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Carnegie Classification of Institutions of Higher Education & Perceived Administrative Biases in Funding Review Processes

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Carnegie Classification of Institutions of Higher Education
& Perceived Administrative Biases in Funding Review Processes

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Dedication

To Stephen and John Thomas:

My precious sons who are the center of my world, the heart of my heart, and the reason I live. Thank you for sharing this journey with me and keeping me real. You will forever be the strong ones who held it together while I was "that mom" studying in the baseball stands, forgave me when the laundry was not done, learned how to make easy mac and peanut butter sandwiches while I was in class or working crazily against a deadline, and let me slide while I was in the "middle of my mess." The moments we have shared are unforgettable, including late night ice cream trips to celebrate papers being finished, being my audience during presentations, letting journal articles and policy textbooks be your bedtime stories, celebrating the passing of candidacy exams, and finally, the tight squeezes we shared when I told you my dissertation was approved and I was finally a doctor of public administration.

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Abstract

Previous research on social equity performance in the distribution of funding mechanisms across institutions of higher education has found biases in reputation and administrative capacity contributing to peer reviews during the funding process. Further research is now necessary to identify what contributes to these perceived biases and what enables an institution to signal competitiveness to funding sponsors based on the Principal-agent and resource dependency theories. A quantitative analysis was used to analyze data from publicly available datasets to explore relationships between Carnegie Classification rankings, institutional control types of public or private, administrative capacities, and sponsored research and foundation funding levels of institutions. The study population included Carnegie classifications of four-year institutions classified as Doctoral Universities, Master's Colleges and Universities, Baccalaureate Colleges, and Special Focus Four-Year. Data sources for this study included the Carnegie Classification 2018 Public Data Report, the National Science Foundation's Higher Education Research and Development FY2017 Survey, the U.S. Department of Education's Integrated Postsecondary Education Data Systems 2016-2017 report, and the Council for Advancement and Support of Education's Voluntary Support of Education FY2016-2017 report. Direct linear relationships were found between both rankings and administrative capacities of institutions and the institution's funding levels, as well as funding source distribution differing between control types of public or private. Narrowing the gap of funding distribution by better qualifying minority institutions and faculty researchers for funding competitiveness is important to the profession of research administration for social equity performance in sponsored research and foundation funding.

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Chapter 1: Introduction

Overview

Funding disparity is not a new struggle for today's institutions of higher education. An analysis of social equity performance in the distribution of funding mechanisms to institutions of higher education, both in sponsored research and foundation funding, reveals an equity gap that is widening. This equity gap contributes to the forecasts in higher education forums and mainstream media that indicate a number of higher education institutions will fold due to resource disparity over the next two decades. Previous research on social equity performance in the distribution of sponsored funding mechanisms to institutions of higher education has found administrative capacity and reputation to be significant contributors to bias considered by peer review panels during the funding process (Collins & Gerber, 2008). This study will concentrate on how sponsored funding agencies and philanthropic foundations distribute their funding to institutions of higher education. Narrowing the funding distribution gap by identifying competitive elements of the process to qualify minority institutions and faculty for better funding competitiveness is crucial to public administration and higher education for social equity performance in sponsored funding mechanisms. *Specifically, this study will analyze how institutional reputation of Carnegie Classification rankings, institutional control type by resource dependence, and size of administrative capacities relate to levels of sponsored research and philanthropic foundation funding.*

Background

According to a study conducted by the California Institute of Technology, 41 percent of all federal research and development funding went to only 20 academic research institutions prior

to 1982, therefore leaving the remaining 59 percent distributed between the remaining 570 institutions of higher education in the U.S. of that time (McGarity, 1994). The most recent National Science Foundation's Higher Education Research and Development Survey (NSF HERD), based on FY2016 data, reports that 71 percent of all national research and development expenditures are generated from research universities of very high research activity, leaving all other universities and colleges representing the remaining 29 percent of expenditures (Gibbons, 2018). As institutions of higher education are held accountable to meet expectations of potential students, parents, the government, and the workforce, rankings have taken a stronghold as indicators of success and perceived reputation. Hierarchy in higher education created by university ranking systems have shown to be influential in determining the social equity distribution between institutions and their ability to secure much needed resources. This also signals the presence of the Matthew effect in social inequities of higher education, as institutions with plentiful resources are in a better position to gain additional resources, while institutions who have historically lacked in resources are struggling to secure the minimum in a funding disparity environment (Li & Agha, 2015). The question remains what can be done to better the practices of the sponsored funding process to equitably distribute resources while still ensuring accountability of results and high impact outcomes for sponsors.

Carnegie Classification of Higher Education Institutions

Social construct is influenced by university ranking systems, affecting perception and bias of higher education institutions. The value of a ranking system is tied to its intended use, and classification is not only a way of seeing or of perception, but it is a social practice directing attention toward selected characteristics and away from others (McCormick & Zhao, 2005). This social practice results in competition within the higher education market. Benefits of such

systems include accountability in higher education with rankings serving as incentives for universities to provide effective and efficient services through market competition. Markets are democratic in that market competition forces the producer to respond to consumer demand with efficiency. Taking this one step further, market-based public management reforms work toward making government services more accessible, less costly, and of better quality (Deleon, 2005). Higher education is a public good or service, thus public accountability by market competition and market-based reforms boosts agency or institutional performance and builds public trust through institutions responding to the needs of the citizenry. National ranking systems provide a mechanism to boost accountability, transparency, and better services provided by U.S. institutions of higher education for the American public.

