level of female representation (low, transitioning, and high fields).

From the population of universities, 3667 faculty were selected and 1774 completed surveys. Of the completed surveys, 176 were removed because of ineligible rank or discipline. Also, 21 partially completed surveys were deemed to have sufficient information to be included (over 95 % of questions answered). These changes led to a final analysis sample size of 1598 surveys, and thus the overall survey response rate using the RR2 method of the American Association for Public Opinion Research

(AAPOR) was 45.8% and the weighted response rate was 43.0%. The final analysis subset for this research, after observations with missing values were deleted, consists of 1127 academic scientists (for more information on survey administration, see Jha & Welch, 2010).

The majority of respondents were white (78%), male (54%), and full professors (44%). Academic discipline was fairly evenly spread across biologists, chemists, earth and atmospheric scientists, computer scientists, electrical engineers, and physicists. About a third of respondents received administrative support (31%) and about a quarter asked for administrative support (25%). Over the two years previous to the survey, the average number of grant applications was 5.11, average number of grant awards was 2.27, the average grant success rate was 43%, the average total dollar amount in grants was about $1.9 million, and the largest grant was about $1.4 million. Table 1 presents the summary statistics for all of the variables in the analysis.

Table 1: Summary Statistics, Administrative Support and Grant Outcomes

Variable	Mean	Std. Dev.	Min	Max
Total Grant Submissions	7.73	11.34	0	200
Total Grant Success Rate	0.42	0.31	0	1
Total Grant Awards	3.38	6.84	0	164
Total Grants (in $)	$1,867,196	$7,431,032	$0	$154,000,000
Largest Grant (in $)	$1,441,987	$7,323,405	$0	$198,000,000
Received Support	0.31	0.46	0	1
Asked for Support	0.23	0.42	0	1
Department Reputation	2.65	0.76	1	4
Administrative Stress	2.18	0.86	1	4
# Courses Taught	3.42	1.12	1	6
# Committees	5.65	2.10	2	12
Five Year Publication Ave.	3.76	5.36	0	100
Assistant Professor	0.27	0.44	0	1
Associate Professor	0.28	0.45	0	1
Full Professor	0.45	0.50	0	1
Female	0.46	0.50	0	1
1st Grant Probability	17.60	14.91	0	95
# Doc Students on Grants	0.60	1.14	0	12
Biology	0.17	0.38	0	1
Chemistry	0.18	0.38	0	1
Computer Science	0.16	0.37	0	1
Earth and Atmospheric Sciences	0.18	0.39	0	1
Electrical Engineering	0.13	0.34	0	1
Physics	0.17	0.38	0	1
South or Southeast Asian	0.05	0.23	0	1
Other Asian / Pacific Islander	0.09	0.29	0	1
African American	0.01	0.11	0	1
Hispanic	0.02	0.15	0	1
Native American	0.00	0.07	0	1
White	0.78	0.41	0	1
Other Race / Ethnicity	0.02	0.13	0	1

Measures

Dependent variables: Survey respondents were asked to report various counts of their academic activity over the previous two academic years. Of particular interest as main dependent variables in this study are the sum of their total PI and Co-PI grant

submission, sum of PI and Co-PI grant awards, and the total dollar amount of grants received and total dollar amount of their largest grant. Grant success rates were calculated as grant awards divided by grant submissions.

Main focal variable and instrumental variables: Survey respondents were asked the following questions: "In the past two academic years: 1) Which of these have you requested from your department / unit? And 2) Of these, which have you received from your department / unit?" which was followed by a list of resources. Among this list was "administrative support for grant writing and grant management."

Department reputation is measured using self-reports to the following survey question: "At this point in your career, how satisfied are you with the following?", to which respondents had the option of responding on a four point (dissatisfied – satisfied) scale for "The reputation of your academic department." While there may be better measures of university reputation, self-reports of department reputation are arguably the best measure because reputation is subjective.

Control variables: To measure various aspects of work stress, respondents were asked the following question in the phase one survey: "To what extent are the following factors currently a source of stress in your work?" Among the factors to assess were 'administrative responsibilities,' 'relationships with colleagues,' 'publishing demands,' teaching responsibilities,' 'time allocation between work and family,' and 'demands for obtaining external research funding,' to which respondents could respond with 'Substantial,' 'Moderate,' 'Minimum,' and 'None.' Taken all together, these measures have a Chronbach's Alpha of .61 indicating moderate scale reliability of overall work stress. Exploratory factor analysis of the entire battery further confirms the weakness of

overall job stress as a function of the entire battery. For the current research, only the measure for job stress from administrative responsibilities is included in the study.

Variables for gender and race/ethnicity are measured using dummy variables. A measure for grants probability is the respondent's estimation of the probability that a first time submission of a federal grant will be funding. Counts measure the number of university and department committees on which faculty currently serve. Academic rank is measured with dummy variable indicating whether the faculty was an assistant professor, associate professor, or full professor. Other academic activity counts include the number of publications and the number of courses taught (previous one year).

ANALYSIS

While the hypothesized relationships in this study are uniformly straightforward – that receiving administrative support improves grant outcomes – analysis of those relationships presents some challenges. The first challenge is the issue of selection for those who receive administrative support. It is obvious that some of the same predictors of grant success also predict who may and may not receive administrative support for grant writing and management. Many of these variables are included in the analysis as control variables but more is needed to further separate this endogeneity problem.

Instrumental variables further address the selection issue. Theoretically, the instrumental variables need to predict the reception of administrative support and only connect to grant outcomes through the reception of administrative support. Two variables that theoretically could affect grant outcomes, but only through the reception of administrative support, include asking for administrative support and department reputation. Asking for administrative support strongly predicts the reception of

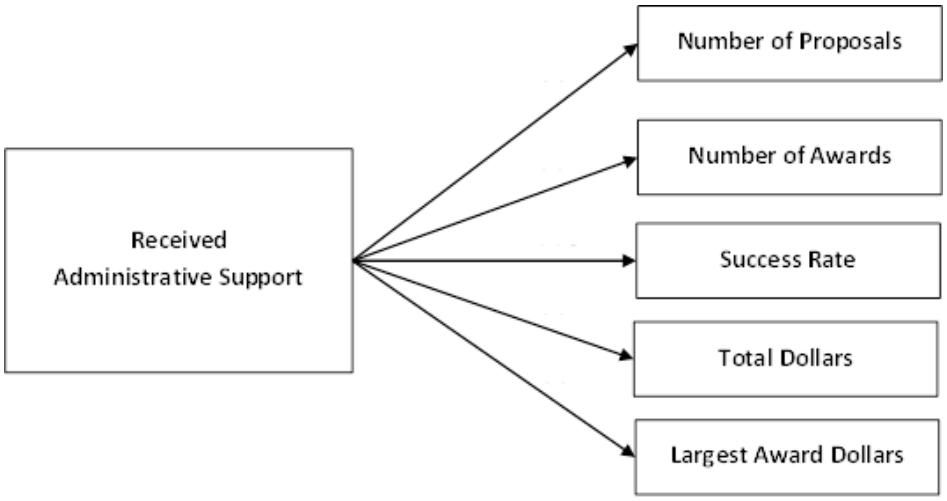
administrative support and only connects to grant outcomes if the requestor actually receives support. That is, there is not a strong argument to be made that asking for administrative support on its own strongly predicts grant outcomes on its own.

Similarly, department reputation affects whether one will receive administrative support because those departments with better reputations will also more likely have the resources to provide administrative support in the form of grant writing and management. Furthermore, department reputation on its own should not affect grant outcomes, especially if grant applications are blinded. While it is true that not all federal grant applications are blind, a stronger predictor of grant outcomes in a non-blind application process than department reputation is institutional reputation. While department and institutional reputation are correlated, institutional reputation is more widely known and less idiosyncratic than department reputation meaning that it has a stronger effect on non-blind processes are affected by reputation. In other words, the difference between an individual researchers and grant authorities' understanding of their department's reputation is larger than the difference in understanding of institutional reputation. This difference is what makes department reputation a good candidate as an instrumental variable in this study.

Figure 3, illustrates the proposed connections in this paper. The reception of administrative support (as predicted by the instrumental variables) will be the main predictor for each of the five dependent variables, along with control variables. Such a system of equations that predict various forms of grant outcomes suggests the use of seemingly unrelated regressions (SUR) or three stage least squares (3sls) approaches to account for the potential correlated errors terms across equations. However, because the

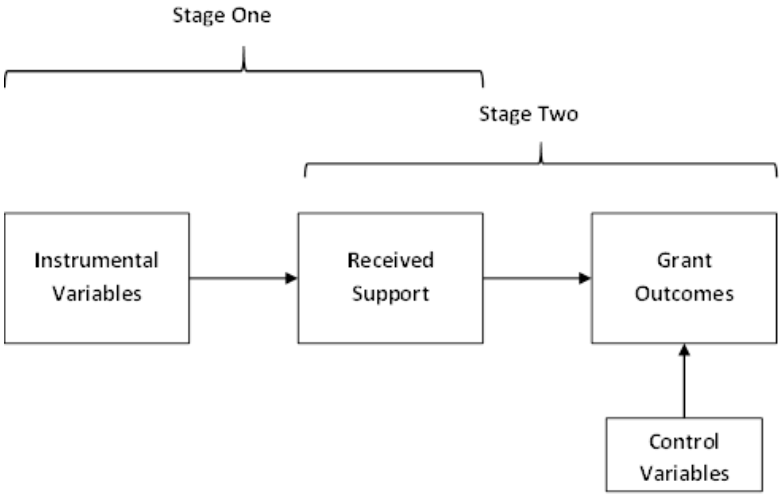
instrumental variables and right hand side variables are identical across all of the equations in this system, estimates from 3sls would reduce down to SUR, which in turn reduces down to the estimates that result from an equation-by-equation approach (Greene, 2011, pp. 343; Hayashi, 2000, pp. 283-286). The main assumption here is that all of the regressors are predetermined, which is the case in this instance. Thus, an equation-by-equation approach is the simplest approach that also yields efficient estimates.

Figure 3: Basic Relationships Tested in the Analysis



The modelling process began with predicted values of administrative support using logistic regression with both instrumental variables as predictors (see Appendix A, Table A1, Model 1). These predicted values were then included in second stage models. Because the dependent variables each had a different forms (i.e., count variables, percentages, dollar amounts), different second stage models that best fit each were used. Figure 4 illustrates the basics of the two-stage process for each model.

Figure 4: Illustration of Two-Stage Process of Modelling



The models predicting grant awards, grant submissions, and total grant dollars used negative binomial regressions because the distributions for these variables were count data. Likelihood ratios tests revealed negative binomial models as better fits than both Poisson, and zero-inflated negative binomial or zero inflated Poisson models. The model predicting grant success rates used ordinary least squares (OLS) regression with heteroscedasticity robust standard errors. Finally, the prediction of the largest grant used a zero inflated negative binomial model. Negative binomial models were preferred over Poisson models because all of the dependent variables were over-dispersed (i.e., conditional variance exceeded conditional means). Likelihood ratio tests also revealed that the zero-inflation model was a better fit to the data for the largest grant award. Some outliers appeared to be present in the data. Sensitivity analysis revealed that none materially affected results and so they were left unaltered in the data. Finally, post-estimation tests revealed low levels of multi-collinearity. Appendix A presents results of post-estimation and sensitivity tests.

Results

Table 2 presents the results of the analyses. Hypotheses 4 and 5 were supported, while hypotheses 1, 2, and 3 were all rejected. The reception of administrative support did not have a statistically significant effect on grant submissions (H1) but had a statistically significant negative effect ($p<.05$) on grant awards (H2) and grant success rate (H3). Those who received administrative support had a 6% lower success rate and received 21% fewer grant awards. The reception of administrative support did have a statistically significant positive effect ($p<.01$) on total grant dollars and largest grant dollars. Those who received administrative support received on average, $620 thousand dollars more in total and their largest grant was $1.07 million larger than those who did not receive support.

Table 2: Modeling Results, Administrative Support and Grant Outcomes

VARIABLES	**Submissions** M2 (NB)	**Awards** M3 (NB)	**Success Rate** M4 (OLS)	**Total $** M5 (NB)	**Largest $** M6 (ZINB)
Received Admin. Sup.	-0.03	-0.21**	-0.06**	0.62***	1.07***
	(0.08)	(0.10)	(0.03)	(0.13)	(0.14)
Administrative Stress	-0.04	-0.02	0.01	0.05	0.17***
	(0.03)	(0.04)	(0.01)	(0.05)	(0.06)
# Courses Taught	0.02	0.04	-0.02*	-0.19***	-0.19***
	(0.02)	(0.03)	(0.01)	(0.04)	(0.04)
# Committees	0.06***	0.03**	-0.01***	-0.03	-0.03
	(0.01)	(0.02)	(0.00)	(0.02)	(0.02)
5-yr Pub. Avg	0.03***	0.02***	0.00	-0.00	-0.01
	(0.01)	(0.01)	(0.00)	(0.01)	(0.001)
Assoc. Prof.	-0.14**	0.13	0.08***	0.48***	0.20
	(0.07)	(0.09)	(0.02)	(0.13)	(0.14)
Full Prof.	-0.20***	0.30***	0.14***	0.99***	0.84***
	(0.06)	(0.08)	(0.02)	(0.12)	(0.13)
University Reputation	0.00	0.06	0.01	0.06	-0.03
	(0.03)	(0.04)	(0.01)	(0.06)	(0.07)
Female	-0.14***	-0.09	0.00	-0.15*	0.00
	(0.05)	(0.06)	(0.02)	(0.09)	(0.09)
Prob. First Sub. Awrdd	-0.01***	0.01**	0.01***	0.01***	0.01***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
# Doc. Stu. Fndd Proj.	0.10***	0.13***	0.02***	0.14***	0.09***
	(0.01)	(0.01)	(0.00)	(0.02)	(0.02)
Chemistry	0.02	-0.38***	-0.08***	-0.18	-0.38**
	(0.08)	(0.11)	(0.03)	(0.15)	(0.158)
Computer Science	0.11	-0.08	-0.03	0.00	-0.43***
	(0.08)	(0.11)	(0.03)	(0.16)	(0.17)
Earth & Atmosphere	0.34***	0.39***	0.04	0.04	-0.37**
	(0.08)	(0.10)	(0.03)	(0.15)	(0.16)
Electrical Engineering	0.03	-0.17	0.00	0.09	-0.39**
	(0.09)	(0.12)	(0.03)	(0.17)	(0.18)
Physics	-0.09	-0.16	0.03	0.29**	-0.11
	(0.08)	(0.11)	(0.03)	(0.15)	(0.16)
South Asian	0.16	0.16	-0.00	0.20	0.17
	(0.11)	(0.14)	(0.04)	(0.19)	(0.21)
Other Asian	0.29***	-0.05	-0.11***	-0.59***	-0.49***
	(0.08)	(0.11)	(0.02)	(0.17)	(0.18)
African American	0.18	0.15	-0.04	0.46	0.00
	(0.22)	(0.29)	(0.06)	(0.40)	(0.44)
Hispanic	0.29**	0.27	0.06	-0.11	-0.12
	(0.15)	(0.18)	(0.05)	(0.26)	(0.27)
Native American	-0.13	0.23	-0.02	0.99*	2.89***
	(0.33)	(0.42)	(0.04)	(0.56)	(0.52)
Race Other	-0.01	0.02	-0.09	2.47***	-0.38
	(0.18)	(0.25)	(0.07)	(0.31)	(0.39)
Constant	1.56***	0.20	0.33***	-0.24	-0.18
	(0.15)	(0.20)	(0.05)	(0.28)	(0.29)
Observations	1,417	1,218	1,172	1,275	1,136
R-squared			0.19		
Zero Inflation Predictor					
Grant Awards					-0.00
					(1.71)
Constant					-25.51
					(13.42)

Notes: ***p<0.01, **p<0.05, *p<0.10; $ in millions. Biology is the base discipline and white is the base race/ethnicity. NB = Negative Binomial, OLS = Ordinary Least Squares, ZINB = Zero Inflated Negative Binomial. Number of grant awards used to predict zero values in largest grant in dollars.

DISCUSSION AND CONCLUSION

The statistical results reveal that those who get administrative support get larger grants in terms of dollar amounts but also get fewer grant awards and have a lower success rate. Despite efforts to account for and correct the endogeneity between administrative support and grant outcomes, the data and analytical issues inherent to this question do not inspire enough confidence to make causal claims about administrative support and its effect on grant outcomes based on these data. One interpretation of these results is that administrative support might be more prevalent in high-risk, high-reward grant situations. That is, faculty who apply for large opportunities that are highly competitive are more inclined to draw from specialized professional assistance than their colleagues seeking smaller levels of external funding.

The findings present an interesting and useful description of the state of administrative support and grant outcomes at American research universities. The results of the analysis describe the commonly known situation in which large research labs that get larger grants have access to administrative support to help develop proposals and manage awards. A certain portion of large grant budgets is money set aside for overhead of which administrative support is a significant part. The data also describe a potential situation in which those who have administrative support win fewer numbers of grants and have a lower success rate. Larger grants also partially explain why these particular scientists receive fewer total grants as each grant goes much further in funding projects, labs, doctoral students, and post-docs. Perhaps the most interesting part of these results is the lower success rate of those who receive large grants and have administrative support. This low success rate speaks to the competitive environment in academic grants that is

probably being exacerbated by the problems outlined at the outset of this paper: that the administrative workload on federally funded research is out of proportion with the need to ensure accountability, transparency, and safety (National Science Board, 2014), that academic researchers' time spent on research administration between 1975-2005 doubled (Barham et. al, 2014), and that the resource environment in academic science and higher education is becoming increasingly constrained (Emrey-Arras, 2014).

Other approaches might provide marginal improvement at answering the research question at hand, such as field experiments or, in the case that experiments prove too costly or infeasible, propensity score matching might better account for variables that affect the outcome variables. Other types of models might also provide alternative fits to the data in these analyses but would also bring with them other challenges. These include two-stage residual inclusion models that may better specify the count data. Or, as previously mentioned, seemingly unrelated regressions (SUR) or three stage least squares (3sls) might better fit account for the error in a parallel system of equations in which each model's regressors or instruments are unique. Finally, other instrumental variables might better account for the endogeneity problem.

A central outcome of administrative burdens as they relate to grant outcomes is the role it plays in maintaining existing power and resource structures. For many academic scientists grants are the main source of resources to support their scholarship. The problem is that if administrative burden is one of the larger hurdles for obtaining a grant, then the most resourced scientists are the most equipped to get more grants. Such a system is safer and less risky by promoting status quo but may be leaving good ideas off

of the table if scientists with innovative ideas cannot overcome administrative hurdles to getting their work funded.

CHAPTER 3

ESSAY 2: ADMINISTRATIVE INTENSITY AND JOB STRESS AMONG FACULTY AT AMERICAN RESEARCH UNIVERSITIES

Put broadly, this is a study of how strategic choices about the size of the bureaucratic component within organizations affect front-line workers. More specifically, this paper examines how administrative intensity (i.e., the ratio of the number of frontline workers to the number of back-end workers) affects the job stress of faculty members at American research universities. The relationship between administrative intensity and the job stress of frontline workers is relevant to university faculty because of recent complaints of and efforts to reduce "shadow work" – or administrative tasks that require little expertise that would have previously been performed by a non-faculty staff member paid to do them (Flaherty, 2016a). Shadow work arises in universities because faculty members at once work on the frontline as direct producers of teaching and research outputs while simultaneously working on back-end job functions by sharing administrative responsibilities with staff. This overlap in job duties make faculty stress levels particularly susceptible to changes in the number of available back-end staff to shoulder administrative workloads and shadow work.

In this paper, evidence from empirical testing suggests that faculty experience more stress as the number of faculty increases relative to the number of staff workers but is inconclusive with regard to how faculty stress is affected by the relative number of executive workers. Statistical evidence also confirms that the relationship between faculty job stress and administrative intensity is stronger for staff intensity (i.e., ratio of faculty to staff workers) than it is for executive intensity (i.e., ratio of faculty to executive

workers), confirming theory that the work of faculty is more loosely coupled with executive workers than it is with staff workers. A potential explanation is that faculty interact with staff and administrative staff on a day-to-day basis, which has a more direct effect on faculty stress than the faculty/executive interactions, which are more sporadic and generally more strategic and tactical than operational in nature.

In organizational studies, competing theories predict opposing effects in the relationship between administrative intensity and outcomes. It has been suggested that overloaded bureaucracies are inefficient, leading to fewer resources for other organizational functions and thus lower performance (Bohte, 2001). Others argue that under-addressed bureaucratic needs result in coordination problems that push frontline workers to worry more about back-end coordination issues and less about client and customer needs (Smith & Meier, 1994; Meier, Polinard, & Wrinkle, 2000). A synthesis of both theories suggests that the relationship between administrative intensity and organizational performance is an inverse U shape (Rutherford, 2015). That is, there is a sweet spot in administrative intensity where organizations have enough bureaucracy to handle coordination issues but not too much bureaucracy so as to create inefficiencies. This research adds to the administrative intensity literature in organization studies by suggesting job stress as another outcome affected by changes to administrative intensity. This research adds to the higher education literature by bringing in an organizational structure variable to the study of faculty job stress, adding to the many studies that have already examined faculty job stress from various angles such as gender, discipline, rank, tenure, time constraints, rewards and recognition, departmental and institutional

influences, race, marital status, home obligations, health concerns, and unclear obligations, among others.