The primary ranking system focused on in this study is the Carnegie Classification of Higher Education Institutions, the dominant classification system for higher education in research and one of the oldest consistently published rankings recognized in classifying university programs and reputations for doctorate-granting universities (Kosar & Scott, 2018). The Carnegie Foundation for the Advancement of Teaching established the Carnegie Commission on Higher Education in 1967 to make recommendations on major issues faced by higher education in an attempt to analytically approach the forecasting of higher education's direction and future demands, ultimately leading to the development of the long-standing national university ranking system (McCormick & Zhao, 2005). Carnegie started out as a classification system, not a ranking, and it did not list the names of individual institutions in the first release. Two years later, the Commission published its detailed list of institutions by category for the purpose of supplying individuals and organizations engaged in research and higher education a tool for analytical research use (McCormick, 2013). While Carnegie was trusted as neutral, and the classification

system was not initially developed with intentions of becoming a ranking system, those using the system for decision making purposes quickly came to see it in competitive terms. Its original purpose was to call attention to the value of institutional diversity in the United States and to serve as a framework to assist researchers in performing comparisons of programs and institutions within a manageable system, but it has since had a homogenizing effect due to universities seeking to move up the ladder to research intensive recognition in pursuit of the prestige or reputation that accompanies this ranking and its associated funding opportunities (McCormick & Zhao, 2005). Updates to the system's design and methodology have helped establish it as a research tool that has served higher education's specific research needs and interests, and while it has been used through the years as a prolific tool in decision making processes for the education system, it has also evolved in use for allocation of scarce resources and to shape political perspectives. Perception and bias are now invoked from the Carnegie Classification system's use by not only higher education's personnel and administration, but also by state systems, foundations and other sponsored funders, membership organizations, news magazines, as well as legislators, faculty, state boards, accreditors, and trustees. The Carnegie Classification of Higher Education of Institutions of Higher Education's purpose is to provide a neutral and objective system for research and policy analysis in higher education, but the effects of the competitive market have influenced administrators, sponsors, and government officials and the use of the classification system. Since the system now reveals broad uses beyond its original purpose, although it is derived from positivist data methods, it cannot be perfectly neutral or objective. As holds true with other ranking systems, the Carnegie Classification reflects decisions made about what data is significant and is subject to the interpretive uses beyond its original design (McCormick & Zhao, 2005).

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Theoretical Framework and Role of Capacity

An in-depth look into the social inequities of sponsored research and foundation funding mechanisms reveals a theoretical framework around the Principal-agent and resource dependency theories thriving on ranking systems, historical funding patterns and sources, and administrative capacities that are feeding into the haves and the have nots of higher education. The funding process of sponsored research agencies and foundations can be explained as a Principal-agent relationship, with the principal being the funding sponsor and the agent being the institution of higher education. The principal looks to the performance of the institution to deliver desired outcomes as its agent, basing partnership decisions on national university rankings due to performance accountability. Institutions signal funding agencies during the funding process by expressing their credibility through their rankings and prestige (Morphew & Swanson, 2011). Institutions further signal their organizational commitment to sponsors by creating administrative capacity in the form of formal offices and staffing that serve direct functional roles in negotiating and managing the exchange relationship's demands of sponsored research and foundation funding. This is best explained by the resource dependency theory that is based on the principle of the institution being required to engage in transactions with external actors in its environment in order to acquire external resources such as the research and foundation funding (Tolbert, 1985). This increased dependency of institutions on external relationships for securing funding has resulted in administrative differentiation as organizations have created specialized administrative offices and positions to signal to sponsors that they can both adequately and competitively manage these relationships. This differentiation can be distinguished between public and private institutions, magnifying the role of the institutional control type as a factor in the source of secured sponsored funding. Public institutions have historically relied on governmental funding

for sustainability, whereas private institutions have had autonomy from governmental control and therefore have received less government funding, relying primarily on private funding from endowments, donors, and foundations. Thus, different expectations have historically been drawn between public and private institutional administrative structures and exchange relationships, distinguishing their dependency patterns by the magnitude of dependency on their sources of external funding, whether it be from sponsored research agencies or foundations (Tolbert, 1985). As ranking systems, historical funding patterns and sources, and administrative capacities feeding into the haves and the have nots of higher education are recognized and allowed to contribute to the funding process decisions and distribution, institutions affected by the disparity in social equity performance of funding mechanisms will typically be those which have less capacity in terms of resources and administrative infrastructure. Resource dependency theories of organizations, reflecting their funding patterns and sources, along with their capacities, combined with the impacts of university rankings on external actors, suggests that funding sponsors are sensitive to shifts in rankings over time. This correlation led Bastedo and Bowman (2011) to an empirical study of the influence of *US* News rankings on future research funding giving by government, foundations, and industry. This study found that the published college rankings and shifts in peer assessment of reputation showed significant effects on financial resources. This can also be tied back to the Matthew effect in which the institutions who have plentiful resources are in a better position to gain additional resources, while the institutions who have historically lacked in resources struggle to secure vital resources in a funding disparity environment (Li & Agha, 2015). Therefore, such institutions will be left lacking the ability to signal their capabilities of being able to competitively secure partnerships with sponsors.

As discussed in the theoretical framework, performance accountability is influenced by the evaluation of transaction costs for both the grantors and grantees. Collins and Gerber (2008) demonstrate with evidence that transaction costs including contract arrangements and negotiations, compliance reporting and monitoring, and administrative support, all which reflect the perception of the administrative capacity to fulfill sponsored project objectives for the principal, lean toward a larger and more justified budget for carrying out the project regardless of social need. Social equity becomes lost in priority during the funding process due to the need-response matching taking a backseat to efficacy that is translated by capacity and reputation. Social equity therefore suffers under competition-based funding models due to applicants with higher capacity and a reputation of prestige and performance gaining higher rank than the historically disadvantaged institutions in the evaluative process.