In practice, predicting the job stress of frontline workers is important for at least three reasons. First, findings from this research give university leaders more information as they react to macro-trends and arguments about administrative bloat at universities. Second, in his seminal work on frontline workers, Lipsky (2010, p. 37) was concerned that frontline workers who were stressed would become demoralized and desensitized to the people they were serving, who would then have to deal with longer wait times and less individual attention. When Lipsky's (2010) concern is extended to the case of higher education, the fear is that having over-stressed faculty will have detrimental effects on students and student outcomes. Finally, evidence from other fields suggests that as job stress decreases creativity (Çekmecelioğlu & Günsel, 2011) (Coelho, Augusto, & Lages, 2011) and job satisfaction (Ruyter, Wetzels, & Feinberg, 2001). The negative effect of job stress on creativity is particularly relevant to faculty, due to the creative nature of their research work.

A long, standing debate exists regarding the size of the administrative component within university organizations. While it is true that administrative costs have risen at U.S. universities over the last 30 years (Bergmann, 1991; Greene, Kisida, & Mills, 2012; Desrochers & Kirshstein, 2014), the underlying mechanisms explaining such growth in administration is still under debate (Archibald & Feldman, 2008; see also Bowen, 1980; Baumol, 1967). A hallmark of the research on university administrative bloat places organizational bureaucracy as a dependent variable to be explained (Archibald & Feldman, 2008). Rather than viewing bureaucracy purely as a result of exogenous forces,

this research takes the viewpoint that the size and structure of internal bureaucracy is also a strategic decision made by top management teams. Viewing bureaucracy as a strategic lever shifts the focus from bureaucracy as a dependent variable to be explained and necessitates that bureaucracy within an organization also be viewed as an independent variable that affects organizational outcomes. This distinction is an important next step in the progression of research on administrative bloat at universities because it takes the research back to the fundamental question of whether and how changing the size or structure of bureaucracy affects outcomes.

LITERATURE

Job Stress

Psychologists acknowledge that work stress affects workers both positively and negatively depending on whether the stressor is perceived as a challenge (generally positive effects) or as a hindrance (generally negative effects) (Cavanaugh, Boswell, Roehling, & Boudreau, 2000; Steinert, 2011). In this paper, administrative work refers to any work that may come up as part of the traditional faculty roles of teaching, research, or service, or work that is associated with formal administrative positions that could be performed by faculty members themselves or by non-faculty support, staff, and administrative workers who are also working in the university. All parts of the faculty job description, including teaching, research, service, and formal administrative positions, are associated with administrative tasks that can be stressful. However, anecdotal evidence would suggest that each part of the faculty work experience can be perceived differently as a challenge stressor or as a hindrance stressor. For example, stress stemming from research and its associated administrative tasks might be perceived as challenge stressors

and have a positive effect that might spillover to teaching or service, or they might be hindrance stressors that inhibits quality teaching by pulling faculty attention from student needs. Similarly, stress stemming from service responsibilities and their associated administrative tasks might be viewed as hindrance stressors and have a negative effect on overall productivity, or it might challenge faculty to work more efficiently at other aspects of their job.

Determining whether shadow work that is pushed onto faculty workloads because of changes in administrative intensity acts as a hindrance stressor or a challenge stressor is not the purpose of this study. Rather, in this study it is implied that the administrative work that faculty must take on as a result of understaffed administrative positions is generally a hindrance stressor and thus a negative outcome. This implication is reasonable because evidence from front-line workers in other arenas suggests that stress stemming from internal administrative work is a stressor hindrance. For example, among police officers, a long and varied stream of research supports the contention that administrative work among police officers negatively affects police officer stress and outcomes more than other stressful job characteristics, such as dangerous situations (Kroes, Hurrell, & Margolis, 1974; Crank & Caldero, 1991; Brooks & Piquero, 1998; Zhao, He, & Lovrich, 2002; Stinchcomb, 2004; Morash, Haarr, & Kwak, 2006).

Faculty Job Stress

Gmelch and colleagues' (1986) seminal study of faculty job stress at doctoral granting institutions resulted in the delineation of five general dimensions that predict faculty stress: reward and recognition, time constraints, departmental influence, professional identity, and student interaction. This early study found that there were no

differences in job stress based on in disciplinary categories but that there were differences in tenure, rank, age, gender, and marital status (Gmelch et. al, 1986). Later studies determined other individual characteristics to be significant antecedents to job stress, including off campus stressors such as family obligations, marital frictions, or health concerns (Dey, 1993); work life integration (Eddy & Gaston-Gayles, 2008); gender – in which research found that women and men perceive job structures and content similarly but women experience higher overall stress but also cope better with demands placed upon them (Doyle & Hind, 1998); and stress due to race discrimination that has negative salience for faculty of color (Eagan Jr & Garvey, 2015).

Research has also examined job stress as a predictor of other outcomes, such as intention to leave (Ryan, Healy, & Sullivan, 2012); whether sense of community moderates the relationship between job stress and intention to leave (Barnes, Agago, & Coombs, 1998); the consideration of leaving specifically to another university (Ryan et al., 2012); burnout (Doyle & Hind, 1998); and job satisfaction (Leung, Siu, & Spector, 2000).

However, the academic research is not aligned on some findings and subsequent research found opposite effects when compared to earlier studies. For example, Gmelch and colleagues (1986) find no differences in job stress across academic disciplines while Smith and colleagues (1995) do find job stress differences across academic disciplines. Gmelch and colleagues (1984) found that teaching is more stressful than research or service while Thorsen (1996) found that teaching is the least stressful of faculty job duties. Differences in findings may be attributed to the differences in type of university being studied or the type of faculty under study. For example student interactions and

under-prepared students are the greatest source of stress for distance educators (Mclean, 2006).

Of interest to the present study is whether organizational structures and the job characteristics that result affect faculty job stress. While administrative intensity has not been specifically tested on faculty job stress, other studies examine organizational level practices and how they affect faculty job stress. For example, Leung and colleagues (2000) examined how organizational practices and job stress interact in the context of external locus of control. Other job characteristics that are predictors of faculty stress include the teaching / research conflict (Thorsen, 1996); overall role conflict (Cavanaugh et al., 2000); unclear expectations (Eddy & Gaston-Gayles, 2008); and time and resource constraints (Gmelch et al., 1984). Perhaps the closest study to the topic at hand is a conference presentation on administrative bureaucracy and red tape and their effects on faculty stress (Koester & Clark, 1980), but this study was exploratory and did not examine administrative intensity as its measure of administrative bureaucracy.

HYPOTHESES

The Effect of Administrative Intensity on Job Stress

The lack of contemporary research on formal structure and its effect on faculty outcomes necessitates a look back at research and theory on formal structure in organization studies. Prior to the 1950s, organizational research was largely focused on questions of organizational design and formal structure (Hammond, 1990, p. 144). Central to this focus was Luther Gulick's (1937) conceptual framework of organizational design within which concepts such as division of labor and span of control were delineated. Herb Simon's (1947) response to Gulick (1937) focused on administrative

behavior instead of structure, emphasizing the importance of psychology and sociology in understanding organizations. The influence of Simon's (1947) response to Gulick (1937) and Simon's subsequent work on behavior cannot be understated; since then a focus on physiological and sociological predictors of traditional organizational behavior outcomes such as job stress or job satisfaction has overshadowed work on how formal structure in bureaucracy and administration affect these types of outcomes. Despite the field wide de-emphasis on structure, 'no one has ever demonstrated, either theoretically or empirically, the irrelevance of the formal structure" (Hammond, 1990, p. 144). A balanced approach acknowledges the importance of both the formal and informal aspects of organizations. Thus, the ability to influence employee stress is a function of psychological and sociological interventions but also the organizational design choices that result in administrative structures.

Gulick's (1937) concept of 'division of labor' speaks to the organizing aspect by which labor is divided according to purpose, process, and place; division of labor is central to the main thrust of this current research. Faculty at research universities have a wide range of labor activities across teaching, research, service, and administration, all of which come with varying levels administrative responsibility. Other types of labor roles within universities, such as administrative staff, have narrower ranges of labor that consist mostly of administrative responsibilities that more indirectly affect outcomes. The wide range of faculty labor activities means that the division of labor between faculty and staff may overlap at times. One of the most common examples is for staff and faculty to in share administrative duties. Therefore, when shortages or surpluses in staffing levels occur, faculty feel the effect most directly in their administrative work loads.

Support Staff Hypothesis. Within universities, two job roles within the bureaucracy potentially affect faculty stress from administrative responsibilities: executive management and support staff. Administrative assistants and support staff workers have day-to-day interactions with faculty as they coordinate meetings, programs, and do non-strategic administrative work at the school or department level. Because faculty share administrative responsibilities with support staff and administrative assistants, faculty are directly affected by changes in staff intensity (i.e., ratio of faculty to support and administrative staff) in the level of administrative work they must assume. The expectation is that as the ratio of faculty to support staff increases, faculty become increasingly stressed as they take on administrative duties. Previous findings connecting faculty stress to organizational constructs such as role conflict (Cavanaugh et al., 2000); unclear expectations (Eddy & Gaston-Gayles, 2008); and time and resource constraints (Gmelch et al., 1984) reinforce this hypothesis, which is formalized as follows:

H1: Larger faculty to support staff ratios are associated with more faculty stress from administrative responsibilities.

Executive Employee Hypothesis. Unlike their relationship with support staff, faculty interact with executive level employees at a university on a more sporadic basis. The role of the executive administrators in a system like a research university is to solidify ties with faculty with a combination of practices, such as symbol management, selective centralization, consistent articulation of a common vision, interpretation of diverse actions in terms of common themes, and a common language (Weick, 1982, p.

676). In other words, the major part of the connection between the typical faculty member and executive and mid-level management is strategic and symbolic in nature. Despite the differences in the faculty-support staff relationship from the faculty-executive relationship, the theoretical mechanism connecting executive intensity and faculty stress is similar. As there are relatively fewer executives and managers, faculty take on more work and are more stressed. Similar to clerical staff, the expectation is that as the relative number of faculty to increase relative to executive staff, faculty stress from administrative responsibilities will increase.

H2: Larger faculty to executive worker ratios are associated with more faculty stress from administrative responsibilities.

Comparison Hypothesis. Understanding the relative impact that both support staff and executive workers have on faculty job stress is also important in practice as university leaders make human resource choices. The major difference between support staff and executive workers as it pertains to their effect on faculty job stress is the relative closeness with which each interacts with faculty. The idea of loose coupling, first ported to social science in the early 1970's (Glassman, 1973), relates to the degree of different groups' independence and closeness within a system. In his seminal study Weick (1976) observed that educational organizations are loosely coupled. To Weick (1976) loose coupling between groups in an organization occurs when groups "are somehow attached, but that each retains some identity and separateness and that their attachment may be circumscribed, infrequent, weak in its mutual affects, unimportant, and/or slow to

respond" (p. 3). Weick's description describes the relationship between faculty, support staff, and executive workers because each group retains a unique identity but is interdependent in a university. Each group is separate and their attachments to each other are certainly circumscribed. Because faculty - executive staff interactions are more sporadic and strategic in nature than the day-to-day operational interactions between faculty and support staff, faculty are more loosely coupled with executive workers than they are with support staff. The tighter coupling between support staff and faculty also suggests that changes in staff intensity would more directly affect faculty job stress than executive intensity. Though executive intensity might still be impactful on faculty job stress, the expectation is that its effect is more indirect and, therefore, weaker. Hypothesis three formalizes this connection.

H3: Staff intensity will have a larger effect on faculty job stress than executive intensity.

DATA AND ANALYSIS

Data for this research comes from two sources that were merged together. Data from the Integrated Postsecondary Education Data System (IPEDS) provides measures for workforce counts, which were used to calculate administrative intensities, and full-time enrollments. Survey data providing information about faculty job stress comes from the Netwise I survey that was deployed in the 2006-07 school year. The survey asked about collaboration and advice networks, research activities, including grant submissions and success rates, teaching and service responsibilities, attitudes and involvement in

interdisciplinary research, work environment, job satisfaction, job stress, and detailed demographic and academic background questions.

The survey was implemented and completed online using Sawtooth Software®. The survey population was invited via traditional mail and a series of personalized follow-up emails. Each invitation provided individually assigned user-ids and passwords and direction to the online survey. Overall, the survey took between 30-45 minutes to complete. The population was constructed by manual retrieval of information from department and university directories from 151 universities in the U.S. that were designated as "Research Extensive" universities under the 2005 Carnegie Classification system. The disciplines (biological sciences, chemistry, computer science, earth and atmospheric sciences, electrical engineering, and physics) were selected based on the level of female representation (low, transitioning, and high fields).

From the population of universities, 3667 faculty were selected and 1774 completed surveys. Of the completed surveys, 176 were removed because of ineligible rank or discipline. Also, 21 partially completed surveys were deemed to have sufficient information to be included (over 95 % of questions answered). These changes led to a final analysis sample size of 1598 surveys, and thus the overall survey response rate using the RR2 method of the American Association for Public Opinion Research (AAPOR) was 45.8% and the weighted response rate was 43.0%. The final analysis subset for this research, after observations with missing values were deleted, consists of 1127 academic scientists (for more information on survey administration, see Jha & Welch, 2010). The IPEDS data, along with data the survey was then linked together for

the analysis. Table 3 presents the summary statistics for all of the variables in the analysis.

Table 3: Summary Statistics, Administrative Intensity and Job Stress

Variable	Mean	St. Dev.	Min	Max
Stress from admin. responsibilities**	1.82	0.86	0	3
Stress from relationships with colleagues	1.33	0.86	0	3
Stress from publishing demands	1.87	0.83	0	3
Stress from teaching responsibilities	1.86	0.78	0	3
Stress from work / family balance	1.89	0.87	0	3
Stress from obtaining external funding	2.42	0.87	0	3
Faculty / staff ratio 2005-06	2.62	1.44	0.42	7.96
Faculty / executive ratio 2005-06	1.02	0.59	0.3	4
Dean	0.04	0.19	0	1
Department Chair	0.01	0.09	0	1
Research Center Director	0.06	0.23	0	1
# Department Committees	3.48	1.35	1	6
# University Committees	2.18	1.3	1	6
Assistant Professor	0.27	0.44	0	1
Associate Professor	0.28	0.45	0	1
Total Full Time Equiv. Enroll. Fall 2006	23,742	11,211	2,116	51,668
Total University Employees 2005-06	9,909	5,359	440	22,641
Executive Turnover 2004-05	0.22	0.41	0	1
Executive Turnover 2005-06	0.14	0.35	0	1
Satisfied with University Reputation	2.69	0.76	1	4
Married	1.27	0.66	1	4
Caucasian	0.78	0.41	0	1
Asian	0.05	0.23	0	1
Non-Asian Minority	0.14	0.35	0	1
Private Non-profit Control (vs. public)	0.23	0.42	0	1

Notes: ** Stress from administrative responsibilities is the dependent variable in the analysis. The other stress variables are included for contextual comparison.

Measures

Dependent variable: stress from administrative responsibilities. To measure various aspects of work stress, respondents were asked the following question in the survey: “To what extent are the following factors currently a source of stress in your

work?" Among the factors to assess were 'administrative responsibilities,' 'relationships with colleagues,' 'publishing demands,' teaching responsibilities,' 'time allocation between work and family,' and 'demands for obtaining external research funding,' to which respondents could respond with 'Substantial.' 'Moderate,' 'Minimum,' and 'None.' Taken all together, these measures have a Chronbach's Alpha of .61 indicating moderate scale reliability of overall work stress. Exploratory factor analysis of the entire battery further confirms the weakness of overall job stress as a function of the entire battery (See Appendix B).

Nevertheless, the use of a single-item measurement does not preclude further analysis, and single-item measures have their merits. Single-item measures may be easier and take less time to complete, may be less expensive, may be more flexible than multiple-item scales, and, most importantly, may contain more face validity (Nagy, 2002). Though single-item measures preclude the analyses of reliability, they are very common in fields like public administration (Cantarelli, Belardinelli, & Belle, 2016). For the current research, only the measure for job stress from administrative responsibilities was included as a dependent variable. Admittedly, this is a weakness in the study, though the outcomes of the analysis that correlate it with a variable from a separate administrative dataset and various administrative job functions strengthen the argument for its use.

Focal variables. In this analysis, executive workers are defined as the sum of 'executive and managerial employees' and 'other professional employees' that each university reported to IPEDS. Support staff are defined as the number of 'clerical and secretarial employees' within the university as reported to IPEDS. To measure

administrative intensity, the number of full and part-time instructional workers was divided by both types of administrative workers to come up with two relative ratios of administrative intensity: 1) staff intensity, and 2) executive intensity. Because the outcome variable in this analysis is a faculty survey response, a relative ratio directly relating the number of faculty to the two different types of administrators is appropriate.

The analysis uses a one year lag for both administrative intensity measures. There were various reasons for this, both practical and theoretical. While administrative intensity does change year over year, changes across years is generally not very large. Furthermore, as administrators are hired, a certain lag period is required for them to learn their job and where to best fill in on the administrative duties. Thus, analyzing the one year lag of administrative intensity will enable these processes to sort themselves out. Practically, count data on IPEDS is only available for each school on odd years.

Control variables. Other factors influence administrative stress experienced by faculty. Most significantly, administrative appointments such as dean, department chair, and center director as well as committee participation at the department or university level will carry with them administrative responsibilities. Expectations for the relationship between these administrative appointments and faculty stress from administrative responsibilities are fairly straightforward. Similar to administrative appointments, rank along the tenure track will influence administrative stress. Due to the common practice of shielding newer professors less far along on the tenure track from administrative and service duties, I expect that relative to full professors, assistant and associate professors will experience less stress from administrative responsibilities.

To measure administrative appointments, dummy variables indicate whether a faculty was a dean, department chair, or center director. Counts measured the number of university and department committees on which faculty serve. Academic rank was measured with dummy variable indicating whether the faculty was an assistant professor or associate professor with full professor being the base case. Table 4 summarizes the measurement and source of the dependent and focal independent variables in the analysis.

Table 4: Survey Questions of Focal Variables, Administrative Intensity and Job Stress

Variable *and Survey Question*	**Survey Response or IPEDS**	**Measurement**
Dependent Variable		
Stress from administrative responsibilities – *To what extent are the following factors currently a source of stress in your work?*	Administrative Responsibilities	3 - Substantial 2 – Moderate 1 - Minimum 0 - None
Main Independent Variables		
Faculty / support staff ratio	IPEDS	# Instructional Employees / # Clerical and Secretarial Employees
Faculty / executive ratio	IPEDS	# Instructional Employees / (# Executive and Managerial + # Other Professional Employees)
Selected Control Variables		
Administrative Appointments *Please tell us whether you currently hold any of these positions:*	Dean Department Chair Center Director	1 – Yes 0 - No
Faculty Rank *Are you currently:*	Assistant Professor Associate Professor Full Professor	1 – Yes 0 - No

Much literature on organizational structure in the 1970s advanced the idea that organization size was as key determinant of administrative intensity (Freeman & Kronenfeld, 1973; Millan & Daft, 1979; MacMillan & Daft, 1984; Dogramaci, 1977; Kimberly, 1976; Blau, 1970; Blau, 1972). Therefore, full-time equivalent enrollment of undergraduates and graduate students for the year 2006-2007 school year as well as the total size of the workforce were included in the analysis to account for organization size. Presumably, other variables would influence faculty administrative stress. Finally, control variables for gender, race/ethnicity, academic field and sector of university ownership (whether public or private non-profit) were also included in the analysis.

Analysis

The model building began with an analysis and understanding of the dependent variable. As a response to a Likert Scale question, the administrative stress variable is an ordered set of options that turn out to be normally distributed (see Appendix B), making it appropriate for use according to statistical theory and regression analysis. The ordered nature of the variable suggest an ordered logit model, though ordinary least squares and a multi-level model to account for variation in at both university and individual levels were also run as robustness checks (see Appendix B). The first model was run with only control variables, then each of the two focal variable were added incrementally and tested on their own until the final model, which included all focal and control variables. A two-tailed post-estimation test of the final model examined the difference between the staff intensity and executive intensity coefficients.

Results

Tables 5 presents the results of the analysis. Using model 4, hypotheses H1 and H3 were confirmed and H2 was rejected. Staff intensity had a substantively small, but statistically significant ($p < .05$) effect on faculty stress from administrative responsibilities. Both the size and statistical significance of this effect held as the other focal variable for executive intensity was added to the analysis. The two-tailed post-estimation test of the focal coefficients revealed that the coefficient for staff intensity was statistically different from the executive intensity coefficient ($p<.05$). Because the staff intensity coefficient is larger than the executive intensity coefficient it is clear that the effect of clerical intensity is both statistically different and larger than the executive intensity coefficient. Of particular note, all of the variables measuring administrative appointments had strong substantive and statistical significance ($p < .01$), as well the variable for assistant professors ($p < .01$), who had reduced administrative stress in relation to full professors.