The need for this study arises as forecasts indicate that many institutions of higher education will fold due to funding resource disparity over the next two decades. One goal of this study is to address the funding distribution gap by identifying competitive elements of the funding process such as reputation of rankings, institutional control type, and size of administrative capacity of institutions. This will enable us as public administrators to work toward better qualifying minority institutions and faculty for funding competitiveness that is vital for not only their institutions, but also for their communities, of which have historically and disproportionately lacked in resources.

Definition of Terms & Concepts

The terms used in this study are derived from the field of higher education and research administration. They are designed to explain the study's concepts and are defined below:

Social equity is the third pillar of public administration and encompasses issues of complexity including fairness, justice, and equality. It is broadly defined to include race, gender, ethnicity, sexual preference, certain mental and physical conditions, language, and variations in economic circumstances (Frederickson, 2005). In this study, it encompasses the economic circumstances and positioning in U.S. institutions of higher education.

Institutions of higher education in this study are public and private educational institutions in the United States, including universities, colleges, and institutes of technology, and must be accredited in any state to provide a program of education beyond secondary education.

Classification ranking within the Carnegie Classification of Institutions of Higher Education is considered the "dominant classification system" for higher education research and is one of the oldest consistently published rankings that is recognized in classifying university programs and reputations for doctorate-granting universities (Kosar & Scott, 2018).

Reputation is the belief or opinion generally held about someone or something, and in this case is in reference to the institution of higher education. For the purposes of this study, reputation is tied to the institution's Carnegie Classification ranking.

Administrative capacity references an institution's ability to carry out administrative responsibility necessitated by a sponsored program or project with adequate human infrastructure, organizational structure or processes, and resources for achieving outcomes. For the purposes of this study, administrative capacity is the research capacity, or headcount of research faculty and all other research and development personnel.

Peer review panels are agency appointed panels or boards made up of individuals of expertise or mission consensus to review and critique funding proposals and rank or recommend

them for funding to the federal or state funding agencies. This also includes foundation or philanthropic agencies.

Philanthropic sponsors include organizations or individuals that make gifts, such as foundations and donors, to an institution of higher education to support research, programming, or institutional desires, causes, or needs. In this study, philanthropic sponsors are the *foundation granting sponsors*.

Sponsored funding agencies are external organizations, public or private, which undertake a contractual agreement through restricted funding mechanisms with an institution to sponsor research or an entrepreneurial activity.

The *sponsored funding process* is the organized process in which funding is obtained by institutions responding to a funding opportunity released by an agency or foundation. It is carried out by submission of a funding proposal or application to the sponsor, a review process carried out by the review panel, and the rejection or awarding of funds to the institution. The process also incorporates the steps in which foundations or individuals engage with an institution to gift or to endow funds.

Research and development expenditures are expended sponsored research funds at an institution directly associated with secured and restricted sponsored funding.

Control type of an institution is whether it is public or private. *Public institutions* are backed by public funds and controlled by the State, whereas *private institutions* are not operated by the government.

Research Questions and Hypotheses

This study analyzes federal, state, and institutional level reporting data to identify social equity gaps in external funding distribution to institutions of higher education and specifically how institutional reputation and administrative capacity correlates to funding decisions made by federal funding agencies and foundations. The desired results are to gain insight about what steps can be taken to bridge the funding distribution gap. As rankings have been found to directly affect the funding for research and development from sponsors including the government, industry, alumni, and foundations, it confirms that financial contributions to higher education are tied to reputation (Morphew & Swanson, 2011). Funding sponsors utilize rankings to be associated with the names of successful universities. In the field of higher education organizations, rankings drive professional assessment of reputation, and prestige is one of the most important factors in assessing organizational performance (Bastedo & Bowman, 2010). Carnegie doctoral research institutions are viewed as elite and top research universities, thus attracting sponsored investments due to the perceived benefits of being associated with these successful institutions. Thus, leading to the following research question and hypotheses:

Research Question 1: *Does an institution's Carnegie Classification ranking reflect its levels of sponsored research and foundation funding?*

Hypothesis 1: Research and development funding distribution is higher in Carnegie doctoral institutions compared to other four-year school Carnegie Classifications.

Hypothesis 2: Foundation funding distribution is higher in Carnegie doctoral institutions compared to other four-year school Carnegie Classifications.

Hypothesis 3: Foundation funding levels will increase as an institution's research and development funding increases.

Public and private universities have a historically long-standing tradition of relying on different sources of funding mechanisms. As public institutions of higher education have operated under state supervision and control, private institutions have had more autonomy from government control and have received less governmental financial support. Thus historically, public institutions have typically relied heavily on sources of government support including state appropriations, the Department of Education, and funding agencies for sponsored research, while private institutions have relied on tuition, endowments, gifts, and grants from private and philanthropic sources. Hence, different expectations have historically been drawn between public and private institutional administrative structures and interorganizational exchange relations, distinguishing their dependency patterns by the magnitude of dependency on their sources of external funding, whether from funding agencies or foundations (Tolbert, 1985). After examining institutional funding levels as related to the institution's Carnegie Classification, considering the institutional control type of public or private will help to analyze whether the *source* of external sponsored funding levels is correlated to the institution being either public or private, leading to the following research question:

Research Question 2: *Does an institution's control type of public or private relate to the source(s) of external funding levels it secures as sponsored research or foundation funding?*

Hypothesis 4: Distributions of sponsored research funding and foundation funding will differ based on institutional control type of public or private, with public institutions receiving more

sponsored research funding and private institutions receiving more philanthropic foundation funding.

Social equity suffers under competition-based funding models due to institutions with increased capacity and a reputation of prestige and performance holding higher rank than disadvantaged minorities in the review process. Demonstrated with evidence by Collins and Gerber (2008), performance accountability is influenced by evaluation of transaction costs for both the sponsors and the institutions, including costs such as contract arrangements and negotiations, compliance reporting and monitoring, and administrative support, all which reflect perceived administrative capacity that can be dedicated to fulfilling proposed objectives. Thus, leading to the following research question and hypotheses:

Research Question 3: *Does an institution's administrative capacity reflect its levels of research and foundation funding?*

Hypothesis 5: Research and development funding distribution will increase as institutional administrative capacities increase.

Hypothesis 6: Foundation funding distribution will increase as institutional administrative capacities increase.

While it is predicted that doctoral universities of research activity in the Carnegie Classification receive more funding based on biases of reputation and administrative capacity, it is important to identify if similar findings of bias affect institutional funding within the Carnegie Classification group itself.

Hypothesis 7: Funding level distributions will increase as institutions' administrative capacities increase in the Doctoral Universities Carnegie Classification group.

Data and Methodology

To test the research questions and hypotheses, a quantitative analysis will be used to analyze data taken from publicly available datasets including the National Science Foundation's Higher Education Research and Development FY2016 data collected through the FY2017 Survey (NSF HERD), the U.S. Department of Education's Integrated Postsecondary Education Data Systems (IPEDs) 2016-2017 report, the Council for Advancement and Support of Education's Voluntary Support of Education (VSE) FY2016-2017 report, and the Carnegie Classification 2018 Report (Gibbons, 2018). Variables for this study include the Carnegie Classifications of the four-year institutions in the study's population, their administrative capacity, institutional control (public or private), total research expenditures, and their total foundation funding. Carnegie classification and administrative capacity are independent variables, with Carnegie classification being a categorical, ordinal variable, and administrative capacity being a continuous variable at the ratio level. Institutional control of public or private also serves as an independent variable, being a categorical, nominal variable for this study. Research expenditures and foundation funding serve as the dependent variables with both being continuous at the interval level. Non-parametric tests, including the Kruskal-Wallis H Test, Spearman's *rho*, and Pearson's *r*, are preferred for this study due to the assumptions of both normal distribution and homogeneity of variances not being met by the dependent variables.

Organized Summary

The following chapters will begin with an analysis in Chapter 2 of existing literature surrounding social equity performance of sponsored funding mechanisms in higher education and contributing elements in the funding review process, including biases in reputation tied to

ranking systems, institutional control type, and institutional administrative capacity. Through

this analysis, a gap in the literature was found surrounding the relationship of secured sponsored

funding correlated with both research administrative capacity and reputation tied to the Carnegie

Classification of Higher Education Institutions, the *dominant classification system* for higher

education research. Although studies have been conducted on the effects of international and

media-based university ranking systems, there is a gap in studying the effects of *national*

university ranking systems, especially when tied to the social equity performance of sponsored

funding distribution mechanisms. Following the literature review is a quantitative methodology

in Chapter 3 to analyze how universities' reputation of Carnegie Classification rankings,

institutional control type, and size of administrative capacities relate to levels of sponsored

research and foundation or philanthropic funding. This methodology includes the sources of

publicly available datasets, key data points used in the research design, and the institutional

population of study. Results follow in Chapter 4 to answer the three research questions and

associated hypotheses. A discussion in Chapter 5 will follow based on the discussion of key

findings in a theoretical framework, limitations of the study, connection of findings to

recommendations for the funding process, and will conclude with a discussion on future research

that is to be considered as a result from this study.

Chapter 2: Review of Literature

Organization of the Literature Review

This literature review is divided into three sections. The first section provides the historical establishment and purpose of the Carnegie Classification of Higher Education Institutions, framing its longitudinal effects and contours on higher education trends, specifically the move from homogenizing categories toward a research-intensive focus. A number of themes emerged from the literature and are discussed in this section: 1) History of the Carnegie Classification of Higher Education Institutions, 2) Updates of the classification system, 3) Social practice and value of a classification system, and 4) Fundamental issues of the system. The second section analyzes the social equity performance of funding mechanisms in higher education, revealing disparities in distribution of funds, both in sponsored funding agencies and philanthropic foundation funding made to institutions. The themes that emerge in this section are as follows: 1) Principal-agent theory in external funding processes, 2) Resource dependency theory and the role of institutional control type, 3) Role of administrative capacity in sponsored funding decisions to higher education institutions, and 4) Reputation bias found in funding review panels. The third section explores previous studies focused on institutional reputation bias in agency peer reviews and foundation and philanthropic funding. The first study reviewed is that of Bastedo and Bowman (2011) focusing on an empirical study of the influence of the US News and World Report rankings on future research and development giving by government, foundations, and industry, and if alumni more readily donated to their alma mater. The second study is that of Li and Agha (2015) focusing on the success of peer-review panels in their ability to predict quality outcomes of proposed research applications to the National Institutes of Health (NIH) versus undermined biases of the researcher's institution and previous funding rates. This

literature review is then brought full circle by tying the original purpose of Carnegie in which it was created to forecast the future of higher education, to the current higher education forecast of institutional sustainability as it pertains to the "haves" and the "have-nots." An analysis of social equity performance in the distribution of funding mechanisms in institutions of higher education, both in sponsored funding agencies and philanthropic foundation funding, will reveal a funding gap that is widening based on institutional control type, capacity, and reputation.

Introduction

Funding disparity is not a new struggle for today's institutions of higher education. Forty-one percent of all federal research and development funding went to 20 academic research institutions prior to 1982, therefore leaving the remaining 59 percent distributed between the remaining 570 institutions according to a study conducted by the California Institute of Technology (McGarity, 1994). The most recent National Science Foundation's Higher Education Research and Development Survey (NSF HERD), based on FY2016 data, reports that 71 percent of all national research and development expenditures are generated from research universities of very high research activity, leaving all other universities and colleges representing the remaining 29 percent of expenditures (Gibbons, 2018). As reflected, funding disparity is a struggle for institutions of higher education seeking both sponsored funding agency and philanthropic foundation funding, as studies have been carried out to determine models for achieving more equitable funding competitions and review mechanisms for better distribution.