Table 5: Ordered Logit Models Predicting Stress from Admin. Responsibilities

VARIABLES	M1 O-Logit	M2 O-Logit	M3 O-Logit	M4 O-Logit
Clerical Intensity		0.09***		0.09**
		(0.04)		(0.04)
Executive Intensity			0.01	0.01
			(0.01)	(0.01)
Department Chair	2.80***	2.82***	2.81***	2.82***
	(0.35)	(0.35)	(0.35)	(0.35)
Dean	2.30***	2.34***	2.31***	2.35***
	(0.67)	(0.67)	(0.67)	(0.67)
Center Director	0.79***	0.79***	0.78***	0.79***
	(0.22)	(0.22)	(0.22)	(0.22)
Assistant Prof.	-0.64***	-0.64***	-0.64***	-0.64***
	(0.12)	(0.12)	(0.12)	(0.12)
Associate Prof.	-0.01	-0.00	-0.01	-0.00
	(0.12)	(0.12)	(0.12)	(0.12)
Log Undergrad FTE	-0.11	-0.17*	-0.13	-0.18**
	(0.09)	(0.09)	(0.09)	(0.09)
Log Graduate FTE	0.09	0.01	0.08	-0.00
	(0.12)	(0.13)	(0.12)	(0.13)
Log Total Workers	-0.04	0.10	-0.02	0.11
	(0.14)	(0.15)	(0.14)	(0.15)
Female	0.12	0.12	0.13	0.13
	(0.10)	(0.10)	(0.10)	(0.10)
South Asian	-0.38*	-0.37*	-0.38*	-0.37*
	(0.22)	(0.22)	(0.22)	(0.22)
Other Asian	-0.16	-0.17	-0.17	-0.18
	(0.17)	(0.17)	(0.17)	(0.17)
Black	0.84*	0.85*	0.84*	0.85*
	(0.46)	(0.46)	(0.46)	(0.46)
Hispanic	0.57*	0.58*	0.57*	0.58*
	(0.30)	(0.30)	(0.30)	(0.30)
Native American	-1.18	-1.20	-1.19	-1.20
	(0.75)	(0.74)	(0.75)	(0.74)
Other Race	-0.16	-0.12	-0.16	-0.12
	(0.38)	(0.38)	(0.38)	(0.38)
Private Control (vs. Public)	0.26**	0.24*	0.28**	0.25*
	(0.13)	(0.13)	(0.13)	(0.13)
Chemistry	0.16	0.15	0.17	0.16
	(0.16)	(0.16)	(0.16)	(0.16)
Computer Science	-0.27*	-0.30*	-0.27*	-0.30*
	(0.17)	(0.17)	(0.17)	(0.17)
Earth & Atmosphere	0.06	0.05	0.06	0.05
	(0.16)	(0.16)	(0.16)	(0.16)
Electrical Engineering	-0.36**	-0.39**	-0.35**	-0.38**
	(0.18)	(0.18)	(0.18)	(0.18)
Physics	0.10	0.09	0.09	0.08
	(0.16)	(0.16)	(0.16)	(0.16)
Ordered Logit Cuts				
Cut1	-3.54***	-3.32***	-3.497***	-3.29***
	(0.80)	(0.81)	(0.81)	(0.81)
Cut2	-1.37*	-1.14	-1.32*	-1.12
	(0.80)	(0.80)	(0.80)	(0.80)
Cut3	0.62	0.85	0.67	0.88
	(0.80)	(0.80)	(0.80)	(0.80)
Observations	1,558	1,558	1,558	1,558

*** p<0.01, ** p<0.05, * p<0.1. Biology is the base field. Caucasian is the base race/ethnicity. Base rank is full professor.

Post-estimation test of Model 4 reveal the difference between the coefficients for clerical and executive intensity are statistically different at the $p<0.05$ level (Chi Squared = 5.14, $p=0.02$).

CONCLUSION AND FURTHER RESEARCH

This research tests how formal structure affects job stress of faculty at research universities in the United States. In this sense, it is a marriage of the old focus on organizational structure and a newer focus on behavioral factors in the work environment. It has been argued that too much bureaucracy is inefficient and that too little bureaucracy results in poor coordination (Rutherford, 2015). This paper demonstrates that administrative intensity is associated with frontline worker stress from administrative responsibilities, making the consideration of administrative intensity more complex than just a coordination and efficiency problem. In other words, to the extent that frontline workers have behavioral or psychological responses in the form of stress to changes in administrative intensity, the relationship between bureaucratic size and organizational outcomes becomes more nuanced.

While administrative staff levels had a statistically significant effect on faculty stress from administrative responsibilities, executive intensity had no statistically significant effect on faculty stress. As noted earlier, the relationship between the average faculty member and executives is largely symbolic and strategic, making their relationship more 'loosely coupled' (Weick, 1976; Weick, 1982) than the day-to-day relationship of faculty and support staff. This theoretical distance may explain the difference in results between the two types of administrative workers.

As noted, a major limitation of the study is the dependent variables based on a single perceptual measure. However, the results of the analysis speak to the validity of

the measure. All of the administrative positions (department chair, dean, and center director) had strong correlations with this measure of administrative stress, which is a highly intuitive result. Furthermore, assistant professors had much less administrative stress than full professors, which aligns with the common practice of shielding assistant professors from large administrative loads. Nevertheless, a stress measure coming from multiple survey questions would probably have less measurement error and more reliability. This study benefits from the fact that some of the predictors in the analysis came from sources other than the faculty survey, an approach that reduces common method and common source bias (Favero & Bullock, 2015). It should also be noted that the faculty in these data represent STEM disciplines from hard science, whose research is typically more contingent on support staff than social science and humanities researchers or researchers in professional schools. Therefore, the relationships between faculty in hard science may be more closely coupled with support staff than the relationships between non-hard science faculty and support staff and thus similar findings may not occur in these different populations of faculty. Prior research supports this contention, as faculty from hard and applied sciences have been found to desire more instrumental support while faculty in soft fields prefer social support (Neumann & Finaly-Neumann, 1990).

Predicting an organizational behavior outcome like faculty stress is important because stress may have various effects on other outcomes. Stress from administrative burdens may have a number of effects on faculty productivity. In one scenario, increased administrative stress will cut into research, teaching, or service productivity, but overall work levels will remain. In another scenario, increased administrative stress will not cut

into research, teaching, or service productivity but work-life balance will suffer. In a final scenario, increased administrative stress will cut into research, teaching, or service productivity and work-life balance. In each of these scenarios, student outcomes could also be affected as could job outcomes like turnover intentions. Further research could test which of these scenarios is most likely to occur under certain circumstances.

This research demonstrates that the relationship between administrative intensity and organizational outcomes is a function of coordination, efficiency, and the psychological response among frontline workers to changes in administrative intensity. Further research could test other factors that influence or moderate the relationship between administrative intensity and outcomes. For example, the effect of administrative intensity on organizational efficiency is further complicated by the concept of organizational slack, which suggests that organizations never operate at optimum efficiency but maintain certain amounts of resource cushions to better deal with changes in the environment (Cyert & March, 1963). Slack allows leaders to experiment with new postures towards the environment, either in product or management innovation. Because they can dip into existing latent resources, experimentation becomes a luxury enabled by slack. Therefore, referring back the relationship between administrative intensity and schoolwide faculty behavior and outcomes, even when enough resources have been allocated to control the coordination problem, creating slack does not immediately lead to lower performance. As more administrative staff are added to the organization with less and less coordinating to do, many scenarios play out as a result. Administrators working in a sinecure could enjoy their easy job, the organization would be highly inefficient, and there would be fewer resources to higher more frontline workers. Administrators working

in a sinecure could also come up with work to do through new programs or initiatives, which at face value might reduce the efficiency problem but could also lead to strategic drift in which resources and time are then funneled to non-core functions that indirectly affect outcomes both positively and negatively. Finally, administrators could use the slack for positive innovation leading to improvements in productivity or efficiency. Thus, excess administrative staff can either be considered an inefficiency, which has negative effects on the organization, or slack, which has positive and negative effects on organizational outcomes.

The findings from the research have implications for human resource decisions at universities and other types of organizations. Results from this study suggest that reducing the relative number of support staff increases faculty stress, which may have a detrimental effect on faculty productivity and ultimately student outcomes. This research is at the university level, and so the findings must be understood in context of the theory that explains the findings. The theory is that the close coupling between frontline workers (i.e., faculty) and backend workers (i.e. support staff) is what drives frontline worker stress with changes to staff intensity. If support staff or backend workers are not closely coupled with frontline workers, then changes in the number of support staff or backend workers will theoretically have little effect on frontline worker stress but may affect them through coordination or efficiency problems. Further research with more detailed data about the relative closeness between faculty or frontline workers and different types of staff and backend workers could determine the interaction effects that close coupling and administrative intensity have on workers.

CHAPTER 4

ESSAY 3: THE EFFECTS OF ROLE CLARITY AND INSTITUTIONAL SUPPORT ON TWO MEASURES OF FACULTY JOB SATISFACTION

This paper examines faculty job satisfaction at universities as it relates to a few aspects of the faculty – administration interactive frame. In particular, it tests whether role clarity for faculty and administrators and institutional support for faculty leaders affect faculty job satisfaction. The traditional faculty position in higher education maintains a relatively wide range of job duties, from the front facing aspects of teaching and mentoring, to knowledge creation as part of the research enterprise, and internal management and organizational maintenance as part of administrative and service work. This clear separation of duties is reflected in research studies that examine each of teaching and research. This research is no different except that unlike much of the academic research on faculty work (Link, Swann, & Bozeman, 2008; Fairweather, 2005; Hagedorn, 2000), this research instead focuses on the aspects of faculty work that are part of service assignments or informal administrative appointments.

This paper adds to academic literature in at least two ways: 1) despite the massive history of literature on job satisfaction much of that literature focuses on business settings while specific knowledge of faculty job satisfaction in university settings historically has been more limited (E. A. Locke, Fitzpatrick, & White, 1983) – this research adds to the subset of faculty job satisfaction literature that has only taken hold in more recent decades, and 2) among the faculty job satisfaction literature common predictors include demographics, disciplinary differences, workplace issues, institutional differences and the tension between teaching and research (Bozeman & Gaughan, 2011) as these two usually

take up the most faculty work time and create the most conflict within and between faculty members (Hattie & Marsh, 1996). With its focus on administrative interactions of faculty, this research rounds out the balance of faculty job satisfaction literature.

Understanding the links between role clarity and support to faculty job satisfaction is important in practice for at least three reasons. First, as universities react to macro trends such as unbundling of faculty roles, unbundling of services, neoliberalism, liberal arts decline, or administrative bloat the relative size of university administrations decline or grow along with the administrative support they can provide to faculty. As a result faculty must shoulder or drop administrative duties to deal with these changes; role clarity about and support for their service and administrative duties will help maintain faculty job satisfaction during the growing pains that accompany these types of transitions. Furthermore, to the extent that bureaucratic drift (McCubbins, Noll, & Weingast, 1987) affects university rules as bureaucracies alter the original intent of rules to their own benefit, role clarity between faculty and administrators becomes even more important for improving or maintaining faculty job satisfaction.

Second, as university leaders better understand the determinants of faculty job satisfaction, university administrators can recruit and retain better talent (Johnsrud & Heck, 1994; Seifert & Umbach, 2008; (Smart, 1990; Weiler, 1985; Rosser, 2004), better compete with private industry for talent (Zumeta & Raveling, 2001), as well as create strategies to improve performance given that the link between job satisfaction and performance has some merit (Petty, McGee, & Cavender, 1984; Judge, Thoresen, Bono, & Patton, 2001). And finally, as public policy makers better understand faculty job

satisfaction, they can formulate policies to improve the pipeline of workers to educational and knowledge creation organizations (Boyer, 1997; Bozeman & Gaughan 2011).

LITERATURE

Job Satisfaction

General overview. The academic literature on job satisfaction is historic and crosses many disciplines. For example, in the 1950's Herzberg and colleagues (1957) reviewed around two thousand papers on job satisfaction that had been produced by that time. Simple extrapolation with most types of growth curves would put the number of papers on job satisfaction now, almost seventy years later, into the tens of thousands, an estimate supported by citation counts of seminal job satisfaction research (see Herzberg, 1966;. Porter, Steers, Mowday, & Boulian, 1974). Given the scope of this research and the multitude of findings on job satisfaction a comprehensive overview of the job satisfaction is not feasible though a few general theories have gained prominence. For example, the idea that job satisfaction results from a person interacting with his or her work environment has been around for 80 years. As far back as 1939, Roethlisberger and Diekson (1939/2003) suggested that workers' attitudes towards objects in the work environment can be analogous to "the relation between an organism and its physical environment . . ." (261-262).

Herzberg's comprehensive review led to what is perhaps the most influential theory on job satisfaction, the two-factor theory, which argues that job satisfaction lies along two planes (Herzberg, 1966). On one plane, 'hygiene' factors are posited to cause one to not be dissatisfied with their job, while on another plane the 'motivating' factors are posited to cause one to be satisfied with their job. Hygiene factors include

organizational policies, administration, relationships with supervisors, peers, and subordinates, work conditions, salary, status, and security. Motivators include achievement, recognition, responsibility, advancement, and growth. Herzberg's theory has some intuitive appeal but is also quit controversial and does not always maintain predictive power (Smerek & Peterson, 2007). Disentangling the two planes of satisfaction and dissatisfaction comes with many methodological issues and difficulties. Furthermore, many of the hygiene and motivating factors have been found to cause both dissatisfaction and satisfaction, though some in the field of positive psychology have found new support for the two-factor theory since other psychological constructs, such as happiness, have been found to fall along two planes as well (Sachau, 2007).

Another theory, Locke's (1969) Theory V or Values Theory, posits that if values – one's conceptions of what is good, desirable or beneficial – are what guide actions and emotions, then values should also guide job satisfaction. Thus, if one's values are satisfied in the workplace, then that person will be satisfied with his or her job. Such theory aligns closely with the basics of expectancy theory (Mowday, 1982; Wigfield & Eccles, 2000), a common theory of motivation in organizational behavior, which argues that individuals make choices based on their estimates of how well the expected results from their behavior will match up with their desired results (Vroom, 1964). Like the expectancy theory of motivation, values theory of job satisfaction is a flexible theory in that it relies on the varying values of employees, not the mechanism of one specific value, as its predictive power. General themes among values may also arise across groups of employees or organizations due to bounded rationality (Simon, 1947) and isomorphism (DiMaggio & Powell, 1983).

In general, however, people want work that corresponds to their interests, that they feel is important, that requires their valued expertise, that has varied assignments, that allows them autonomy, responsibility, and a sense of achievement and recognition. Also, employees want clarity both for their work tasks but also in the requirements put on them by different people, supervisors, and co-workers. Finally, employees want the tools and support necessary to get their job done (Gruneberg, 1979).

Antecedents to faculty job satisfaction. During the same time frame that Herzberg and colleagues (1957) were reviewing the extant work on job satisfaction, Caplow and McGee (1958) observed that academics had applied the methods of social research to every important institution except their own. Though more recent than the general work on job satisfaction, multiple studies report findings specific to faculty. Antecedents of faculty job satisfaction are often split among individual, work related, and institutional factors (Blackburn & Lawrence, 1995; Bozeman & Gaughan, 2011; Hagedorn, 2000) though specific factors certainly could be classified across multiple parts of this rough typology. In general, individual factors among university faculty that have been found to correlate with job satisfaction include gender (Seifert & Umbach, 2008; Bilimoria et al., 2006; Sabharwal & Corley, 2009; Callister, 2006; Olsen, Maple, & Stage, 1995), race (Laden & Hagedorn, 2000; Olsen, Maple, & Stage, 1995), and stress levels (Leung et al., 2000).

Work related factors affecting faculty job satisfaction include academic discipline (Seifert & Umbach, 2008; Sabharwal & Corley, 2009), relationships with students (Hill, 1986; McKeachie, 1982 Willie & Stecklein, 1982), autonomy (McKeachie, 1982; Willie & Stecklein, 1982), social network determinants (Welch & Jha, 2015), and pay

(Hagedorn, 1996). Also, a common theme for decades has been role conflict, especially between teaching and research as many university faculty believe that teaching effectiveness is not adequately rewarded (Bess, 1977; Hattie & Marsh, 1996; Fairweather, 2005) or they disregard administrative decision making duties instead preferring to focus on teaching or research (Dykes, 1968). Finally, institutional factors include department climate (Callister, 2006), resources (Willie & Stecklein, 1982), and university administration (Lock et al 1983).

Faculty job satisfaction as an outcome and measure. Because of the historical depth of the job satisfaction literature, the measurement of job satisfaction has likewise evolved. One most well-known and used measures of job satisfaction is the Job Description Index or JDI (Smith & And Others, 1969; Kinicki, McKee-Ryan, Schriesheim, & Carson, 2002), which is an index of various items and sub-dimensions of job satisfaction. While widespread use of indexed versions of job satisfaction remain widely in use, in recent decades research has tested the use of single-item measures of global job satisfaction and found that they correlate highly with indexed versions (Scarpello & Campbell, 1983**;** Wanous, Reichers, & Hudy, 1997).

In this study, job satisfaction is measured both globally and with an index of sub-dimensions of faculty time allocation. Measuring the global job satisfaction of faculty aligns with more contemporary measures of job satisfaction and provides a snapshot into the overall satisfaction that faculty have with their job. Satisfaction with time allocations is also a unique and relevant measure for university faculty because of the wide range of faculty job roles and the autonomy that faculty enjoy. As mentioned, faculty members must spend time teaching, researching, doing service work, any administrative tasks

associated with those roles, and formal administrative duties to varying degrees depending on their contract, the type of university at which they work, internal and external norms in their department, and formal appointments and assignments. In addition, personal attitudes and aptitudes allow faculty members to make marginal adjustments in time allocation to one or another of the general areas. This tension – the combination of the wide range of faculty duties and the various forces at play that pull faculty between these duties – make examining an index of faculty job satisfaction with time allocations very relevant for study.

This paper focuses on the faculty-administration interactions, and how those affect faculty job satisfaction. Specifically, its focuses on 1) role clarity of faculty and administrators, and 2) institutional support for faculty leaders. Theoretically, role clarity and institutional support can affect global job satisfaction and also satisfaction with time allocations. The hypotheses that follow delve deeper into these connections.

HYPOTHESES

In relation to administrative work, research has examined antecedents to job satisfaction among full-time university administrators, such as the impact of state regulations (Volkwein, Malik, & Napierski-Prancl, 1998) and work climate (Volkwein & Zhou, 2003). Others studies examine the differences in job satisfaction among administrators in public versus private universities (Volkwein & Parmley, 2000), or even the facets of job satisfaction among administrators (Glick, 1992) but these studies all focus on full-time administrators, not faculty.

Many faculty members enter academia with more clear ideas about the job requirements of teaching and research and less clear ideas about the job requirements for

formal administrative appointments and service work. Even when working in the job, many disregard the decision making and responsibilities of administration choosing rather to focus on teaching or research (Dykes, 1968). For many, the idea of being an administrator, decision maker, or manager might create stress and insecurity, which is common among many professionals who enter their profession for the technical or specialized work and not necessarily management (Hill, 2003). Likewise in academia, research and teaching both come with training and preparation, while service and administrative work is often learned on the fly. For these reasons, role clarity and support are vitally important for faculty members who take on administrative and leadership roles and as well as those in the department who do not currently work in such roles but may in the future.

Role Clarity and Global Job Satisfaction

Locke and colleagues (1983) (role clarity) and Olsen and colleagues (1995) (support) are among the few papers that examine administrative role clarity and administrative support as they relate to faculty job satisfaction. Unlike many quantitative studies, Locke et al (1983) is inductive and exploratory; their hope being that it would stimulate further more elaborate studies (p. 343). A central finding of their work is that job clarity was one of the strongest predictors of faculty job satisfaction. Furthermore, Locke and colleagues (1983) suggest that "job values that are more important to the individual have more influence on job attitudes than job values that are less important" (p. 344). In other words, the most important values to an employee will influence their job satisfaction the most (see Lawrence, Ott, & Bell, 2012). With this idea in mind and referring to Locke and colleagues' (1983) central finding, it would not be unreasonable to

suggest that role clarity is a strong value among faculty members given that their roles can often be wide and varied. Role clarity enables faculty to understand how to be successful in their job. Role clarity is a value espoused in other fields (Lyons, 1971).

Given that role clarity stems from the rules and procedures that govern that specific role, any dysfunction in those rules will result in unfocused clarity. Research has shown that rule dysfunction creates manager alienation leading to lower job satisfaction (DeHart-Davis & Pandey, 2009). Similarly, red tape has been shown to correlate with lower job satisfaction (Giauque, Ritz, Varone, & Anderfuhren-Biget, 2012). Previous research finds that role clarity has a positive effect on job satisfaction (Locke, et al, 1983; Daley, 1986; Ting, 1996; Wright & Davis, 2003). Wright and Davis (2003) explain that as workers understand more clearly the expectations placed upon them, the tensions of role ambiguity decrease while the likelihood of completing their responsibilities increases resulting in a higher degree of job satisfaction. With this in mind, this research hypothesizes that:

H1a: Faculty who agree that their institution has clear rules about the roles and authority of faculty and administration report higher global job satisfaction.

Role Clarity and Job Satisfaction with Time Allocations

In the case of tenure-track university faculty, the clarity and relative importance of job duties are outlined both by professional norms and university rules and policies. In academia, professional norms have led to a general acceptance that faculty duties are spread across the three functions of research, teaching, and service, as well as formal

administrative positions (Boyer, 1997). The relative importance of research, teaching, service, and administration is determined both by type of university and by individual appointments. For example, research and teaching are largely determined by whether the university focuses more on research or teaching (i.e., Carnegie Classification). Service and administrative duties are largely determined by the faculty member's administrative appointments, that person's predisposition to volunteer for service work, and the needs of the department. Place along the tenure-track also affects administrative work with those who have passed tenure being more likely to shoulder administrative loads.

For faculty members, the clarity and relative importance of their service and administrative work compared to their other academic work will be greatly affected by university rules and policies, or lack thereof, governing that work. Lack of role clarity with regard to faculty and administrative roles will affect faculty satisfaction with time allocations regardless of university type because even though there may be different norms for administrative roles across different university Carnegie classifications, unclear explicit rules leave open the possibility of implied rules which may be misinterpreted and lead to confusion, miscommunication, and dissatisfaction. In other words, the nature of this relationship is similar across all types of universities, precluding the need to separate across university type. Therefore, this paper also hypothesizes that:

H1b: Faculty who agree that their institution has clear rules about the roles and authority of faculty and administration report higher satisfaction with time allocations.

Institutional Support and Global Job Satisfaction

Like role clarity, institutional help or support is another aspect of work that enables workers in many fields to be more successful at their jobs (Baruch-Feldman, Brondolo, Ben-Dayan, & Schwartz, 2002; Ulleberg & Rundmo, 1997). The idea of support can be a somewhat vague as it has multiple connotations. The ten or so various definitions of 'support' according to Merriam-Webster include the following: "to promote the interests or cause of," "to uphold or defend as valid or right," "to hold up or serve as a foundation or prop for," and finally to "assist, help" (Merriam-Webster, n.d.). Based on these definitions, it is clear that support could be describing both an attitude, which in organizations may result in concrete rules or policies that aid the employees, or also a concrete service that results in actual work to promote the work of the employee. Given the fiduciary duties inherent to being an employee, receiving support (using any of the previous definitions) from decision makers higher up in the organizations would be highly valued. Functionally, the idea or concept of 'institutional help' for faculty leaders could manifest or be interpreted in at least two ways: 1) in the manifestation of attitudes that exude support, and 2) in the work of support workers. While supportive attitudes and realized support workers are ontologically different concepts, both have the same effect as theoretical mechanisms in explaining how the general idea of institutional support affects faculty job satisfaction.

Evidence from other settings buttresses the idea that attitudinal support by an institution influences faculty job satisfaction. After splitting up administrative support among, informational, instrumental, emotional, and appraisal support, Littrell and

colleagues (1994) found that K-12 teachers who received informational and emotional support were more satisfied in their work. Among choral teachers, community and parent support, and administrative support predict greater job satisfaction (Baker, 2007). Research in other non-educational settings, such as among retail workers, where support is a strong predictor of job satisfaction (Babin & Boles, 1996) and among prison staff where support is a strong predictor of burnout (Garland, 2004), buttress the general finding that attitudinal support improves both job satisfaction and antecedents to job satisfaction. Although faculty tend to have more trust in the academic culture than in the administrative hierarchy (Volkwein & Malik, 1997), enjoy a high degree of autonomy, power, and self-governance (Hattie & Marsh, 1996; AAUP, 1994), there is not a strong theoretical argument to suggest that these attributes that set apart the faculty job would also alter the relationship between institutional support and job satisfaction because faculty are still affected by institutional attitudes in their work.

Higher education institutions also provide support workers for the day-to-day work necessary for teaching, research, and the service or administrative duties that likely affect faculty job satisfaction. However, despite the ubiquity of support and administrative assistant positions in virtually all organizations there is scant research on this position in any field of research on how support workers might affect the job satisfaction of their colleagues at work. Grey literature argues that administrative assistants can provide substantial return on investment, boost productivity, and that experienced administrative staff can help new workers during the onboarding process acting as ‘reverse mentors’ (Duncan, 2011). Administrative assistants have also been found to be important technology trainers for less experienced workers (Vizer & Hanson,

2009) and professional interrupters knowing the best times to interrupt to maximize productivity (Dabbish & Baker, 2003). Research confirms in the nursing industry that the introduction of administrative assistants improved the frontline productivity of nursing managers (Locke, Leach, Kitsell, & Griffith, 2011). A sizable stream of research in K-12 education settings agrees that in general administrative support has a positive effect on job satisfaction among teachers (Erdogan, Kraimer, & Liden, 2004; Tickle, Chang, & Kim, 2011). Given the potential impact that support workers can have on the productivity and worklife of those they work with, it is also reasonable to suggest that institutional support in the form of staff workers can affect the job satisfaction of faculty members at universities. With both theoretical mechanisms in mind, this research hypothesizes that:

> *H2a: Faculty who agree that their institution does what it can to help faculty who take on additional leadership roles (e.g. major committee assignments, department chairmanship) to sustain other aspects of their faculty work report higher global job satisfaction.*

Institutional Support and Job Satisfaction with Time Allocations

In addition to its effects on global job satisfaction, institutional support can have an effect on how faculty are satisfied with time allocation. While not using a formal test, Ethington, Smart, & Zeltmann (1989) suggest that a university's ability to both attract and support the research capabilities of faculty is crucial to their professional satisfaction and success. Rausch and colleagues (1989) also suggest a link between a lack of institutional support and a higher rate of voluntary turnover among faculty. These

hypotheses were later tested and confirmed by Olsen and colleagues (1995). The effect of support on job satisfaction is even stronger among faculty who work in distance learning settings given the extra need for support that distance creates (Mclean, 2006). Given that faculty satisfaction in the settings of research (Olsen et al, 1995) and teaching (Mclean, 2006) is affected by the presence of institutional support, it is also probable that the presence of institutional support affects how faculty are satisfied with how their time is allocated, regardless of the type of university. Therefore, this research hypothesizes that:

> *H2b: Faculty who agree that their institution does what it can to help faculty who take on additional leadership roles (e.g. major committee assignments, department chairmanship) to sustain other aspects of their faculty work report higher satisfaction with time allocations.*

DATA

Data for this study are drawn from the Faculty Job Satisfaction Survey by the Collaborative on Academic Careers in Higher Education (COACHE) at the Harvard Graduate School of Education and the Integrated Postsecondary Education Data System (IPEDS). The COACHE survey has been sent to faculty from multiple institution types and has been conducted annually since 2005 and completed a major update in 2011. This research utilized five years of data following the update, from 2012-2016. A diverse set of four-year colleges and universities participate voluntarily. Composed mostly of Likert-scale items, themes in the questionnaire examine nature of work, shared governance, policies, and satisfaction with various aspects of the job pertinent to this study.

According to COACHE, institutional response rates vary by Carnegie Classification and by the proportion of tenured, pre-tenure, and non-tenure-track faculty in the eligible population at each university (COACHE, n.d.). Typical response rates by institution are in the 50% to 80% range, and most faculty complete the questionnaire in 25 minutes with 90% who begin the questionnaire going on to complete it. For purposes of this research, I limited this sample to faculty at the assistant professor, associate professor, and professor rank, ultimately retaining about 5500 responses from faculty at 55 institutions who had responded to the survey questions relevant for the analysis and to their position. Data on Carnegie classification in the sample was not available in this analysis, but as previously noted, the connections being studied are not materially affected by differences in Carnegie Classification.

Within the resulting data, the responses were mostly men (63%) and white (75%) with 44% being full professors, 36% associate professors, 20% assistant professors, and 26% of the respondents reported working in an official administrative appointment. There were some apparent outliers, such as a few respondents with ages over 100 years. These responses were retained and unaltered in the analysis after sensitivity testing revealed that they did not have a material effect on the findings. Table 6 presents the summary statistics for these data.

Table 6: Summary Statistics, Role Clarity and Job Satisfaction

Variable	Mean	Std. Dev.	Min	Max
Global Job Satisfaction	0.00	0.78	-2.11	0.97
Satisfaction with Time Allocations	0.00	0.85	-2.84	1.82
Role Clarity for Faculty and Administration	3.02	1.13	1.00	5.00
Institutional Support for Faculty Leaders	2.80	1.31	1.00	5.00
Administrative Appointment	0.26	0.44	0.00	1.00
Satisfaction - Number of Committees	3.41	0.94	1.00	5.00
Satisfaction - Clerical Support	0.00	0.82	-1.87	1.59
Assistant Professor	0.20	0.40	0.00	1.00
Associate Professor	0.36	0.48	0.00	1.00
Full Professor	0.44	0.50	0.00	1.00
Annual Salary	6.55	2.06	1.00	9.00
American Indian or Alaskan Native	0.00	0.07	0.00	1.00
Asian, Asian American, Pacific Islander	0.13	0.34	0.00	1.00
White (non-Hispanic)	0.75	0.43	0.00	1.00
Black or African-American	0.05	0.22	0.00	1.00
Hispanic or Latino	0.04	0.19	0.00	1.00
Other	0.02	0.13	0.00	1.00
Multi-racial	0.01	0.09	0.00	1.00
Age	51.54	10.46	21.00	105.00
Student Enrollment Size	4.22	0.99	1.00	5.00
Public or Private	1.20	0.40	1.00	2.00
Female	0.37	0.48	0.00	1.00
Marital Status	2.09	0.63	1.00	4.00
Balance Teaching, Research, and Service	3.23	1.29	1.00	5.00
Satisfaction - Internal Funding Support	2.96	1.20	1.00	5.00
Satisfaction - Number of Courses Taught	3.80	1.03	1.00	5.00
Satisfaction - External Funding Expectations	3.25	1.01	1.00	5.00

MEASUREMENT AND ANALYSIS

Measurement

This article uses two multiple-item scales to measure job satisfaction. One measures satisfaction with time spent on job facets unique to faculty work, and the other uses two global items of faculty job satisfaction. Measures for *administrative role clarity, institutional support for faculty leaders, administrative leadership appointments,* and

committee appointments were all single-item responses to survey questions. The measure for satisfaction with *clerical support* is created using multiple-items that relate to facets of clerical work that faculty come in contact with during their work. With the exception of *administrative leadership appointments*, which is a binary indicator variable, the rest of the focal variables are responses to Likert-scale items. Table 7 reports the various survey items used to measure the focal variables in the analysis.

Table 7: Survey Items of Focal Variables, Role Clarity and Job Satisfaction

Variable	Survey Question	Response Options
Global job satisfaction	All things considered, your department as a place to work - Please rate your level of satisfaction or dissatisfaction with the following.	1, Very dissatisfied; 2, Dissatisfied; 3, Neither satisfied nor dissatisfied; 4, Satisfied; 5, Very satisfied
Global job satisfaction	All things considered, your institution as a place to work - Please rate your level of satisfaction or dissatisfaction with the following.	1, Very dissatisfied; 2, Dissatisfied; 3, Neither satisfied nor dissatisfied; 4, Satisfied; 5, Very satisfied
Satisfaction with time allocations	Teaching - Please rate your level of satisfaction or dissatisfaction with the portion of your time spent on the following.	1, Very dissatisfied; 2, Dissatisfied; 3, Neither satisfied nor dissatisfied; 4, Satisfied; 5, Very satisfied
Satisfaction with time allocations	Research - Please rate your level of satisfaction or dissatisfaction with the portion of your time spent on the following.	1, Very dissatisfied; 2, Dissatisfied; 3, Neither satisfied nor dissatisfied; 4, Satisfied; 5, Very satisfied
Satisfaction with time allocations	Service (e.g., department/program administration, faculty governance, committee work, advising/mentoring students, speaking to alumni or prospective students/parents) - Please rate your level of satisfaction or dissatisfaction with the portion of your time spent on the following.	1, Very dissatisfied; 2, Dissatisfied; 3, Neither satisfied nor dissatisfied; 4, Satisfied; 5, Very satisfied
Satisfaction with time allocations	Outreach (e.g., extension, community engagement, technology transfer, economic development, K-12 education) - Please rate your level of satisfaction or dissatisfaction with the portion of your time spent on the following.	1, Very dissatisfied; 2, Dissatisfied; 3, Neither satisfied nor dissatisfied; 4, Satisfied; 5, Very satisfied
Satisfaction with time allocations	Administrative tasks (e.g., creating and submitting reports, routine paperwork) - Please rate your level of satisfaction or dissatisfaction with the portion of your time spent on the following.	1, Very dissatisfied; 2, Dissatisfied; 3, Neither satisfied nor dissatisfied; 4, Satisfied; 5, Very satisfied
Role Clarity for Faculty and Administration	My institution has clear rules about the various roles and authority of the faculty and administration - Please rate your level of agreement or disagreement with the following:	1, Strongly disagree; 2, Somewhat disagree; 3, Neither agree nor disagree; 4, Somewhat agree; 5, Strongly agree
Institutional Support for Faculty Leaders	My institution does what it can to help faculty who take on additional leadership roles (e.g. major committee assignments, department chairmanship) to sustain other aspects of their faculty work. - Please rate your level of agreement or disagreement with the following statements.	1, Strongly disagree; 2, Somewhat disagree; 3, Neither agree nor disagree; 4, Somewhat agree; 5, Strongly agree

Analysis

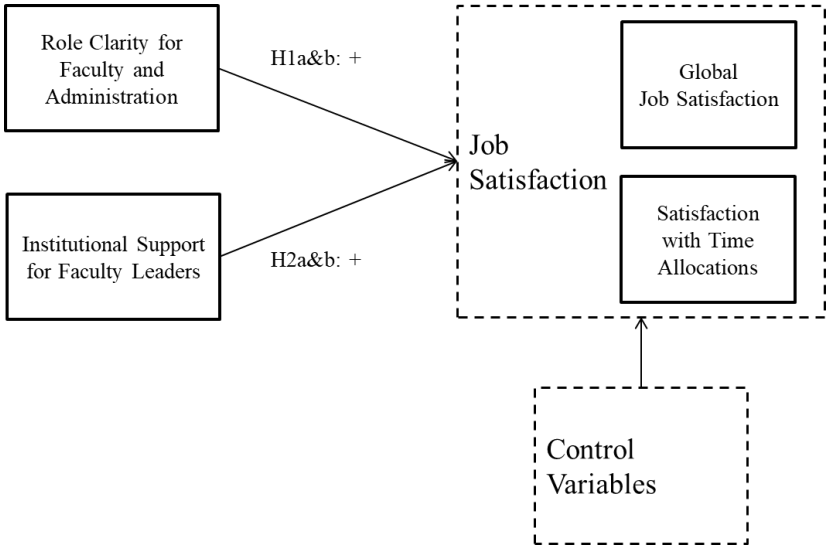
To obtain factor loadings for three theoretical factor variables, confirmatory factor analysis with varimax rotation was conducted. Each of the survey questions loaded

strongly on their respective factor. Chronbach's alpha scores for the items used to create the factor variables *global job satisfaction, satisfaction with time allocations, and clerical satisfaction* were .75, .75, and .70 respectively, which are all above the common rule of thumb of .70. To determine the possibility of multi-level variation across individuals (level 1) and institutions (level 2) , intercept only or 'unconditional' models for each of the dependent variables of interest were run, which yielded intraclass correlations of .06 for the global job satisfaction variable and .03 for the time allocation satisfaction variable. Since 6% and 3% of the total variation for the two dependent variables comes from the institutional level, there is potential for multi-level modeling. Given that the factor variables were found to be reliable and all focal variables are normally distributed the set of variables were suitable for analysis using ordinary least squares regression.

The resulting variables were analyzed using both multi-level modeling with maximum likelihood estimation and ordinary-least-squares regressions with heteroscedasticity robust standard errors. Multi-level models clustered on institution to account for differences by institution. Likelihood ratio tests post-estimation revealed the multi-level models as better fits to the data and thus only findings of the multi-level models are reported, though findings from ordinary least squared regression were very similar. An early version of the analysis included fixed effects for years, but these were removed for later analyses due to high levels of collinearity across years, which also indicate low variation across years. Post-estimation tests also indicate low levels of multi-collinearity among the variables. Finally, additional tests were also conducted including the Harman's one-factor test to identify issues with common source bias (George & Pandey, 2017). For further information on the preceding analyses, see Appendix C.

To begin the model building process, a first model for each dependent variable only included the first focal variable. Subsequent models gradually added focal variables and finally control variables in a step-wise fashion until all variables were present for the final models. Control variables include race/ethnicity, gender, marital status, salary, tenure-track rank, and age as these have all been found to correlate with job satisfaction (see Bozeman & Gaughan, 2011; Hagedorn, 2000). In addition, control variables measuring satisfaction with external funding expectations and internal funding support, ability to balance teaching, research, and service, and public or private control were included. Figure 5 is a visual representation of the empirical models and the hypothesized connection between the variables, in which the hypotheses with subscript *a* represent the relationships between the independent variables and *global job satisfaction* and hypotheses with subscript *b* represent the relationships between the independent variables and *satisfaction with time allocations.*

Figure 5: Empirical Model and Summary of Hypotheses



Results

Tables 8 and 9 present the findings of the analysis. All of the hypotheses were supported with statistically significant outcomes at the p<.01 value with the variables *role clarity for faculty and administration* and *institutional support for faculty leaders* both having statistically significant and positive effects on *global job satisfaction* (p<.01) and *satisfaction with time allocations* (p<.01) respectively. Among the control variables, contrary to previous studies *gender* did not have a statistically significant effect on *satisfaction with time allocations* or *global job satisfaction*. Also surprisingly, *salary* did not have a statistically significant effect on *global job satisfaction* but had a significant effect on *satisfaction with time allocations* (p<.05). University size had a statistically significant and negative effect on both *global satisfaction* (p<.05) but no significant effect on *satisfaction with time allocations*. Finally, working in a *private university* (vs. a public university) had a statistically significant and positive effect on *global job satisfaction* (p<.10) but had a statistically significant and negative effect on *satisfaction with time allocations* (p<.01).

Table 8: Multi-level Models predicting Global Job Satisfaction

VARIABLES	(1)	(2)	(3)
Role Clarity for Faculty and Administration	0.27***	0.17***	0.12***
	(0.01)	(0.01)	(0.01)
Institutional Support for Faculty Leaders		0.25***	0.13***
		(0.01)	(0.01)
Administrative Leadership Appointments			0.13***
			(0.02)
Number of Committees Satisfaction			0.04***
			(0.01)
Assistant Professor			0.02
			(0.03)
Associate Professor			-0.01
			(0.02)
Salary			0.01
			(0.01)
Clerical Satisfaction			0.11***
			(0.01)
Number of Courses Taught Satisfaction			0.09***
			(0.01)
Ext. Funding Expectations Satisfaction			0.04***
			(0.01)
Age			0.00
			(0.00)
Enrollment			-0.05**
			(0.02)
Private Control (vs. Public)			0.08*
			(0.04)
Female			0.02
			(0.02)
Marital Status			-0.00
			(0.01)
Time Balance Ability			0.05***
			(0.01)
Institutional Grant Support Satisfaction			0.08***
			(0.01)
Native American			-0.08
			(0.10)
Asian			-0.16***
			(0.03)
Black			-0.06
			(0.04)
Hispanic			-0.07*
			(0.04)
Other Race			-0.16*
			(0.10)
Multiracial			0.01
			(0.07)
Constant	-0.83***	-1.184***	-1.68***
	(0.03)	(0.03)	(0.13)
Observations	6,036	6,036	5,590
Number of groups	56	56	55

Notes: Base case for faculty rank is full professor, and for race is White. Standard errors in parentheses.
*** p<0.01, ** p<0.05, * p<0.1

Table 9: Multi-level Models Predicting Satisfaction with Time Allocations

VARIABLES	(4)	(5)	(6)
Role Clarity for Faculty and Administration	0.23***	0.10***	0.03***
	(0.01)	(0.01)	(0.01)
Institutional Support for Faculty Leaders		0.31***	0.07***
		(0.01)	(0.01)
Administrative Leadership Appointments			0.03
			(0.02)
Number of Committees Satisfaction			0.23***
			(0.01)
Assistant Professor			0.06*
			(0.03)
Associate Professor			-0.00
			(0.02)
Salary			0.01**
			(0.010)
Clerical Satisfaction			0.08***
			(0.01)
Number of Courses Taught Satisfaction			0.14***
			(0.01)
Ext. Funding Expectations Satisfaction			0.04***
			(0.01)
Age			0.01***
			(0.00)
Enrollment			-0.02
			(0.01)
Private Control (vs. Public)			-0.08***
			(0.03)
Female			-0.02
			(0.02)
Marital Status			0.01
			(0.01)
Time Balance Ability			0.18***
			(0.01)
Institutional Grant Support Satisfaction			0.04***
			(0.01)
Native American			0.02
			(0.10)
Asian			0.04
			(0.03)
Black			0.13***
			(0.04)
Hispanic			0.01
			(0.04)
Other Race			-0.05
			(0.10)
Multiracial			-0.02
			(0.06)
Constant	-0.72***	-1.16***	-2.78***
	(0.04)	(0.03)	(0.10)
Observations	6,159	6,159	5,702
Number of groups	56	56	55

Notes: Base case for faculty rank is full professor, and for race is White. Standard errors in parentheses.
*** p<0.01, ** p<0.05, * p<0.1

DISCUSSION AND CONCLUSION

Evidence from the empirical analyses support the hypotheses that both role clarity for faculty and administrators and institutional support for faculty leaders affect both global job satisfaction and satisfaction with time allocations of university faculty. Like any research, this has its weaknesses. Common source and common method bias stand out as most of the data in the analyses comes from the COACHE surveys. These issues are abetted by the large size of the sample, the use of various waves of the survey, and the strength of the relationships. Furthermore, some of the focal variables are single-item measures reducing their reliability. Like much of the red tape research, which uses a single-item measure, this paper uses a single-item to measure the rule clarity about administrative roles and the presence of institutional support for faculty leaders. Once again, however, the strength of the correlations in the findings helps alleviate this concern as measurement error often results in weaker findings.