Previous research on social equity performance in the distribution of funding mechanisms in institutions of higher education has found administrative capacity and reputation to be significant contributors considered by peer reviews and panels during the funding process

(Collins & Gerber, 2008). Further research is now necessary to identify what contributes to perceived reputations and administrative capacities during the review process of federal funding agencies and foundation or philanthropic sponsors. Narrowing the funding distribution gap by identifying these competitive elements and qualifying the minority institutions and faculty researchers for better funding competitiveness is crucial to both public administration and higher education for social equity performance in federal and philanthropic funding.

An analysis of social equity performance in the distribution of funding mechanisms in institutions of higher education, both in competitive research and foundation or philanthropic funding, reveals a funding gap that is widening. Forecasts in higher education forums and mainstream media are indicating that a number of higher education institutions will fold due to resource disparity over the next two decades. In Forbes, Harvard Business School Professor Clayton Christensen's prediction references that 50 percent of colleges and universities will fold in the next decade due to declining enrollments, large fixed costs, and disruptive innovations such as the dominance of online programs emerging in higher education. Further, vulnerabilities are the biggest in small institutions located in rural areas of the Northeast and the Midwest where enrollment decline is slated to occur (Horn, 2018). In the Washington Post, Moody's Investors Service reports a growing divide in higher education with large public research universities and other top public schools holding more than 90 percent of the total cash and investments in the higher education sector, as well as the top quarter of colleges and universities among private institutions holding 85 percent of all cash and investments (Selingo, 2018). While closures and bankruptcies of higher education institutions are based on declining enrollments and revenue streams, and not research and foundation funding streams, it clarifies the social equity gap of resources between the large prestigious universities and the small rural institutions. This further

affects reputation and resources to build administrative capacity of the smaller and minority institutions. Contributing elements to funding competitiveness must be identified before one is able to work toward qualifying the minorities affected by the funding distribution disparity. One such element is that of the institution's Carnegie Classification. Does an institution of higher education's classification ranking in the Carnegie Classification of Institutions of Higher Education contribute to perceived reputation and administrative capacity biases that are considered by agency review panels and philanthropic sponsors during the sponsored funding review process? A current study of research and development expenditures and secured foundation or philanthropic funding reported by institutions, focusing between Carnegie Classification rankings and administrative capacities, will reveal a lack in social equity today based on disproportionate percentage of funding mechanisms distributed between institutions. This further supports the elements of reputation and administrative capacity used in research and philanthropic funding decisions, and it will help in gaining more insight to what contributes to the perceived elements of reputation and capacities in funding models.

Carnegie Classification of Higher Education Institutions

History of Carnegie. Forecasting higher education's direction and its future demands is not a new issue in the field of U.S. higher education's administration and mainstream media, as it has been approached analytically since the 1960's starting with The Carnegie Foundation for the Advancement of Teaching. The Carnegie Foundation for the Advancement of Teaching established the Carnegie Commission on Higher Education in 1967 to make recommendations on major issues faced by higher education. This resulted in the Commission's development of a new classification scheme in 1970 to meet analytical needs (McCormick & Zhao, 2005). This classification scheme, known today as the Carnegie Classification of Higher Education

Institutions, is described as the *dominant classification system* for higher education research and is one of the oldest consistently published rankings recognized in classifying university programs and reputations for doctorate-granting universities (Kosar & Scott, 2018). At the time of establishment, the classification system called attention to the institutional diversity in U.S. higher education in order to facilitate an increase in diverse offerings of institutional mission for various fields of study and workforce needs. It was meant as a framework to assist researchers in performing comparisons of programs and institutions within manageable categories. Ironically, since its inception, it has had a homogenizing influence due to institutions seeking to move up the scale to research intensive recognition in pursuit of prestige and associated funding opportunities (McCormick & Zhao, 2005).

The Commission's original classification system created categories based upon empirical data representing the type and number of degrees awarded, federal research funding, and curricular specialization. It also included information about undergraduate college admissions' selectivity and preparation of future PhD recipients. Degree level and specialization emerged as the definitive organization criteria that grouped institutions by doctorate-granting universities, master's level institutions, undergraduate liberal arts colleges, two-year colleges, and specialized institutions (McCormick & Zhao, 2005). *New Students and New Places: Policies for the Future Growth and Development of Higher Education* was first published by the Commission in 1971 and supplied analytical categories for the analysis of the U.S. higher education system and its forecasted growth and direction. However, it did not list the names of individual institutions in the first release. Two years later, the Commission published its detailed list of institutions by category for the purpose of supplying individuals and organizations engaged in research and higher education a tool for analytical research use (McCormick, 2013). This history of the

Carnegie Classification is defined by both the creation of the research tool and the classification's design reflected in the organization's specific research needs and interests during the process (McCormick, 2013). The Carnegie Classification system has evolved through both purpose of use and systematic changes to its current classification's algorithms, translating the contours and forecast of U.S. higher education direction and sustainability.