Research suggests that determinants of faculty job satisfaction are alike but also do differ in some ways from those of other professional workers (Bozeman & Gaughan, 2011). University faculty are unique among professional workers across sectors because academic institutions have long staved off the institutional logic of corporatism (Thornton & Ocasio, 1999; Rindova, 2008; Kraatz, Ventresca, & Deng, 2010; Birnbaum, 2000) and enjoy a high degree of autonomy, power, and self-governance (Hattie & Marsh, 1996; AAUP, 1994). The unique management structure of academic institutions includes faculty roles as part-time administrators. This situation motivated the focus of the paper, as it examines how aspects of that role affect their job satisfaction. In imagining a world where universities adhere to the corporate logic, contemporary faculty

job duties might well be split among three entirely separate job titles. Evidence suggests that this might already be happening (Macfarlane, 2011). If traditional universities begin to use full-time, professional administrators in positions that were once the domain of researcher/teachers, then role clarity will become less of a problem as full-time administrators and managers do not have to question how teaching and research fall into their work duties.

Though service and administration work often become less important than research and teaching in the mind and focus of faculty members, as a specific endeavor university leadership is becoming a priority for theory and practice (Crow & Dabars, 2015). A key aspect of university leadership relevant to society, business, and public policy is knowledge management. As Drucker (1997) sagely observed and predicted, management originated 150 years ago in an attempt to organize the production of things and the next frontier would be refining the management of knowledge resources. As we now sit decades into the information age, the development of theory and practice in management of knowledge resources, of which universities play a central role, is of paramount importance.

To the topic at hand the question now becomes, how does the need to improve knowledge management apply to issues of university administration and faculty job satisfaction? The answer lies in the realization that the management of knowledge in the university setting lies at the hand of university administration and the intertwined and participatory role that faculty play in knowledge production, knowledge management, and shared governance in university leadership. The gist of this research is the idea that if faculty are not clear about their role in administration or not supported by the

administration, then job satisfaction and potentially productivity, knowledge creation, and knowledge management will suffer. This research is part of the refinement of university management with the goal being able to understand better the human capital responsible for knowledge resources and management.

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APPENDIX A

SUPPLEMENTAL MATERIAL FOR ESSAY 1

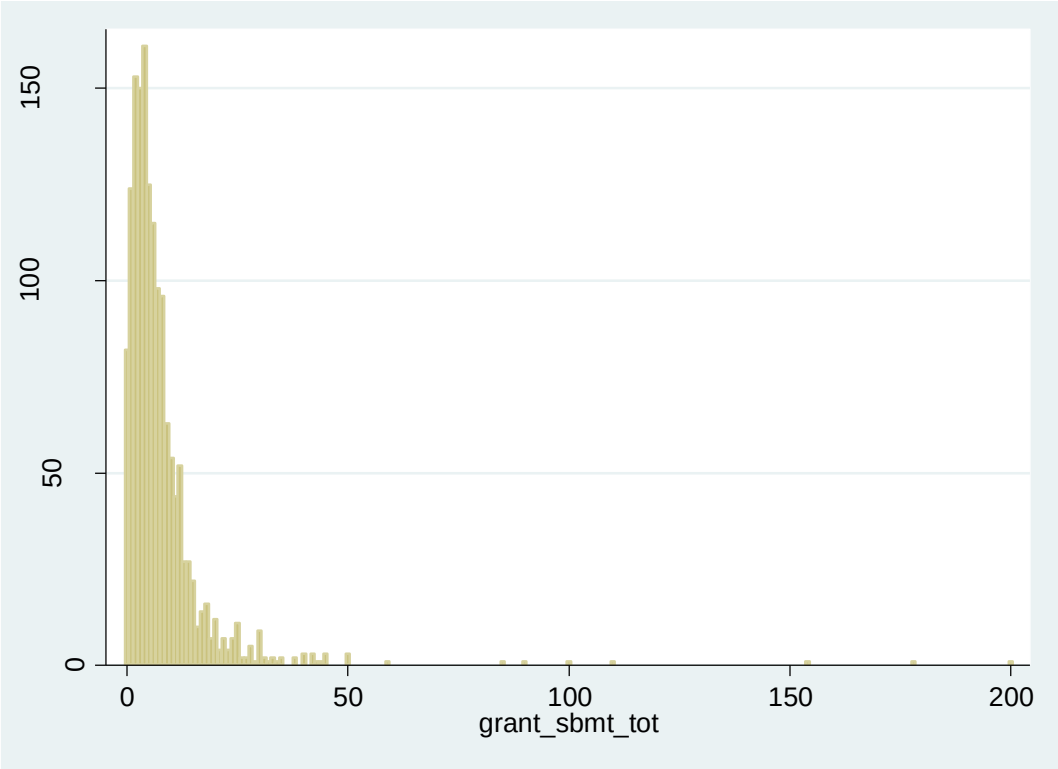
Table A1: First Stage Logistic Model Predicting the Reception of Administrative Support

Variables	**M1**
Requested Administrative Support	4.48***
	(0.23)
Department Reputation	0.79***
	(0.12)
Constant	-5.75***
	(0.44)
Observations	1,571

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Notes: As expected, both the request for administrative support, and department reputation strongly predict the reception of administrative support.

Figure A1: Histogram of Total Grant Submissions



Notes: In figure A1 the distribution of grant submissions is truncated at zero as expected. This count data has some zero values, but not an overwhelming amount. Inspection of the summary statistics (see Table 1) suggest that a negative binomial model would be a better fit than a Poisson model.

Table A2: Different Model Types Predicting Total Grant Submissions

VARIABLES	M2 NB	M2a OLS	M2b NB: No Outliers
Received Admin. Sup.	-0.03	-0.09	-0.01
	(0.08)	(0.92)	(0.07)
Administrative Stress	-0.04	-0.26	-0.06**
	(0.03)	(0.28)	(0.03)
# Courses Taught	0.02	-0.11	0.04
	(0.02)	(0.36)	(0.02)
# Committees	0.06***	0.61**	0.04***
	(0.01)	(0.26)	(0.01)
5-yr Pub. Avg	0.03***	0.33	0.01
	(0.01)	(0.22)	(0.00)
Assoc. Prof.	-0.14**	-1.20*	-0.13**
	(0.07)	(0.65)	(0.06)
Full Prof.	-0.20***	-1.77**	-0.16***
	(0.06)	(0.77)	(0.06)
University Reputation	0.00	0.16	-0.04
	(0.03)	(0.40)	(0.03)
Female	-0.14***	-1.19**	-0.08*
	(0.05)	(0.56)	(0.05)
Prob. First Sub. Awrdd	-0.01***	-0.05***	-0.01***
	(0.00)	(0.01)	(0.00)
# Doc. Stu. Fndd Proj.	0.10***	1.04***	0.09***
	(0.01)	(0.24)	(0.01)
Chemistry	0.02	-0.53	0.01
	(0.08)	(1.06)	(0.08)
Computer Science	0.11	0.72	-0.20**
	(0.08)	(0.79)	(0.08)
Earth & Atmosphere	0.34***	2.37**	0.03
	(0.08)	(1.14)	(0.08)
Electrical Engineering	0.03	-0.14	-0.18**
	(0.09)	(0.81)	(0.08)
Physics	-0.09	-0.84	-0.24***
	(0.08)	(1.40)	(0.08)
South Asian	0.16	1.05	0.27***
	(0.11)	(0.99)	(0.10)
Other Asian	0.29***	2.39**	0.29***
	(0.08)	(1.02)	(0.07)
African American	0.18	2.22	0.12
	(0.22)	(1.42)	(0.21)
Hispanic	0.29**	1.58	-0.06
	(0.15)	(2.59)	(0.14)
Native American	-0.13	-1.78	-0.17
	(0.33)	(3.33)	(0.29)
Race Other	-0.01	-0.56	0.19
	(0.18)	(1.45)	(0.19)
Constant	1.56***	3.37*	1.60***
	(0.15)	(1.87)	(0.15)
Observations	1,417	1,417	1,410
R-squared		0.10	

***p<0.01, **p<0.05, *p<0.10. Biology is the base discipline and white is the base race/ethnicity. NB = Negative Binomial.

Notes to Table A2: Removal of potential outliers (bolded values in Table A3), does not appear to materially affect the results between model 2 and model 2b.

Table A3: Sample of Grant Submissions Data (Potential Outliers Bolded)

Grant Submissions
42
42
42
43
44
45
45
45
50
50
50
59
85
90
100
110
154
178
200

Post-estimation Tests for Grant Submission Models

Model 2:

- Likelihood-ratio tests of Model 2 reveal the negative binomial a better fit to the data than the Poisson model.
    - Chi Squared = 5767.94 (p<0.01)

Model 2b:

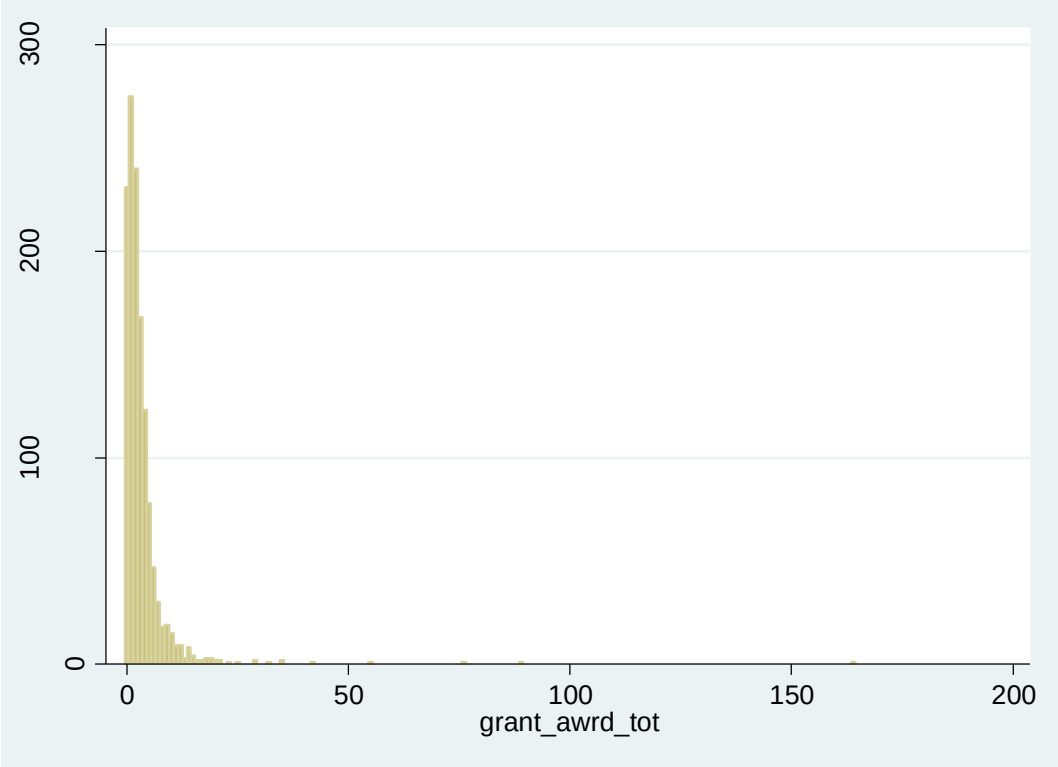
- Likelihood-ratio tests of Model 2b reveal the negative binomial a better fit to the data than the Poisson model.
    - Chi Squared = 1693.57 (p<0.01)

Table A4: Multicollinearity Post-estimation of Model 2a Results

Variable	VIF	1/VIF
Full Prof.	1.83	0.55
Earth & Atmosphere	1.77	0.57
Chemistry	1.76	0.57
Physics	1.73	0.58
Computer Science	1.69	0.59
Electrical Engineering	1.67	0.60
Assoc. Prof.	1.65	0.61
# Committees	1.28	0.78
# Doc. Stu. Fndd Proj.	1.23	0.81
5-yr Pub. Avg	1.18	0.84
Administrative Stress	1.15	0.87
# Courses Taught	1.14	0.88
Prob. First Sub. Awrdd	1.09	0.92
University Reputation	1.07	0.93
South Asian	1.06	0.95
Other Asian	1.06	0.95
Received Admin. Sup.	1.06	0.95
Female	1.04	0.96
Native American	1.03	0.97
Hispanic	1.03	0.97
African American	1.03	0.97
Race Other	1.02	0.99

Notes to Table A4: Variables have low levels of multi-collinearity.

Figure A2: Histogram of Total Grant Awards



Notes: In figure A2 the distribution of total grant awards is truncated at zero as expected. This count data has some zero values, but not an overwhelming amount. Inspection of the summary statistics (see Table 1) suggest that a negative binomial model would be a better fit than a Poisson model.

Table A5: Different Model Types Predicting Total Grant Awards

VARIABLES	M3 NB	M3a OLS	M3b No Outliers NB
Received Admin. Sup.	-0.21**	-0.59	-0.23**
	(0.10)	(0.53)	(0.10)
Administrative Stress	-0.02	-0.09	-0.09**
	(0.04)	(0.17)	(0.04)
# Courses Taught	0.04	0.03	0.02
	(0.03)	(0.22)	(0.03)
# Committees	0.03**	0.17	0.04**
	(0.02)	(0.17)	(0.02)
5-yr Pub. Avg	0.02***	0.13	0.00
	(0.01)	(0.12)	(0.01)
Assoc. Prof.	0.13	0.17	0.15*
	(0.09)	(0.30)	(0.09)
Full Prof.	0.30***	0.73	0.35***
	(0.08)	(0.54)	(0.08)
University Reputation	0.06	0.33	-0.02
	(0.04)	(0.23)	(0.04)
Female	-0.09	-0.33	-0.08
	(0.06)	(0.32)	(0.06)
Prob. First Sub. Awrdd	0.01**	0.02**	0.01***
	(0.00)	(0.01)	(0.00)
# Doc. Stu. Fndd Proj.	0.13***	0.56***	0.13***
	(0.01)	(0.13)	(0.01)
Chemistry	-0.38***	-1.62***	-0.44***
	(0.11)	(0.62)	(0.11)
Computer Science	-0.08	-0.41	-0.37***
	(0.11)	(0.45)	(0.11)
Earth & Atmosphere	0.39***	1.47*	0.15
	(0.10)	(0.80)	(0.11)
Electrical Engineering	-0.17	-0.66	-0.32***
	(0.12)	(0.49)	(0.12)
Physics	-0.16	-0.66	-0.37***
	(0.11)	(0.82)	(0.12)
South Asian	0.16	0.44	0.27*
	(0.14)	(0.53)	(0.14)
Other Asian	-0.05	0.02	-0.02
	(0.11)	(0.38)	(0.11)
African American	0.15	0.80	0.15
	(0.29)	(0.80)	(0.29)
Hispanic	0.27	0.37	0.23
	(0.18)	(0.81)	(0.18)
Native American	0.23	0.44	0.29
	(0.42)	(2.23)	(0.40)
Race Other	0.02	0.05	-0.00
	(0.25)	(0.78)	(0.27)
Constant	0.20	-0.46	0.29
	(0.20)	(1.08)	(0.20)
Observations	1,218	1,218	1,215
R-squared		0.09	

***p<0.01, **p<0.05, *p<0.10. Biology is the base discipline and white is the base race/ethnicity. NB = Negative Binomial.

Notes to Table A5: Removal of potential outliers (bolded values in Table A6), does not appear to materially affect the results between model 3 and model 3b. An attempted zero-inflated negative binomial model did not converge.

Table A6: Sample of Grant Awards Data (Potential Outliers Bolded)

Grant Awards
20
20
21
21
23
25
29
29
32
35
35
42
55
76
89
164

Post-estimation Tests for Grant Awards Models

Model 3:

- Likelihood-ratio tests of Model 2 reveal the negative binomial a better fit to the data than a Poisson model.
    - Chi Squared = 2350.38 (p<0.01)

Model 3b:

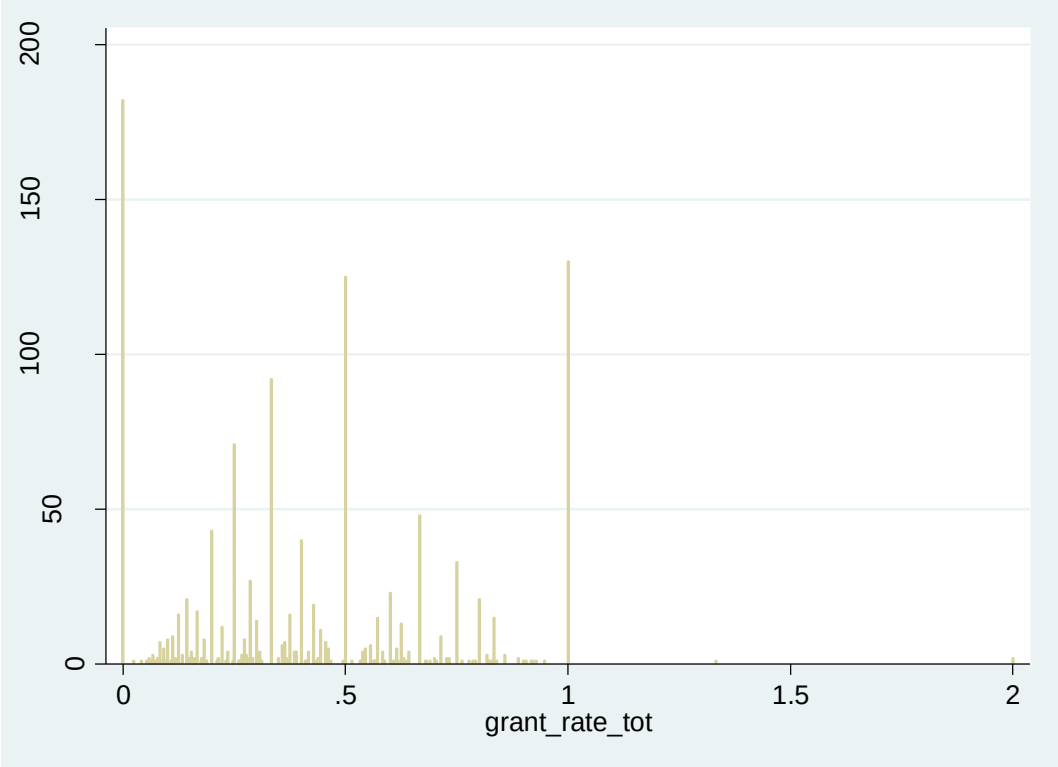
- Likelihood-ratio tests of Model 2b reveal the negative binomial a better fit to the data than a Poisson model.
    - Chi Squared = 692.55 (p<0.01)

Table A7: Multicollinearity Post-estimation of Model 3a Results

Variable	VIF	1/VIF
Earth & Atmosphere	1.89	0.53
Chemistry	1.87	0.54
Computer Science	1.81	0.55
Electrical Engineering	1.81	0.55
Full Prof.	1.80	0.55
Physics	1.79	0.56
Assoc. Prof.	1.61	0.62
# Committees	1.29	0.78
# Doc. Stu. Fndd Proj.	1.27	0.79
5-yr Pub. Avg	1.20	0.84
Administrative Stress	1.16	0.86
# Courses Taught	1.13	0.88
Prob. First Sub. Awrdd	1.09	0.92
University Reputation	1.08	0.93
South Asian	1.07	0.94
Other Asian	1.06	0.94
Received Admin. Sup.	1.06	0.94
Female	1.05	0.96
Hispanic	1.03	0.97
Native American	1.03	0.97
African American	1.03	0.97
Race Other	1.02	0.98

Notes to Table A7: Variables have low levels of multi-collinearity.

Figure A3: Histogram of Grant Success Rates



Notes: In figure A3 the distribution of grant success rates is mostly bounded at 0 and 1 with a few outliers at values of 2, which were removed for the analysis.

Table A8: Different Models Predicting Grant Success Rate

VARIABLES	M4 OLS	M4a With Outliers
Received Admin. Sup.	-0.06**	-0.07***
	(0.03)	(0.03)
Administrative Stress	0.01	0.02**
	(0.01)	(0.01)
# Courses Taught	-0.02*	-0.02
	(0.01)	(0.01)
# Committees	-0.01***	-0.01**
	(0.00)	(0.00)
5-yr Pub. Avg	0.00	0.00
	(0.00)	(0.00)
Assoc. Prof.	0.08***	0.07***
	(0.02)	(0.03)
Full Prof.	0.14***	0.15***
	(0.02)	(0.02)
University Reputation	0.01	0.01
	(0.01)	(0.01)
Female	0.00	-0.02
	(0.02)	(0.02)
Prob. First Sub. Awrdd	0.01***	0.01***
	(0.00)	(0.00)
# Doc. Stu. Fndd Proj.	0.02***	0.02***
	(0.00)	(0.00)
Chemistry	-0.08***	-0.09***
	(0.03)	(0.03)
Computer Science	-0.03	-0.06*
	(0.03)	(0.03)
Earth & Atmosphere	0.04	0.052*
	(0.03)	(0.03)
Electrical Engineering	0.00	-0.00
	(0.03)	(0.03)
Physics	0.03	-0.01
	(0.03)	(0.03)
South Asian	-0.00	-0.00
	(0.04)	(0.04)
Other Asian	-0.11***	-0.12***
	(0.02)	(0.03)
African American	-0.04	-0.02
	(0.06)	(0.07)
Hispanic	0.06	0.11*
	(0.05)	(0.06)
Native American	-0.025	0.39
	(0.04)	(0.31)
Race Other	-0.09	-0.11*
	(0.07)	(0.06)
Constant	0.33***	0.32***
	(0.05)	(0.06)
Observations	1,172	1,174
R-squared	0.19	0.19

Notes: Notes: ***p<0.01, **p<0.05, *p<0.10. Biology is the base discipline and white is the base race/ethnicity. OLS = Ordinary Least Squares.
Notes to Table A8: Insertion of outliers (bolded values in Table A9), does not appear to materially affect the results between model 4 and model 4a. The final model (model 4) did not include outliers because success rates cannot be larger than 1.

Table A9: Sample of Grant Awards Data (Potential Outliers Bolded)

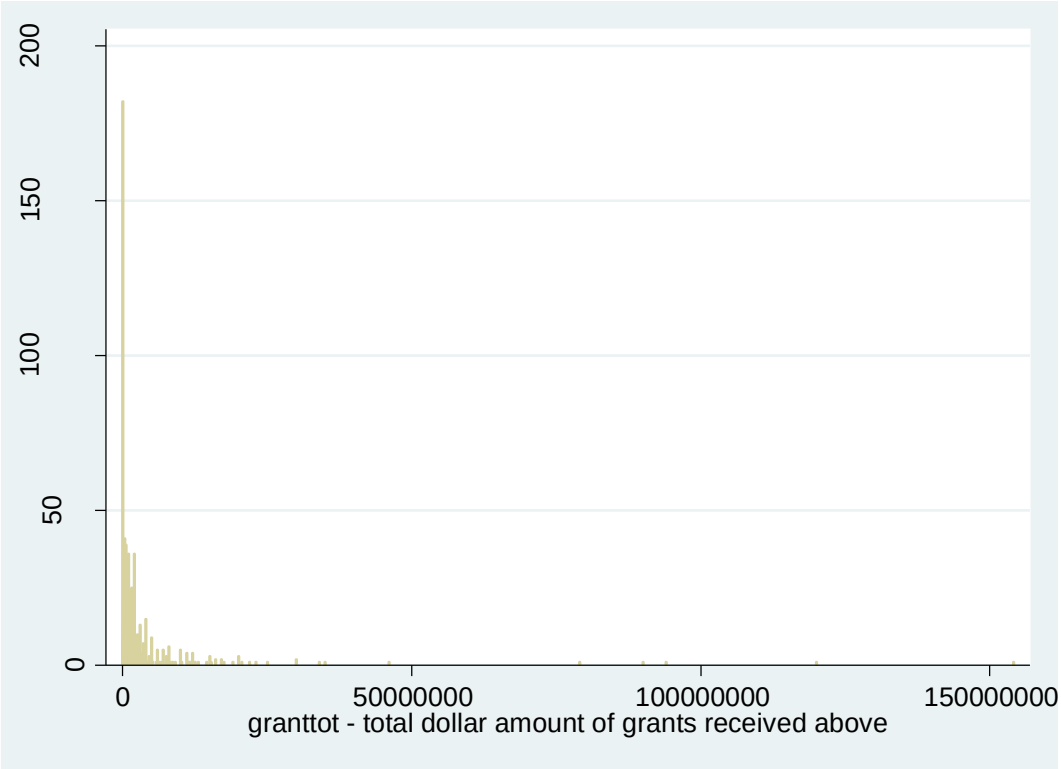
Grant Success Rate
1
1
1
1
1
1
1
1
1
1
1
1
1
1
2
2

Table A10: Multicollinearity Post-estimation of Model 4 Results

Variable	VIF	1/VIF
Chemistry	1.91	0.52
Earth & Atmosphere	1.90	0.53
Electrical Engineering	1.84	0.54
Computer Science	1.84	0.54
Physics	1.81	0.55
Full Prof.	1.79	0.56
Assoc. Prof.	1.60	0.63
# Committees	1.28	0.78
# Doc. Stu. Fndd Proj.	1.26	0.79
5-yr Pub. Avg	1.20	0.84
Administrative Stress	1.15	0.87
# Courses Taught	1.13	0.89
Prob. First Sub. Awrdd	1.10	0.91
University Reputation	1.08	0.92
South Asian	1.07	0.93
Other Asian	1.07	0.94
Received Admin. Sup.	1.06	0.94
Female	1.05	0.96
Hispanic	1.03	0.97
Native American	1.03	0.97
African American	1.03	0.97
Race Other	1.02	0.98

Notes to Table A10: Variables have low levels of multi-collinearity.

Figure A4: Histogram of Total Grant Dollars



Notes: In figure A4 the distribution of total grant dollars is truncated at zero as expected. This count data has many zero values making it a potential candidate for zero-inflated models. Inspection of the summary statistics (see Table 1) suggest that a negative binomial model would be a better fit than a Poisson model.

Table A11: Different Model Types Predicting Total Grant Dollars

VARIABLES	M5 NB	M5a OLS	M5b ZINB	M5c No Outliers NB
Received Admin. Sup.	0.62***	1.39	0.68***	0.14
	(0.13)	(0.88)	(0.14)	(0.13)
Administrative Stress	0.05	-0.00	0.05	0.10**
	(0.05)	(0.25)	(0.06)	(0.05)
# Courses Taught	-0.19***	-0.40**	-0.17***	-0.16***
	(0.04)	(0.17)	(0.04)	(0.04)
# Committees	-0.03	-0.07	-0.03	-0.03*
	(0.02)	(0.14)	(0.02)	(0.02)
5-yr Pub. Avg	-0.00	-0.01	-0.00	-0.01
	(0.01)	(0.04)	(0.01)	(0.01)
Assoc. Prof.	0.48***	1.09**	0.50***	0.34***
	(0.13)	(0.47)	(0.13)	(0.12)
Full Prof.	0.99***	1.78***	1.02***	0.70***
	(0.12)	(0.51)	(0.12)	(0.14)
University Reputation	0.06	-0.01	0.06	0.18***
	(0.06)	(0.21)	(0.06)	(0.05)
Female	-0.15*	-0.52	-0.12	-0.05
	(0.09)	(0.42)	(0.09)	(0.08)
Prob. First Sub. Awrdd	0.01***	0.02	0.01***	0.00
	(0.00)	(0.01)	(0.00)	(0.00)
# Doc. Stu. Fndd Proj.	0.14***	0.27***	0.14***	0.17***
	(0.02)	(0.10)	(0.02)	(0.02)
Chemistry	-0.18	-0.48	-0.16	-0.12
	(0.15)	(0.52)	(0.16)	(0.14)
Computer Science	0.00	-0.03	0.10	0.09
	(0.16)	(0.54)	(0.17)	(0.14)
Earth & Atmosphere	0.04	0.19	0.08	-0.09
	(0.15)	(0.71)	(0.16)	(0.14)
Electrical Engineering	0.09	0.75	0.07	-0.06
	(0.17)	(0.93)	(0.18)	(0.15)
Physics	0.29**	0.85	0.37**	0.21
	(0.15)	(0.84)	(0.16)	(0.14)
South Asian	0.20	0.23	0.17	0.30*
	(0.19)	(0.75)	(0.20)	(0.1)
Other Asian	-0.60***	-0.99***	-0.62***	-0.48***
	(0.17)	(0.29)	(0.18)	(0.15)
African American	0.46	0.24	0.53	0.51
	(0.40)	(0.65)	(0.42)	(0.36)
Hispanic	-0.11	-0.00	-0.11	0.19
	(0.26)	(0.81)	(0.27)	(0.23)
Native American	0.99*	1.32	1.05*	0.93*
	(0.56)	(1.16)	(0.59)	(0.50)
Race Other	2.47***	6.11	2.716***	-0.09
	(0.31)	(6.63)	(0.33)	(0.29)
Constant	-0.24	1.437	-0.33	-0.56**
	(0.28)	(1.04)	(0.30)	(0.25)
Observations	1,275	1,275	1,114	1,270
R-squared		0.05		
Zero Inflation Predictor				
Grant Awards Total			-0.02	

		(1.17)
Constant		-23.55
		(6.72)

***p<0.01, **p<0.05, *p<0.10; $ in millions. Biology is the base discipline and white is the base race/ethnicity. NB = Negative Binomial, OLS = Ordinary Least Squares, ZINB = Zero inflated negative binomial. Number of grant awards used to predict zero values in largest grant in dollars.

Notes to Table A11: Removal of potential outliers (bolded values in Table A12), does appear to materially affect the results between model 5 and model 5c. However, there is no reason to think these outliers are a result of input errors.

Table A12: Sample of Total Grant Dollars (Potential Outliers Bolded)

Total Grant Dollars
20000000
20000000
20600000
21900000
23000000
25000000
30000000
30000000
34000000
35000000
46000000
79000000
90000000
94000000
120000000
154000000

Post-estimation Tests for Total Grant Dollars Models

Model 5:

- Likelihood-ratio tests of Model 5 reveal the negative binomial a better fit to the data than a Poisson model.
    - Chi Squared = 3943.31 (p<0.01)

Model 5b:

- The Vuong test of Model 5b reveal the negative binomial a better fit to the data than a zero-inflated negative binomial model.
    - Z Score = -2.01 (p = 0.98)
- Likelihood-ratio tests of Model 5b reveal the zero-inflated negative binomial a better fit to the data than a zero-inflated Poisson model.
    - Chi Squared = 3351.98 (p<0.01)

Model 5c:

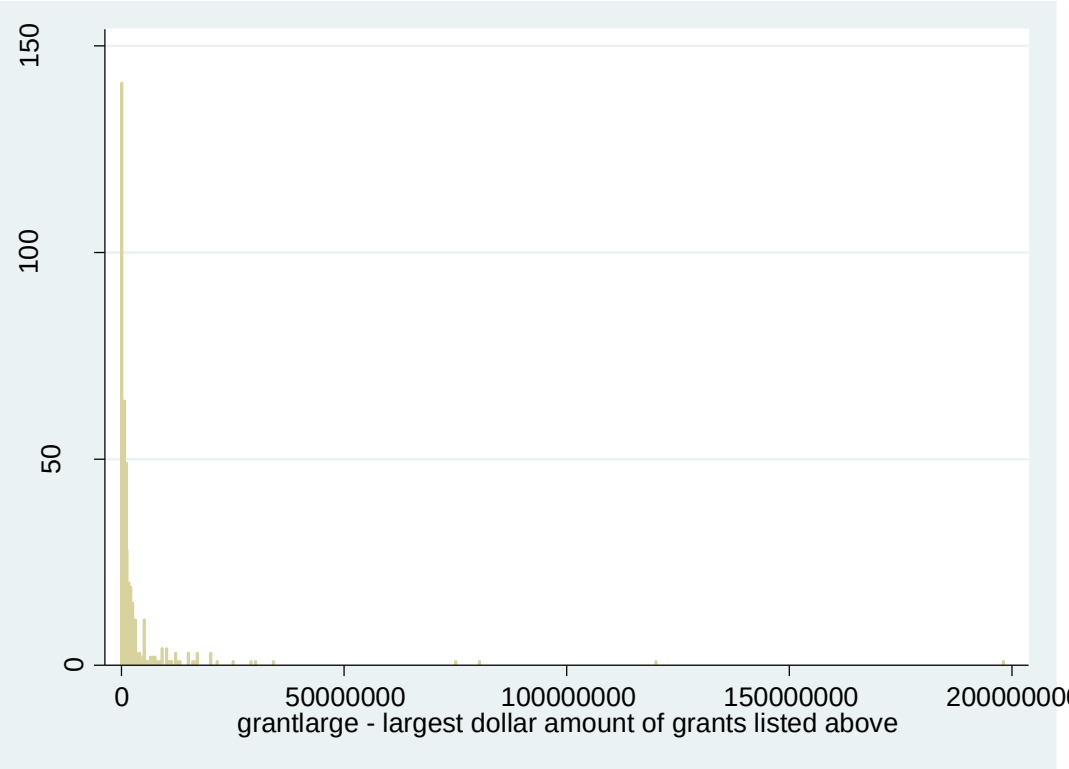
- Likelihood-ratio tests of Model 5 reveal the negative binomial a better fit to the data than a Poisson model.
    - Chi Squared = 1286.17 (p<0.01)

Table A13: Multicollinearity Post-estimation of Model 5a Results

Variable	VIF	1/VIF
Earth & Atmosphere	1.84	0.54
Chemistry	1.81	0.55
Full Prof.	1.80	0.55
Physics	1.79	0.56
Electrical Engineering	1.73	0.58
Computer Science	1.71	0.58
Assoc. Prof.	1.61	0.62
# Committees	1.28	0.78
# Doc. Stu. Fndd Proj.	1.24	0.81
5-yr Pub. Avg	1.18	0.85
Administrative Stress	1.16	0.86
# Courses Taught	1.14	0.88
Prob. First Sub. Awrdd	1.09	0.92
University Reputation	1.08	0.93
Received Admin. Sup.	1.06	0.94
South Asian	1.06	0.94
Other Asian	1.06	0.95
Female	1.05	0.95
Native American	1.03	0.97
Hispanic	1.03	0.97
African American	1.03	0.97
Race Other	1.02	0.98

Notes to Table A13: Variables have low levels of multi-collinearity.

Figure A5: Histogram of Largest Grant in Dollars



Notes: In figure A5 the distribution of largest grant in dollars is truncated at zero as expected. This count data has many zero values making it a potential candidate for zero-inflated models. Inspection of the summary statistics (see Table 1) suggest that a negative binomial model would be a better fit than a Poisson model.

Table A14: Different Model Types Predicting Largest Grant in Dollars

VARIABLES	M6 ZINB	M6a OLS	M6b NB	M6c No Outliers ZINB	M6d No Outliers NB
Received Admin. Sup.	1.07***	1.62*	0.93***	0.54***	0.49***
	(0.14)	(0.93)	(0.13)	(0.13)	(0.12)
Administrative Stress	0.17***	0.16	0.17***	0.15***	0.15***
	(0.06)	(0.19)	(0.06)	(0.05)	(0.05)
# Courses Taught	-0.19***	-0.21	-0.16***	-0.14***	-0.14***
	(0.04)	(0.13)	(0.04)	(0.04)	(0.04)
# Committees	-0.03	0.01	-0.03	-0.03	-0.02
	(0.02)	(0.18)	(0.02)	(0.02)	(0.02)
5-yr Pub. Avg	-0.01	-0.02	-0.01	-0.01	-0.01
	(0.01)	(0.04)	(0.01)	(0.01)	(0.01)
Assoc. Prof.	0.20	0.29	0.19	0.17	0.16
	(0.14)	(0.19)	(0.13)	(0.12)	(0.12)
Full Prof.	0.84***	1.35***	0.88***	0.56***	0.58***
	(0.13)	(0.42)	(0.12)	(0.11)	(0.11)
University Reputation	-0.03	-0.15	-0.01	0.09	0.08
	(0.07)	(0.30)	(0.06)	(0.06)	(0.06)
Female	0.00	-0.37	-0.06	0.03	0.01
	(0.09)	(0.43)	(0.09)	(0.08)	(0.08)
Prob. First Sub. Awrdd	0.01***	0.03	0.01***	-0.00	-0.00
	(0.00)	(0.03)	(0.00)	(0.00)	(0.00)
# Doc. Stu. Fndd Proj.	0.09***	0.18***	0.11***	0.10***	0.11***
	(0.02)	(0.07)	(0.02)	(0.02)	(0.02)
Chemistry	-0.38**	-1.28	-0.43***	-0.02	-0.13
	(0.16)	(1.05)	(0.15)	(0.15)	(0.13)
Computer Science	-0.43***	-1.27	-0.50***	-0.060	-0.20
	(0.17)	(1.03)	(0.16)	(0.15)	(0.14)
Earth & Atmosphere	-0.37**	-0.79	-0.38***	-0.22	-0.33**
	(0.16)	(1.12)	(0.15)	(0.15)	(0.14)
Electrical Engineering	-0.39**	-0.97	-0.40**	-0.13	-0.16
	(0.18)	(0.93)	(0.17)	(0.16)	(0.15)
Physics	-0.11	-0.39	-0.02	0.18	0.03
	(0.16)	(1.19)	(0.15)	(0.15)	(0.14)
South Asian	0.17	0.18	0.12	0.17	0.17
	(0.21)	(0.40)	(0.20)	(0.19)	(0.17)
Other Asian	-0.49***	-0.54***	-0.50***	-0.40**	-0.39**
	(0.18)	(0.19)	(0.18)	(0.16)	(0.16)
African American	0.00	-0.48	0.00	0.11	0.09
	(0.44)	(0.57)	(0.44)	(0.39)	(0.38)
Hispanic	-0.12	-0.22	-0.12	0.04	0.08
	(0.27)	(0.66)	(0.27)	(0.24)	(0.23)
Native American	2.89***	6.28	2.64***	2.57***	2.44***
	(0.52)	(4.41)	(0.49)	(0.44)	(0.42)
Race Other	-0.38	-0.98**	-0.61*	-0.26	-0.47

	(0.39)	(0.45)	(0.37)	(0.34)	(0.33)
Constant	-0.18	1.328	-0.24	-0.54**	-0.42*
	(0.29)	(1.03)	(0.28)	(0.26)	(0.24)
Observations	1,136	1,298	1,298	1,133	1,294
R-squared		0.03			
Zero Inflation Predictor					
Grant Awards Total	-0.0			-0.01	
	(1.71)			(689.50)	
Constant	-25.51			-23.09	
	(13.42)			(4.36)	

***p<0.01, **p<0.05, *p<0.10; $ in millions. Biology is the base discipline and white is the base race/ethnicity. NB = Negative Binomial, OLS = Ordinary Least Squares, ZINB = Zero inflated negative binomial. Number of grant awards used to predict zero values in largest grant in dollars.

Notes to Table A14: Removal of potential outliers (bolded values in Table A15), does not appear to materially affect the results between model 6 and model 6c.

Table A15: Sample of Largest Grant in Dollars (Potential Outliers Bolded)

Largest Grant in Dollars
16500000
17000000
17000000
17000000
20000000
20000000
20000000
21400000
25000000
29000000
30000000
34000000
75000000
80330100
120000000
198000000

Post-estimation Tests for Largest Grant Models

Model 6:

- The Vuong test of Model 6 reveal the zero-inflated negative binomial a better fit to the data than a negative binomial model (M6b).

    - Z Score = 2.68 (p = 0.00)
- Likelihood-ratio tests of Model 6 reveal the zero-inflated negative binomial a better fit to the data than a zero-inflated Poisson model.
    - Chi Squared = 2681.74 (p<0.01)

Model 6d:

- The Vuong test of Model 6 reveal the negative binomial a better fit to the data than a negative zero-inflated binomial model.
    - Z Score = -3.85 (p = 0.99)
- Likelihood-ratio tests of Model 6b reveal the zero-inflated negative binomial a better fit to the data than a zero-inflated Poisson model.
    - Chi Squared = 735.76 (p<0.01)

Table A16: Multicollinearity Post-estimation of Model 6a Results

Variable	VIF	1/VIF
Earth & Atmosphere	1.86	0.54
Chemistry	1.82	0.55
Full Prof.	1.81	0.55
Physics	1.80	0.56
Electrical Engineering	1.73	0.58
Computer Science	1.73	0.58
Assoc. Prof.	1.62	0.62
# Committees	1.28	0.78
# Doc. Stu. Fndd Proj.	1.25	0.80
5-yr Pub. Avg	1.19	0.84
Administrative Stress	1.17	0.86
# Courses Taught	1.14	0.88
Prob. First Sub. Awrdd	1.09	0.92
University Reputation	1.08	0.93
Received Admin. Sup.	1.06	0.94
South Asian	1.06	0.94
Other Asian	1.05	0.95
Female	1.05	0.95
Native American	1.03	0.97
Hispanic	1.03	0.97
African American	1.03	0.97
Race Other	1.02	0.98

Notes to Table A16: Variables have low levels of multi-collinearity.