Updates of the Classification System. The viability of Carnegie has provided a consistent and adaptable classification system upon which to base comparisons of research activity across U.S. institutions of higher education. Updates to the system are crucial to adequately represent the changing landscape of higher education. The classification system is considered in decision making processes based on perspective of structure and function in the U.S. higher education system, allocation of scarce resources, and from political perspectives. Research into the flow of inputs and outputs of the higher education system, types of students served in different institutional categories, identification of social benefits from institutional types, along with finding the delicate balance of serving social needs and national priorities, have been derived through classifications of higher education (McCormick, 2013). The Carnegie Classification, originally published in 1973, has updated its methodology seven times since its inception, with updates occurring in 1976, 1987, 1994, 2000, 2005, 2015, and 2018. The updates have accounted for changes in the constellation of institutions, including impact of openings, closings, and mergers, and the internal changes of institutions such as changes in offering and activities. Changes have also been initiated by criticism of the traditional classification paying insufficient attention to teaching, as research had been prioritized over teaching when reflected in institutional type categories (McCormick, 2013). As Carnegie has periodically updated its methodology to accommodate the changing landscape of research and higher education, the most

recent update to the basic classification system recognizes professional doctoral degrees, thus reflecting teaching and the contour of degree type conferral, further translating the forecast of growth and direction in U.S. higher education.

Social Practice and Value of a Classification System. Classification systems influence social construct, affecting not only perception and bias within the public and private sectors, but *social equity performance* of public services and resources between defined categories of people, institutions, and communities. McCormick and Zhao (2005) emphasize that the value of a classification system is tied to its intended use, and classification is not only a way of seeing or of perception, but it is a *social practice* directing attention toward selected characteristics and away from others. Significant to this study of social equity performance in the distribution disparities of funding mechanisms and higher education is the focus on what contributes to the biases present in the funding process. Reification can be a dangerous result of such classification systems that define our social constructs. McCormick and Zhao (2005) reiterate how the Carnegie Classification can result in reification of what is empirically real and natural, as well as how a dominant classification has the ability to influence the public's perceptions in a biased direction and limit the consideration of other possibilities or perspectives of institutions and their value to U.S. higher education.

Fundamental Issues of the System. The Carnegie Classification system, although originally purposed for research analytic needs for the Carnegie Foundation for the Advancement of Teaching, has evolved over its lifetime into a general-purpose classification system used by a broad range of users and for various applications (McCormick & Zhao, 2005). Perception and bias are now invoked from the system's usage by higher education institutional personnel and administration, state systems, foundations and other sponsored funders, membership

organizations, and news magazines, as well as legislators, faculty, state boards, accreditors, and trustees (McCormick & Zhao, 2005). It is also an identifying factor used in published rankings amongst various sources for U.S. higher education institutions. McCormick and Zhao (2005) voice concerns over reliability of the classification system used in funding decisions, especially directed by foundations. Foundations have been found to use this classification as eligibility criteria in their grant programs, thus a contributing factor to the funding disparity and mobility of equity between the institutional haves and have-nots. As McCormick and Zhao (2005) reveal the now broad uses of the system beyond its original purpose, the realization that a classification system, although empirically derived from positivist data methods, cannot be perfectly neutral or objective, as it will reflect decisions made about what data is important and meaningful and be subject to interpretive uses beyond its original design.

Social Equity Performance of Funding Mechanisms

Principal-Agent Theory in External Funding Processes. The sponsored funding process of federal agencies and philanthropic foundations is explained as a Principal-agent relationship, with the principal being the funding sponsor and the agent being the institution of higher education. The principals, specific to this case the sponsored funding agencies and philanthropic foundations, look to the performance of the institution to deliver desired outcomes as their agent, basing partnership decisions on national university rankings due to performance accountability. Johnes (2018) in his study of university rankings ties the attention of the public, government, and funding sponsors to relative performance of the institutions of higher education based on university rankings. University rankings have been found to directly affect the funding of research and development from government, industry, and foundations, not to leave out alumni endowments and gifting. Donors have been found to utilize these rankings when making

financial contributions to institutions due to being associated with successful universities. Sponsors and constituents are drawn to universities that are perceived as more prestigious because of the perceived benefits of becoming associated with highly ranked institutions. Along these findings, Morphew and Swanson (2011) reveal that universities use rankings to provide both informational and promotional properties to internal and external constituents. Thus, signaling is supported in the Principal-agent theory by institutions expressing their credibility through their rankings and prestige to sponsors during the funding process.

Resource Dependency Theory and Institutional Control Type. Institutions of higher education also signal their organizational commitment to funding agencies and foundations by creating administrative capacity in the form of formal offices and staffing that serve direct functional roles in negotiating and managing the exchange relationship's demands and problems (Tolbert, 1985). Resource dependency theory is based on the principle that the institution of higher education has to engage in transactions with other actors and organizations in its environment in order to successfully acquire external resources, in this case sponsored research and foundation funding. The institution has a need to ensure the stable flow of resources, placing emphasis on the environmental relations and influences rather than the internal relationships, thus determining its administrative structure (Tolbert, 1985). As institutions experience pressure from members of the society to meet expectations of appropriate organizational form, they adapt their structure and behavior to be consistent with their environment to ensure legitimacy and institutional survival (Tolbert, 1985). The increasing dependence of institutions on external relationships with funding agencies and foundations to secure funding has produced administrative differentiation as organizations create specialized administrative offices and positions to signal that they can adequately and competitively manage these relationships.

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Differentiating administrative structures are a result of the institutional control of

institutions in higher education, distinguishing between public and private institutions. Public

and private universities have a historically long-standing tradition of relying on different sources

of funding mechanisms. As public institutions of higher education are under state supervision

and control, private institutions have autonomy from government control and receive less

governmental financial support. Public institutions typically rely heavily on sources of

government support including state appropriations, the Department of Education, and funding

agencies for sponsored research, while private institutions rely primarily on tuition, endowments,

gifts, and grants from private and philanthropic sources. Thus, different expectations have

historically been drawn between public and private institutional administrative structures and

interorganizational exchange relations, distinguishing their dependency patterns by the

magnitude of dependency on their sources of external funding, whether from funding agencies or

foundations (Tolbert, 1985).