Post-Estimation Tests of Instrumental Variables

Because post-estimation tests for instrumental variables in negative binomial regressions do not exist, OLS regressions were run for all of the dependent variables in order to run post-estimation tests. The first-stage test examines whether the instrumental variables are correlated with the *received administrative support* variable and uncorrelated with the error term. Table 2 shows that the instruments have strong explanatory power in each of the models. The endogeneity test examines whether the *received administrative support* variable is endogenous with the grant outcomes variables. The Durbin chi-squared test reveal that only the *success rate* variable is empirically endogenous below the p=.05 rule of thumb. However, the *submissions, awards, total dollars,* and *largest dollars* models for these tests are mispecified as OLS models, so results of these tests can be disregarded. Furthermore, there is a strong theoretical argument that administrative support is endogenous with grant outcomes, providing support for the need to correct for the reverse causality issue. Finally, the test for overidentifying restrictions tests both whether the instrumental variables are uncorrelated with the structural error term and whether the equation as hand is specified correctly. Results from these tests reveal that each of the models was specified correctly and that the instruments are uncorrelated with the error term in each model.

Table A17: Instrumental Variable Post-Estimation Tests

	Ideal	M2a Submissions	M3a Awards	M4 Success Rate	M5a Total $	M6a Largest $
First Stage Test						
F Statistic	**F>10**	393.27	393.27	393.27	393.27	393.27
Endogeneity Test						
Chi. Sq.		0.60	0.00	5.58	2.10	1.53
P Value	**P<0.05**	0.44	0.96	0.02	0.15	0.22
Overidentifying Restrictions						
Chi. Sq.		0.10	0.02	2.09	0.00	0.07
P Value	**P>0.05**	0.75	0.89	0.15	0.96	0.79

Table A18: Summary Statistics of PI and Co-PI Grant Outcomes

Variable	Mean	Std. Dev.	Min	Max
PI Grant Submissions	5.11	8.68	0	180
PI Grant Success Rate	0.43	0.35	0	1
PI Grant Awards	2.27	5.75	0	159
Co-PI Grant Submissions	2.61	4.42	0	80
Co-PI Grant Success Rate	0.40	0.38	0	1
Co-PI Grant Awards	1.10	2.19	0	40

Notes: Total grant submissions, awards, and success rates were split up between principal investigators and co-principal investigators. Futher analyses of the models when these outcomes were split up between PI's and Co-PI's (Tables A19 and A20) reveal that the statistically significant relationships when combined were mostly because of grant activity as principal investigator.

Table A19: PI Grant Outcomes

	Submissions	**Awards**	**Success Rate**
VARIABLES	NB	ZINB	OLS
Received Admin. Sup.	0.03	-0.24**	-0.07**
	(0.09)	(0.10)	(0.03)
Administrative Stress	-0.05	-0.05	0.02**
	(0.03)	(0.04)	(0.01)
# Courses Taught	0.03	0.07**	-0.02*
	(0.03)	(0.03)	(0.01)
# Committees	0.03**	0.01	-0.01**
	(0.01)	(0.02)	(0.00)
5-yr Pub. Avg	0.03***	0.02***	0.00
	(0.01)	(0.01)	(0.00)
Assoc. Prof.	-0.20***	0.09	0.08***
	(0.07)	(0.09)	(0.02)
Full Prof.	-0.15**	0.41***	0.16***
	(0.07)	(0.08)	(0.02)
University Reputation	-0.02	0.02	0.01
	(0.04)	(0.04)	(0.01)
Female	-0.16***	-0.14**	-0.01
	(0.05)	(0.06)	(0.02)
Prob. First Sub. Awrdd	-0.01***	0.01***	0.01***
	(0.00)	(0.00)	(0.00)
# Doc. Stu. Fndd Proj.	0.11***	0.12***	0.02***
	(0.01)	(0.01)	(0.00)
Chemistry	-0.08	-0.40***	-0.09***
	(0.09)	(0.11)	(0.03)
Computer Science	-0.21**	-0.35***	-0.06*
	(0.10)	(0.12)	(0.03)
Earth & Atmosphere	0.22**	0.35***	0.05
	(0.09)	(0.10)	(0.03)
Electrical Engineering	-0.25**	-0.31**	-0.02
	(0.10)	(0.12)	(0.03)
Physics	-0.32***	-0.39***	-0.01
	(0.09)	(0.11)	(0.03)
South Asian	0.27**	0.19	-0.00
	(0.12)	(0.14)	(0.04)
Other Asian	0.39***	-0.05	-0.12***
	(0.10)	(0.11)	(0.03)
African American	0.12	0.08	0.01
	(0.25)	(0.31)	(0.07)
Hispanic	0.27	0.17	0.11*
	(0.17)	(0.18)	(0.06)
Native American	-0.11	0.54	0.08
	(0.37)	(0.38)	(0.13)
Race Other	-0.12	-0.07	-0.11*
	(0.21)	(0.26)	(0.06)
Constant	1.433***	0.12	0.32***
	(0.171)	(0.21)	(0.06)
Observations	1,429	1,344	1,247
R-squared			0.19
Zero Inflation Predictor			
Grant Awards Total		-5.75***	

	(1.08)
Constant	4.17***
	(1.01)

***p<0.01, **p<0.05, *p<0.10; $ in millions. Biology is the base discipline and white is the base race/ethnicity. NB = Negative Binomial, OLS = Ordinary Least Squares, ZINB = Zero inflated negative binomial. Number of grant awards used to predict zero values in largest grant in dollars.

Table A20: Co-PI Grant Outcomes

	Submissions	**Awards**	**Success Rate**
VARIABLES	NB	ZINB	OLS
Received Admin. Sup.	-0.11	-0.20	-0.04
	(0.10)	(0.12)	(0.04)
Administrative Stress	-0.01	0.00	0.01
	(0.04)	(0.05)	(0.02)
# Courses Taught	-0.01	-0.06*	-0.03**
	(0.03)	(0.03)	(0.01)
# Committees	0.10***	0.05***	-0.01**
	(0.02)	(0.02)	(0.01)
5-yr Pub. Avg	0.03***	0.02***	-0.00
	(0.01)	(0.01)	(0.00)
Assoc. Prof.	-0.05	0.21**	0.06*
	(0.09)	(0.11)	(0.03)
Full Prof.	-0.30***	0.15	0.08**
	(0.09)	(0.11)	(0.03)
University Reputation	0.03	0.14***	0.02
	(0.04)	(0.05)	(0.02)
Female	-0.10	-0.00	0.01
	(0.06)	(0.08)	(0.02)
Prob. First Sub. Awrdd	-0.01***	0.00	0.00***
	(0.00)	(0.00)	(0.00)
# Doc. Stu. Fndd Proj.	0.08***	0.07***	0.01*
	(0.01)	(0.02)	(0.00)
Chemistry	0.24**	-0.26*	-0.05
	(0.11)	(0.15)	(0.04)
Computer Science	0.72***	0.37***	0.02
	(0.11)	(0.14)	(0.05)
Earth & Atmosphere	0.62***	0.31**	0.02
	(0.11)	(0.14)	(0.04)
Electrical Engineering	0.62***	0.14	-0.02
	(0.12)	(0.15)	(0.05)
Physics	0.38***	0.21	0.07*
	(0.11)	(0.14)	(0.04)
South Asian	-0.06	-0.13	-0.02
	(0.14)	(0.17)	(0.05)
Other Asian	0.10	-0.26*	-0.06
	(0.11)	(0.13)	(0.04)
African American	0.38	0.12	-0.10
	(0.28)	(0.35)	(0.09)
Hispanic	0.33*	0.18	0.06
	(0.19)	(0.21)	(0.07)
Native American	-0.25	0.05	0.17
	(0.42)	(0.47)	(0.16)
Race Other	-0.01	0.24	-0.04
	(0.24)	(0.28)	(0.10)
Constant	-0.09	-0.65***	0.36***
	(0.20)	(0.25)	(0.08)
Observations	1,424	1,266	1,014
R-squared			0.08
Zero Inflation Predictor			
Grant Awards Total		-22.83	

	(3.61)
Constant	21.37
	(3.61)

***p<0.01, **p<0.05, *p<0.10; $ in millions. Biology is the base discipline and white is the base race/ethnicity. NB = Negative Binomial, OLS = Ordinary Least Squares, ZINB = Zero inflated negative binomial. Number of grant awards used to predict zero values in largest grant in dollars.

Table A21: Correlations

	Submissions	Awards	Success Rate	Grant $ Tot.	Grant $ Large.	Received Admin.	Requested Admin.	Deprt. Reputation
Submissions	1							
Awards	0.84	1						
Success Rate	-0.10	0.22	1					
Grant $ Tot.	0.12	0.15	0.13	1				
Grant $ Large.	0.03	0.05	0.09	0.62	1			
Received Admin.	-0.02	-0.04	-0.04	0.03	0.03	1		
Requested Admin.	0.01	-0.03	-0.09	0.05	0.07	0.70	1	
Deprt. Reputation	0.02	0.06	0.12	0.03	0.03	0.14	0.00	1
Admin. Str.	0.02	0.04	0.08	0.02	0.05	-0.06	0.02	-0.01
# Courses	-0.01	0.00	-0.09	-0.07	-0.05	-0.09	-0.03	-0.10
# Committees	0.09	0.06	-0.01	0.01	0.04	-0.03	0.03	-0.03
5-yr Pub Avg.	0.16	0.14	0.10	0.04	0.03	0.00	0.01	0.09
Associate Prof.	0.00	-0.03	-0.02	-0.02	-0.04	-0.04	-0.02	-0.08
Full Prof.	0.03	0.12	0.20	0.10	0.10	-0.08	-0.07	0.15
Uni. Reputation	0.02	0.05	0.06	0.02	0.01	0.11	0.04	0.68
Female	-0.03	-0.03	-0.02	-0.03	-0.01	0.05	0.11	0.02
1st Grant Prob.	-0.06	0.06	0.28	0.06	0.07	0.06	0.01	0.11
# Stu Funded	0.17	0.16	0.12	0.10	0.07	0.03	0.04	0.05
Chemistry	0.02	-0.05	-0.10	-0.04	-0.02	0.01	-0.02	-0.10
Computer Science	0.00	-0.02	-0.06	-0.01	-0.02	0.06	0.07	-0.06
Earth & Atmosph	0.02	0.09	0.11	-0.02	0.00	-0.05	-0.06	0.11
Electrial Eng.	0.00	-0.01	-0.02	0.03	-0.03	-0.06	-0.02	0.00
Physics	-0.05	-0.03	0.09	0.05	0.02	0.01	0.01	0.02
South Asian	0.02	0.00	-0.03	0.00	-0.01	-0.02	-0.03	-0.01
Other Asian	0.05	-0.02	-0.12	-0.05	-0.03	-0.02	0.02	-0.04
African Amer.	0.00	-0.01	-0.04	-0.01	-0.01	-0.03	0.02	-0.03
Hispanic	0.02	0.01	0.03	0.00	-0.01	0.02	0.00	0.06
Native American	0.00	0.02	0.05	0.01	0.06	-0.01	-0.03	-0.01
Race Other	0.01	0.00	-0.02	0.14	-0.01	0.01	0.01	-0.02

	Admin. Str.	# Courses	# Committees	5-yr Pub Avg.	Associate Prof.	Full Prof.	Uni. Reputation	Female
Admin. Str.	1							
# Courses	-0.06	1						
# Committees	0.33	0.10	1					
5-yr Pub Avg.	0.02	-0.09	0.09	1				
Associate Prof.	0.00	0.15	0.02	-0.03	1			
Full Prof.	0.16	-0.06	0.24	0.17	-0.56	1		
Uni. Reputation	-0.03	-0.08	-0.07	0.06	-0.09	0.10	1	
Female	0.04	-0.07	0.11	-0.04	-0.03	-0.01	0.02	1
1st Grant Prob.	0.06	-0.07	0.04	0.07	-0.07	0.12	0.09	-0.04
# Stu Funded	0.12	-0.12	0.11	0.26	-0.04	0.18	0.05	0.00
Chemistry	0.04	-0.03	0.09	0.09	-0.01	0.00	-0.11	0.01
Computer Science	-0.06	0.00	-0.07	-0.14	0.00	0.01	0.00	0.00
Earth & Atmosph	0.06	0.10	0.00	-0.08	-0.02	0.04	0.07	0.03
Electrial Eng.	-0.09	0.10	-0.06	-0.05	0.08	-0.05	0.03	0.00
Physics	0.02	-0.08	0.00	0.18	-0.02	-0.01	-0.01	-0.01
South Asian	-0.09	0.03	-0.06	0.02	0.01	-0.06	0.01	-0.03
Other Asian	-0.08	-0.04	-0.11	0.00	0.00	-0.09	-0.03	0.01
African Amer.	0.04	0.07	-0.01	-0.05	0.04	-0.05	-0.02	0.03
Hispanic	0.02	0.01	0.04	0.04	0.02	-0.04	0.07	-0.01
Native American	0.00	0.04	0.03	-0.03	0.01	-0.02	-0.05	-0.02
Race Other	0.00	-0.03	-0.03	-0.02	-0.03	0.01	-0.05	0.01

	1st Grant Prob.	# Stu Funded	Chemistry	Computer Science	Earth & Atmosph	Electrial Eng.	Physics	South Asian
1st Grant Prob.	1							
# Stu Funded	0.03	1						
Chemistry	-0.06	0.17	1					
Computer Science	-0.03	0.04	-0.21	1				
Earth & Atmosph	0.11	-0.18	-0.23	-0.21	1			
Electrial Eng.	-0.05	0.12	-0.20	-0.18	-0.21	1		
Physics	0.14	-0.03	-0.21	-0.19	-0.21	-0.18	1	
South Asian	-0.07	0.00	-0.04	0.06	-0.10	0.12	0.04	1
Other Asian	0.00	0.01	0.01	0.06	-0.08	0.10	0.00	-0.08
African Amer.	0.01	-0.06	0.01	-0.03	-0.01	0.04	-0.03	-0.03
Hispanic	0.06	-0.01	0.00	-0.03	-0.02	0.01	0.01	-0.04
Native American	-0.05	0.06	0.03	0.00	0.06	-0.03	-0.03	-0.02
Race Other	0.01	0.03	-0.04	-0.03	-0.02	0.05	0.03	-0.03

	Other Asian	African Amer.	Hispanic	Native American	Race Other
Other Asian	1				
African Amer.	0.02	1			
Hispanic	-0.06	-0.02	1		
Native American	0.02	0.10	-0.01	1	
Race Other	-0.04	-0.01	0.06	-0.01	1

APPENDIX B

SUPPLEMENTAL MATERIAL FOR ESSAY 2

Table B1: Correlations

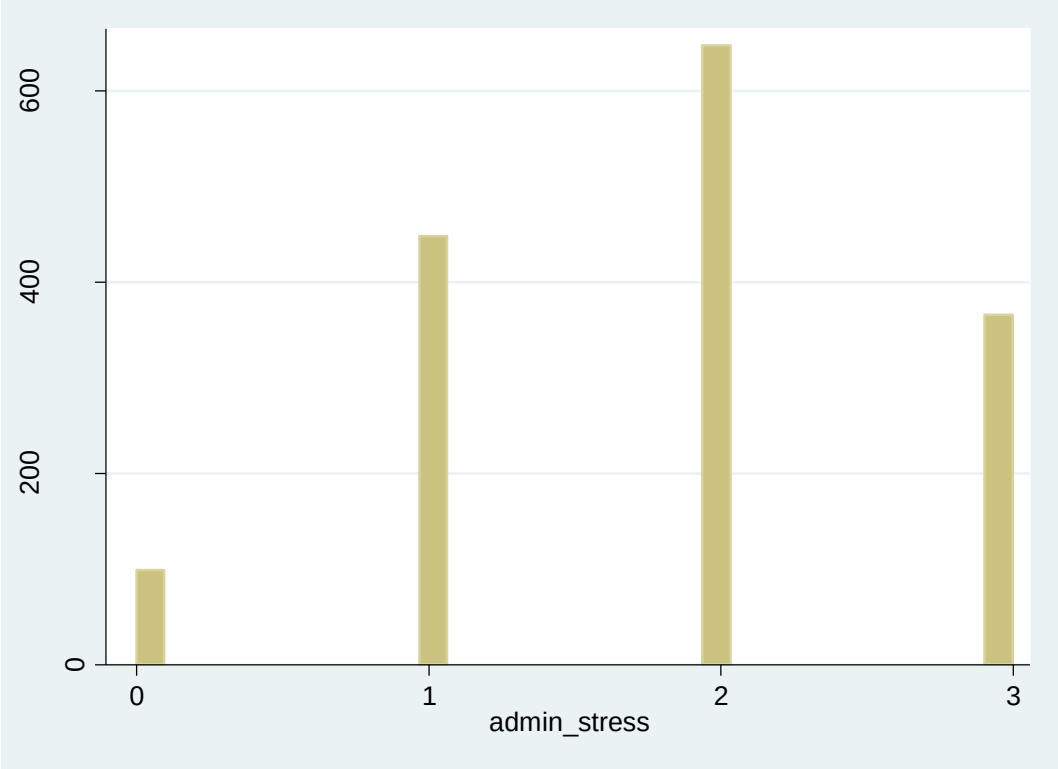
	Admin Stress	Cler. Int.	Exec. Int.	Dept. Chair	Dean	Cent. Dir.	Assist. Prof.	Assoc. Prof.
Admin Stress	1							
Clerical Intensity	0.04	1						
Executive Intensity	0.01	0.14	1					
Dept. Chair	0.22	-0.01	0.00	1				
Dean	0.09	-0.01	0.00	-0.02	1			
Center Director	0.10	-0.01	0.02	0.01	0.01	1		
Assist. Prof.	-0.18	0.02	-0.03	-0.12	-0.05	-0.13	1	
Assoc. Prof.	0.02	0.03	0.03	-0.06	-0.05	-0.06	-0.37	1
Undergrad FTE	-0.08	-0.03	0.05	-0.03	0.03	0.00	-0.01	0.03
Grad. FTE	-0.02	0.00	0.03	-0.03	0.03	0.00	0.00	-0.04
Total Workers	-0.02	-0.23	-0.07	-0.02	0.01	0.01	-0.02	-0.08
Female	0.03	0.00	-0.04	-0.01	0.01	-0.02	0.04	-0.02
South Asisan	-0.06	0.00	0.00	0.01	-0.02	-0.01	0.05	0.02
Other Asian	-0.07	0.03	0.00	-0.04	-0.03	-0.01	0.12	-0.02
Black	0.04	0.02	-0.03	-0.02	-0.01	0.00	0.03	0.05
Hispanic	0.03	-0.01	0.02	-0.01	-0.01	0.00	0.02	0.04
Nat. American	-0.02	0.04	0.01	0.04	-0.01	0.03	0.00	0.02
Other Race	-0.01	-0.03	-0.01	0.00	-0.01	0.01	0.01	-0.04
Private Control	0.08	-0.06	-0.19	0.00	0.00	-0.01	0.04	-0.11
Chemistry	0.04	0.01	-0.01	-0.02	-0.02	-0.08	0.02	0.00
Computer Science	-0.05	0.04	-0.01	0.01	-0.04	0.04	-0.01	-0.01
Earth & Atmosphere	0.03	-0.04	0.01	0.03	0.05	-0.02	-0.02	-0.01
Electrical Engin.	-0.07	0.05	-0.06	0.02	-0.01	0.06	0.01	0.06
Physics	0.03	-0.01	0.06	0.01	0.02	-0.01	0.02	-0.03

	Ugrad FTE	Grad. FTE	Ttl Wrkrs	Female	South Asisan	Other Asian	Black	Hispanic
Undergrad FTE	1							
Grad. FTE	0.49	1						
Total Workers	0.54	0.73	1					
Female	-0.02	-0.01	0.00	1				
South Asisan	0.03	0.03	0.01	-0.03	1			
Other Asian	0.02	0.02	0.02	-0.01	-0.07	1		
Black	-0.06	-0.06	-0.07	0.04	-0.03	0.01	1	
Hispanic	0.04	0.05	0.04	-0.01	-0.04	-0.05	-0.02	1
Nat. American	-0.01	-0.04	-0.04	0.00	-0.02	0.01	0.08	-0.01
Other Race	-0.04	0.01	-0.02	0.00	-0.03	-0.01	-0.01	0.04
Private Control	-0.55	-0.06	-0.10	-0.02	-0.04	-0.02	0.04	-0.03
Chemistry	-0.06	-0.05	-0.08	0.03	-0.02	-0.01	0.01	0.00
Computer Science	-0.04	0.03	-0.01	-0.01	0.06	0.05	-0.03	-0.02
Earth & Atmosphere	0.02	-0.03	0.03	0.03	-0.09	-0.08	-0.02	-0.01
Electrical Engin.	0.06	0.03	0.03	-0.02	0.09	0.09	0.04	0.01
Physics	0.01	0.04	0.04	-0.02	0.05	0.02	-0.02	-0.01

	Nat. Amer.	Other Race	Private	Chem	Comp Sci	E & A	EE	Phys
Nat. American	1							
Other Race	-0.01	1						
Private Control	0.01	0.03	1					

Chemistry	0.04	-0.03	0.02	1				
Computer Science	0.00	-0.02	-0.01	-0.21	1			
Earth & Atmosphere	0.04	-0.02	-0.05	-0.22	-0.21	1		
Electrical Engin.	-0.03	0.05	0.00	-0.18	-0.17	-0.18	1	
Physics	-0.03	0.02	0.02	-0.21	-0.20	-0.21	-0.18	1

Figure B1: Histogram of Stress from Administrative Responsibilities



Notes: The dependent variable is relatively normal, with slight skew to right, making it fit with the assumptions of statistical theory.