Role of Administrative Capacity. As classifications such as Carnegie are recognized

and allowed to contribute to broad based decisions that affect U.S. institutions of higher

education, institutions affected by the disparity in social equity performance of funding

mechanisms will typically be those which have less capacity in terms of funding resources and

administrative infrastructure. This equity concern also becomes compounded as these

institutions have frequently experienced these disparities in the past during distribution of

resources. Institutions of higher education depend on and competitively struggle to secure a

proportionate share of external funding, namely federal research funding mechanisms and

foundation grants, resulting in social equity performance concerns in the disproportionate

distribution. Social equity suffers under competition-based funding models due to applicants

with higher capacity and a reputation of prestige and performance holding higher rank than disadvantaged minorities in the evaluative process. The disparities of funding distribution result in inequalities across multiple levels and constituents, jeopardizing opportunities for the development of these institutions, their communities, and their individuals (Schaar, 1964). Demonstrated with evidence by Collins & Gerber (2008), performance accountability is influenced by the evaluation of transaction costs for both the grantors and the applicants, including costs such as contract arrangements and negotiations, compliance reporting and monitoring, and administrative support, all which reflect the perception of the administrative capacity that can be dedicated to fulfilling proposed objectives. This results in larger and more justified budgets for carrying out the project, regardless of the social need. Therefore, social equity is lost in priority due to need-response matching taking a backseat to efficiency and effectiveness translated by capacity and reputation.

Reputation Bias in Funding Reviews. Reputation bias in peer reviews and panels is sometimes referred to as the "halo effect" due to agencies awarding funds based on the review panel's recommendations for funding when the peer reviewer ranks the proposal higher based on the researcher's or institution's past reputation rather than the merit of the proposal (McGarity, 1994). Some agencies have also been stifled by the "old boy network" or "old boyism" when their peer review panels allow members to serve extended terms and take care of their own in the review process (McGarity, 1994). Such reputation biases further divide the disadvantaged minority institution from the large and stable institutions which rely on their established reputations from advantageous access to funding resources. As reflected in such biases, American politics has weighted the advantage toward the privileged and away from the under-privileged, thus making it even more difficult for the public administrator's advancements in

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social equity (Frederickson, 2005). Developing reputation as an institutional resource in the field of higher education has proven difficult since it cannot be easily purchased or improved. Social equity disparity is reflected in observing organizations of positive reputation finding it relatively easy to maintain their status, while organizations with flat or less than positive reputations finding it hard to improve their reputation. It has been found through studies of institutional ranking systems such as US News that if an institution changes ranking tiers, it can result in a positive impact on future peer assessments of the university (Morphew & Swanson, 2011). Reputation perception or biases can be a contributor to the social equity performance issue in distribution of funds and resources in higher education institutions and demands attention from government agencies and foundation sponsors to better the funding model processes in best practices for better equity.

Further blurring the reputation bias, institutional capacity is also seen as organizational performance as the varying dimensions of capacity encompasses the separate abilities to both attract and to absorb funding or resources. Within the perspective of a funding agency or philanthropic sponsor, the ability of the institution to both absorb and manage funds with efficacy is critical during their decision process, as they perceive institutions that are smaller or with less rank as less able to absorb the same or equal amount of resources as the larger or higher ranked institutions (Honandle, 1981). Administrative capacity, also referred to as *administrative stock*, can be described as a fixed inventory of resources, including materials and human infrastructure, that are controlled and managed by an institution for achieving organizational potential (Honandle, 1981). Such capacity is measured through data points identified in the Carnegie Classification system, thus administrative capacity being a contributor to the perceived reputation considered during the funding process.

Studies on Influence of Rankings, Peer Reviews, & Funding Mechanisms

Higher education administrators have been found to correlate financial resources linked to college rankings, especially administrators at research universities. Resource dependency theories of organization, combined with the impacts of university rankings on external actors, suggests that third-party resource providers are sensitive to shifts in rankings over time. This correlation led Bastedo and Bowman (2011) to an empirical study of the influence of *US News* rankings on future research and development giving by government, foundations, and industry, and if alumni more readily donated to their alma mater. Predictions were tested using structural equation models, and the study's authors found that published college rankings had significant impact on future giving by resource providers, independent of organizational change in quality and performance. The exception they found was in the proportion of alumni who donated to their alma mater, yet the amount of giving was not impacted. Shifts in peer assessment of reputation, a by-product of college rankings, also showed significant effects on financial resources. Therefore, it is not a coincidence that higher education administrators are sensitive to college ranking systems since universities are dependent upon a continuous flow of external funding mechanisms, especially sponsored funding and private giving.

Bastedo and Bowman (2011) included all universities that appeared in the 1998 *U.S. News and World Report* in their study. They extracted data on college rankings, peer assessments, changes in institutional quality, and the reported proportion of alumni giving to institutions. They also extracted data from the Integrated Postsecondary Educational Data Set (IPEDS), the National Science Foundation's Survey of Research and Development Expenditures at Universities and Colleges (HERD), and the Council for Aid to Education's Voluntary Support of Education (VSE) survey. Significant findings that college rankings in 1998 were predictors of

financial indicators in 2006 reveals the influence that rankings have on social equity distribution between institutions and their ability to secure sponsored and private funds. Bastedo and Bowman (2011) also found evidence of the difficulty for reputational change in that if an institution was ranked below the top tier in their study, it adversely affected research and development funding of federal and industry resources and the proportion of alumni giving. Effects of reputation and funding disparity were felt the strongest in the lowest of the tiers, Tier 4. Objective changes in institutional quality were found to have a positive association with total alumni giving and foundation funding, and peer assessment ratings provided positive impacts on industry research and development, total alumni donations, and total foundation funding. Overall, their findings supported college rankings having an effect on research and development funding mechanisms of government and industry, but not a significant effect on foundation funding. Findings also supported that rankings affected the proportion of alumni giving, but it was not apparent for the total amount of alumni donations. Bastedo and Bowman (2011) and their study on the influence on college ranking systems, specifically U.S. News, supported findings of a progressive look into a previously undocumented correlation of universities being financially impacted by the evaluations of third parties through influence with external resource providers.