Table B2: Alternative Models Predicting Stress from Administrative Responsibilities

VARIABLES	M4a OLS	M4b Multi-Level
Staff Intensity	0.04***	0.04***
	(0.02)	(0.02)
Executive Intensity	0.00	0.00
	(0.00)	(0.00)
Department Chair	0.95***	0.95***
	(0.07)	(0.11)

Dean	0.86***	0.86***
	(0.14)	(0.24)
Center Director	0.31***	0.34***
	(0.09)	(0.09)
Assistant Prof.	-0.28***	-0.28***
	(0.05)	(0.05)
Associate Prof.	-0.00	-0.00
	(0.05)	(0.05)
Log Undergrad FTE	-0.07*	-0.07*
	(0.04)	(0.04)
Log Graduate FTE	-0.00	-0.00
	(0.05)	(0.05)
Log Total Workers	0.06	0.05
	(0.06)	(0.06)
Female	0.06	0.06
	(0.04)	(0.04)
South Asian	-0.16*	-0.16*
	(0.09)	(0.09)
Other Asian	-0.08	-0.08
	(0.07)	(0.07)
Black	0.35*	0.36*
	(0.19)	(0.19)
Hispanic	0.23*	0.23*
	(0.13)	(0.13)
Native American	-0.47	-0.47
	(0.33)	(0.31)
Other Race	-0.06	-0.06
	(0.16)	(0.16)
Private Control (vs. Public)	0.12**	0.12**
	(0.06)	(0.06)
Chemistry	0.08	0.08
	(0.07)	(0.07)
Computer Science	-0.11	-0.11
	(0.07)	(0.07)
Earth & Atmosphere	0.03	0.03
	(0.07)	(0.07)
Electrical Engineering	-0.17**	-0.17**
	(0.05)	(0.08)
Physics	0.05	0.05
	(0.07)	(0.07)
Constant	1.93***	1.93***
	(0.35)	(0.35)
Observations	1,558	1,558
R-squared	0.12	

Number of groups	148

*** p<0.01, ** p<0.05, * p<0.1. Biology is the base field. Caucasian is the base race/ethnicity. Base rank is full professor. OLS = Ordinary Least Squares.

Post-estimation Tests

Model 4 (Ordered Logit):

- Post-estimation test of Model 4 reveal the difference between the coefficients for staff and executive intensity are statistically different at the p<0.05 level.
    - Chi Squared = 5.14 (p=0.02)

Model 4a (OLS):

- Post-estimation test of Model 4a reveal the difference between the coefficients for staff and executive intensity are statistically different at the p<0.05 level.
    - Chi Squared = 5.48 (p=0.02)

Model 4b (Multilevel):

- Post-estimation test of Model 4a reveal the difference between the coefficients for staff and executive intensity are statistically different at the p<0.05 level.
    - Chi Squared = 5.50 (p=0.02)
- Likelihood-ratio tests of Model 4a and 4b reveal the OLS model to be a better fit to the data than a multi-level model.
    - Chi Squared = 0.06 (p=.40)

Table B3: Multicollinearity of Model 4a

Variable	VIF	1/VIF
Total Workers	2.86	0.35
Grad FTE	2.48	0.40
Undergrad FTE	2.36	0.42
Earth & Atmosphere	1.71	0.59
Private Control	1.70	0.59
Chemistry	1.69	0.59
Computer Science	1.68	0.60
Physics	1.67	0.60
Electrical Engineering	1.59	0.63
Assistant Professor	1.27	0.79
Associate Professor	1.25	0.80
Staff Intensity	1.16	0.86
Executive Intensity	1.08	0.92
Other Asian	1.05	0.95
South Asian	1.05	0.95

Center Director	1.05	0.96
Department Chair	1.04	0.96
Black	1.02	0.98
Native American	1.02	0.98
Dean	1.02	0.98
Hispanic	1.02	0.98
Other Race	1.02	0.98
Female	1.01	0.99

Factor analysis of the job stressors

Table B4: *Job Stress* Factor Loadings

Variable	Factor 1	Factor 2	Factor 3	Uniqueness
Administrative Responsibilities	0.24	0.32	-0.01	0.84
Relationships with Colleagues	0.23	0.26	0.04	0.88
Publishing Demands	0.65	-0.12	0.02	0.56
Teaching Responsibilities	0.55	0.00	-0.03	0.69
Time Allocation Between Work and Family	0.54	0.05	-0.03	0.70
Demands for Obtaining External Research Funding	0.50	-0.17	0.03	0.72

- **Number of items in the scale:** 6
- **Scale reliability coefficient:** 0.6136

Multilevel Modeling

The multi-level model building process began with an unconditional model for the dependent variable from which variance estimates yielded an intraclass correlation of .01, signifying that university level differences accounted for 1% of the variation in faculty stress from administrative responsibilities. This number indicates very low variation in stress across universities making the dependent variable not particularly suitable for multilevel modeling at the university and individual level.

Table B5: Unconditional Model

VARIABLES	M4c Uncond
Constant	1.82***
	(0.02)
Observations	1,560
Number of groups	149
Level 1 Variance	0.10
	(0.05)
Level 2 Variance	0.85
	(0.02)

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Intra-class Correlation Calculation

$$\frac{.10^2}{.10^2 + .85^2} = .01$$

APPENDIX C

SUPPLEMENTAL MATERIAL FOR ESSAY 3

Table C1: Correlations

	Time Satis.	Global Satis.	Role Clarity	Inst. Support	Cleric. Satis.	Admin. Appoint.	Num. Comm. Sat.	Assist. Prof.
Time Satis.	1							
Global Satis.	0.48	1						
Role Clarity	0.30	0.40	1					
Inst. Support	0.53	0.51	0.3646	1				
Cleric. Satis.	0.41	0.43	0.32	0.44	1			
Admin. Appoint.	0.03	0.11	0.06	0.04	0.03	1		
Num. Comm. Sat.	0.56	0.34	0.22	0.44	0.28	-0.02	1	
Assist. Prof.	-0.02	0.00	0.04	0.05	0.02	-0.21	0.05	1
Assoc. Prof.	-0.15	-0.09	-0.03	-0.09	-0.06	0.01	-0.11	-0.36
Full Prof.	0.16	0.08	0.00	0.04	0.04	0.15	0.07	-0.42
Salary	0.18	0.11	0.02	0.09	0.12	0.21	0.09	-0.38
Num Courses. Sat	0.47	0.36	0.19	0.33	0.29	0.06	0.29	-0.03
Ext. Fund. Exp. Sat.	0.37	0.37	0.24	0.35	0.44	0.02	0.27	0.00
Nat. American	-0.02	-0.02	-0.01	-0.02	-0.01	0.03	-0.02	0.01
Asian	0.05	-0.04	0.02	0.08	0.03	-0.03	0.08	0.06
Black	-0.02	0.06	-0.03	-0.03	0.02	0.01	-0.04	-0.11
Hispanic	0.03	-0.01	0.06	-0.02	0.00	0.00	0.00	0.07
White	-0.03	-0.04	0.00	-0.02	-0.04	-0.01	-0.02	0.04
Other Race	-0.03	-0.04	-0.03	-0.02	-0.05	0.02	-0.02	-0.01
Multiracial	-0.02	-0.01	-0.01	-0.02	-0.02	0.01	0.00	0.01
Age	0.16	0.05	-0.01	0.02	0.02	0.11	0.09	-0.50
Enrollment	0.02	-0.05	0.01	0.00	0.03	0.05	-0.01	-0.04
Private Control	0.01	0.10	0.01	0.04	0.07	-0.02	0.02	-0.04
Female	-0.13	-0.06	-0.02	-0.11	-0.09	0.00	-0.10	0.09
Married	0.01	-0.01	0.00	-0.02	-0.02	0.04	0.01	-0.06
WL Balance	0.61	0.40	0.25	0.54	0.34	-0.04	0.46	-0.01
Inst. Supp. Sat.	0.39	0.45	0.30	0.46	0.53	0.06	0.25	0.05

	Assoc. Prof.	Full Prof.	Salary	Num Courses. Sat	Ext. Fund. Exp. Sat.	Nat. American	Asian	Black
Assoc. Prof.	1							
Full Prof.	-0.69	1						
Salary	-0.31	0.60	1					
Num Courses. Sat	-0.08	0.10	0.13	1				
Ext. Fund. Exp. Sat.	-0.10	0.10	0.15	0.28	1			
Nat. American	-0.01	0.00	-0.01	-0.02	-0.02	1		
Asian	0.01	-0.06	0.02	-0.03	-0.01	-0.02	1	
Black	-0.05	0.13	0.07	0.06	0.05	-0.16	-0.60	1
Hispanic	0.04	-0.09	-0.11	-0.02	-0.02	-0.02	-0.07	-0.47
White	0.03	-0.06	-0.04	-0.05	-0.04	-0.02	-0.06	-0.40
Other Race	-0.01	0.02	0.01	-0.03	-0.03	-0.01	-0.02	-0.17
Multiracial	0.01	-0.02	-0.03	-0.01	-0.02	-0.01	-0.03	-0.25
Age	-0.17	0.55	0.39	0.08	-0.03	0.02	-0.11	0.10
Enrollment	0.01	0.03	0.13	0.09	-0.04	0.00	0.02	0.03
Private Control	-0.03	0.06	0.14	0.03	0.07	-0.02	-0.01	0.02
Female	0.10	-0.16	-0.20	-0.05	-0.07	0.02	-0.05	-0.02
Married	0.02	0.03	0.02	0.00	-0.03	0.02	-0.04	0.01
WL Balance	-0.17	0.17	0.18	0.38	0.35	-0.02	0.08	-0.01
Inst. Supp. Sat.	-0.06	0.02	0.07	0.31	0.49	0.00	-0.02	0.05

	Hispanic	White	Other Race	Multiracial	Age	Enrollment	Private Control	Female
Hispanic	1							

White	-0.04	1						
Other Race	-0.02	-0.02	1					
Multiracial	-0.03	-0.02	-0.01	1				
Age	0.00	-0.05	0.02	-0.04	1			
Enrollment	-0.07	0.02	0.00	-0.03	0.02	1		
Private Control	-0.04	0.01	0.02	0.02	0.01	-0.50	1	
Female	0.07	0.02	-0.03	0.03	-0.10	-0.03	0.00	1
Married	0.03	-0.02	0.01	0.02	0.11	0.00	0.00	0.07
WL Balance	-0.02	-0.03	-0.01	-0.03	0.08	0.02	0.02	-0.18
Inst. Supp. Sat.	-0.01	-0.03	-0.04	-0.01	-0.02	-0.02	0.10	-0.03

	Married	WL Balance	Inst. Supp. Sat.
Married	1		
WL Balance	-0.01	1	
Inst. Supp. Sat.	-0.03	0.33	1

Factor Loadings

Table C2: *Global Job Satisfaction* Factor Loadings

Variable	Factor Loading	Uniqueness
Department Satisfaction	0.70	0.52
Institution Satisfaction	0.70	0.52

Table C3: *Satisfaction with Time Allocations* Factor Loadings

Variable	Factor 1 Loadings	Factor 2 Loadings	Uniquenes s
Teaching Time Satisfaction	0.55	0.17	0.67
Research Time Satisfaction	0.59	0.14	0.63
Service Time Satisfaction	0.71	-0.12	0.49
Outreach Time Satisfaction	0.54	0.01	0.71
Administrative Tasks Satisfaction	0.62	-0.17	0.59

Table C4: *Clerical Satisfaction* Factor Loadings

Variable	Factor Loadings	Uniqueness
Grant Support Pre-award Satisfaction	0.71	0.5
Grant Support Post-award Satisfaction	0.74	0.45
Clerical / administrative Support Satisfaction	0.45	0.8

Model Equation

The final multi-level models (Tables 8 and 9) took the following form with 'i' indicating individual level, and 'j' indicating university level, u_{0j} representing university error and ε_{ij} respresenting individual error:

$$Dependent\ Variable_{ij} = \gamma_0 + \gamma_1(role\ clarity_{ij}) + \gamma_2(insitutional\ support_{ij}) + \gamma_{3\ldots}(other\ control\ variables_{j\,\&\,ij}) + u_{0j} + \varepsilon_{ij}$$

Unconditional Models and Intra-class Correlation Calculations

Table C5: Unconditional Model for *Global Job Satisfaction*

Variable	(13)
Constant	-0.00
	(0.03)
Observations	6,036
Number of groups	56
Level 1 Variance	0.19
	(0.02)
Level 2 Variance	0.76
	(0.01)

Notes: Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Intra-class Correlation Calculation

$$\frac{.19^2}{.19^2 + .76^2} = .06$$

Table C6: Unconditional Model for *Satisfaction with Time Allocations*

Variable	(14)
Constant	-0.03
	(0.02)
Observations	6,159
Number of groups	56
Level 1 Variance	0.14
	(0.02)
Level 2 Variance	0.85
	(0.01)

Notes: Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Intra-class Correlation Calculation

$$\frac{.14^2}{.14^2 + .85^2} = .03$$

OLS Linear Regressions and Likelihood Ratio Tests Comparing with Multilevel Models

Table C7: Ordinary Least Squares Regressions Predicting *Global Job Satisfaction*

Variable	(7)	(8)	(9)
Role Clarity for Faculty and Administrators	0.28***	0.17***	0.12***
	(0.01)	(0.01)	(0.01)
Institutional Support for Faculty Leaders		0.25***	0.13***
		(0.01)	(0.01)
Administrative Leadership Appointments			0.13***
			(0.02)
Number of Committees Satisfaction			0.04***
			(0.01)
Assistant Professor			0.00
			(0.03)
Associate Professor			-0.02
			(0.02)
Salary			0.00
			(0.01)
Clerical Satisfaction			0.10***
			(0.01)
Number of Courses Taught Satisfaction			0.09***
			(0.01)
Ext. Funding Expectations Satisfaction			0.04***
			(0.01)
Age			0.00
			(0.00)
Enrollment			-0.04***
			(0.01)
Private Control (vs. Public)			0.07***
			(0.03)
Female			0.02
			(0.02)
Marital Status			-0.00
			(0.01)
Time Balance Ability			0.05***
			(0.01)
Institutional Grant Support Satisfaction			0.08***
			(0.01)
Native American			-0.10
			(0.11)
Asian			-0.18***
			(0.03)
Black			-0.08**
			(0.04)
Hispanic			-0.07
			(0.05)
Other Race			-0.16
			(0.11)
Multiracial			0.01
			(0.07)
Constant	-0.84***	-1.20***	-1.68***
	(0.03)	(0.03)	(0.10)
Observations	6,036	6,036	5,590
R-squared	0.17	0.32	0.42

Notes: Base case for faculty rank is full professor, and for race is White. Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. Likelihood ratio test comparing fits of model 3 and model 9: Chi-Squared = 53.10; P-value = 0.00.

Table C8: Ordinary Least Squares Regressions Predicting *Satisfaction with Time Allocations*

Variable	(10)	(11)	(12)
Role Clarity for Faculty and Administrators	0.23***	0.09***	0.03***
	(0.01)	(0.01)	(0.01)
Institutional Support for Faculty Leaders		0.31***	0.07***
		(0.01)	(0.01)
Administrative Leadership Appointments			0.02
			(0.02)
Number of Committees Satisfaction			0.23***
			(0.01)
Assistant Professor			0.05*
			(0.03)
Associate Professor			-0.01
			(0.02)
Salary			0.01*
			(0.01)
Clerical Satisfaction			0.08***
			(0.01)
Number of Courses Taught Satisfaction			0.14***
			(0.01)
Ext. Funding Expectations Satisfaction			0.04***
			(0.01)
Age			0.01***
			(0.00)
Enrollment			-0.02*
			(0.01)
Private Control (vs. Public)			-0.08***
			(0.02)
Female			-0.02
			(0.02)
Marital Status			0.01
			(0.01)
Time Balance Ability			0.19***
			(0.01)
Institutional Grant Support Satisfaction			0.04***
			(0.01)
Native American			0.03
			(0.12)
Asian			0.04
			(0.03)
Black			0.13***
			(0.04)
Hispanic			0.01
			(0.04)
Other Race			-0.05
			(0.12)
Multiracial			-0.02
			(0.07)
Constant	-0.69***	-1.14***	-2.78***
	(0.03)	(0.03)	(0.10)
Observations	6,159	6,159	5,702
R-squared	0.09	0.29	0.56

Notes: Base case for faculty rank is full professor, and for race is White. Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. Likelihood ratio test comparing fits of model 6 and model 12: Chi-Squared = 5.01**;** P-value = 0.01

Tests for Multi-collinearity

Table C9: Multicollinearity Results from Model 9

Variable	VIF	1/VIF
Assistant Prof.	2.49	0.40
Associate Prof.	1.90	0.53
Annual Salary	1.86	0.54
Institutional Support	1.83	0.55
Age	1.76	0.57
Work Balance	1.73	0.58
Institutional Support Sat.	1.72	0.58
Clerical Satisfaction	1.62	0.62
Ext. Fund. Exp. Sat.	1.51	0.66
Private Control	1.46	0.69
Enrollment	1.46	0.69
# Committee Satisfaction	1.41	0.71
# Courses Satisfaction	1.29	0.78
Role Clarity Rules	1.23	0.81
Administrative Position	1.10	0.91
Gender	1.09	0.92
Asian	1.06	0.95
Black	1.05	0.96
Marital Status	1.03	0.98
Hispanic	1.02	0.98
Multiracial	1.01	0.99
Other Race	1.01	0.99
Native American	1.00	1.00

Table C10: Multicollinearity Results from Model 12

Variable	VIF	1/VIF
Assistant Prof.	2.47	0.41
Associate Prof.	1.90	0.53
Annual Salary	1.86	0.54
Institutional Support	1.83	0.55
Age	1.75	0.57
Work Balance	1.73	0.58
Institutional Support Sat.	1.72	0.58
Clerical Satisfaction	1.62	0.62
Ext. Fund. Exp. Sat.	1.51	0.66
Private Control	1.46	0.69
Enrollment	1.46	0.69
# Committee Satisfaction	1.41	0.71
# Courses Satisfaction	1.29	0.77
Role Clarity Rules	1.23	0.81
Administrative Position	1.10	0.91
Gender	1.09	0.92
Asian	1.06	0.95
Black	1.05	0.96
Marital Status	1.02	0.98
Hispanic	1.02	0.98
Multiracial	1.01	0.99
Other Race	1.01	0.99
Native American	1.01	0.99

Table C11: Harman Single Factor Test for All Variables

Variable	Factor1	Factor2	Factor3	Factor4	Factor5	Factor6
Satisfaction with Time Allocations	0.75	0.11	0.03	0.05	0.01	-0.01
Global Satisfaction	0.65	0.14	-0.10	0.05	0.06	0.03
Role Clarity Rules	0.42	0.18	-0.03	0.05	0.06	0.01
Institutional Support	0.68	0.22	-0.03	0.04	-0.04	0.02
Clerical Satisfaction	0.60	0.17	-0.08	0.06	0.01	0.01
Administrative Position	0.09	-0.16	0.05	0.15	0.03	0.01
# Committees Satisfaction	0.55	0.14	0.03	0.00	-0.03	-0.01
Assistant Professor	-0.07	0.60	-0.09	-0.78	0.03	0.00
Associate Professor	-0.31	0.37	-0.29	0.82	-0.07	0.00
Full Professor	0.36	-0.83	0.35	-0.19	0.05	0.00
Salary	0.33	-0.53	0.22	0.05	-0.06	0.01
# Courses Satisfaction	0.51	0.05	-0.06	0.06	0.02	0.01
Ext. Funding Satisfaction	0.55	0.11	-0.08	0.01	0.02	0.02
Native American	-0.04	0.02	0.16	0.02	0.11	0.02
Asian	0.03	0.29	0.56	0.04	-0.69	-0.30
White	0.08	-0.46	-0.87	-0.13	-0.04	-0.02
Black	-0.05	0.27	0.36	0.10	0.72	-0.42
Hispanic	-0.08	0.17	0.33	0.05	0.07	0.86
Other Race	-0.05	-0.02	0.21	0.01	0.03	-0.02
Multiracial	-0.05	0.10	0.20	0.04	0.16	0.16
Age	0.20	-0.55	0.17	0.19	0.09	-0.02
Enrollment	0.01	-0.07	0.01	0.05	-0.14	0.01
Private Control	0.10	-0.04	0.00	-0.02	0.07	0.05
Gender	-0.18	0.12	-0.07	0.00	0.09	0.00
Marital Status	-0.01	-0.07	0.01	0.06	0.06	-0.02
Work Balance	0.68	0.09	0.04	0.00	-0.05	0.00
Institutional Support Satisfaction	0.59	0.20	-0.13	0.04	0.05	0.04