This study of the influence found in the *U.S. News and World Report* ranking reveals the likelihood that higher education rankings influence those who are most vulnerable to status hierarchy created by these rankings, and this hierarchy of perceived value results in generating financial resources for research universities. It also reveals that alumni are vulnerable to the perception of the value of their degree in the job market, thus affecting their likelihood *to* donate rather than *how much* they donated. Another stark finding is that faculty members who served

on agency peer review committees were more likely to fund projects from institutions who were highly ranked (Bastedo & Bowman, 2011). Peer review committees in the sponsored funding review process are unique in that they are meant to be able to assess research funding proposals from an expert level. Yet, the peer review process has been questioned if it is undermined by biases. Due to funding becoming more competitive and funding success rates decreasing, public stakeholders that rely on this funding have spoken out that the system favors institutions that are less risk and can guarantee results (Li & Agha, 2015). Stable evaluation of reputation over time of institutions who are less risk with high output have proved more substantial than movement between rankings (Bastedo & Bowman, 2011). This further reflects the notion of the sponsored funding gap disparity between the *haves and the have nots* in higher education institutions. Hierarchy in higher education, created by rankings such as *U.S. News* and a study on *Carnegie*, has shown to be influential in determining the social equity distribution between institutions and their ability to secure sponsored and private funds in the future.

Previous studies assessing the peer review system's efficacy in predicting successful research outcomes has yielded mixed results. In response, Li and Agha (2015) conducted a study to examine if peer review committees were found successful in predicting the quality of the proposed research funded by the National Institutes of Health (NIH). They concentrated their study on 137,215 research project (R01) grants funded by the NIH from 1980-2008. Funded grants were important to this study to analyze funding and its direct effect on research productivity, focusing on the relationship between scores and outcomes of peer review. The authors measured applicant-level characteristics including the researcher's publication and grant history, educational background, and institutional affiliation. Institutions were ranked by the number of NIH grants received over the study period of 1980-2008 and measured the applicants

by whether they were from a top 5-, 10-, 20-, or 50- ranked institution. Using a Poisson

regression of future outcomes on peer-reviewed scores, including controls for the researcher's

previous performance, the authors found that NIH peer-review evaluations were statistically

related to grant quality. Additional controls were studied, including differences in citation and

publication rates by disciplinary fields, applicant credentials of MD or PhD and/or if they had

both MD and PhD, grant proposal writing skills, institutional quality, as well as the applicant's

gender and ethnicity. The additional control factors still suggested that scores were better than

randomly allocated and results remained stable (Li & Agha, 2015). Findings included that peer-

review scores provided value by identifying hit publications and research with potential for

commercialization. The authors also found that peer reviewers trended toward awarding funds to

projects with potential for very high-impact publication, exhibiting the peer review panel's

ability to discriminate among strong applications. Results also found a steep relationship

between scores and residual research outcomes, with the steepest results found among the

highest-ranking proposals. The relationship between proposal scores and hit publications

weakened among applications with the lesser of the competitive scoring. Li and Agha (2015) did

not find evidence that the peer-review system added value beyond the factors of previous

publications and qualifications when screening out low-citation papers. This study demonstrates

how the peer-review system positively generates information about the quality of grant proposals

tied to research outputs in the funded applications, but it does not directly assess whether it

rejects high-potential applications. It is important to consider the Matthew effect in the

association of better scores and better outcomes, of which credit and citations accrue to the

already established investigators because they are established, regardless of their quality of work.

Li and Agha's (2015) study provides support of the peer-review system in accountability and

outcomes related to the Principal-agent theory of sponsored agencies, but it also provides

consideration that the widened gap of sponsored funding distribution is supported by this system,

contributing to the disparity of funding opportunities among the *haves and the have-nots* of

higher-education institutions.

Forecast of Higher Education & Role of Funding Mechanisms

As forecasts indicate that a number of higher education institutions will fold due to

resource disparity over the next two decades, statistics raise important questions as to how

reputation and prestige combined with institutional control type contributes to funding resources

and distribution between institutions. A further look into how the percentage of funding

distribution reveals gaps between Carnegie classifications both in sponsored funding agencies

and philanthropic foundation funding, how the institutional control type if public or private plays

a significant role in funding trends, as well as the size of administrative capacity, will provide

additional insight to the role of reputation and capacity in funding models and social equity

performance. While research on social equity performance in the distribution of funding

mechanisms in institutions of higher education has found perceived administrative capacity and

reputation to be weighed against intellectual merit, further research is now necessary to identify

what contributes to perceived reputations and administrative capacities by review panels and

philanthropic sponsors. Narrowing the gap by qualifying institutions and faculty researchers that

have typically received less funding in the past for better funding opportunities and distribution

is critical to public administration, funding models, and higher education. This current study of

research and development expenditures and secured foundation or philanthropic funding reported

by institutions, focusing between Carnegie Classification rankings, private and public

institutions, and size of administrative capacities, will assist in uncovering the contributing

elements of bias used in research and private funding decisions and will assist in developing

better frameworks for social equity performance of funding mechanisms.

Chapter 3: Methodology of Quantitative Analysis

Introduction

Disparities of federal and philanthropic funding distribution across institutions of higher education result in inequalities across multiple levels, jeopardizing opportunities for institutional development and impairing the development of their communities and individuals. This study focuses on variables including Carnegie Classification rankings, institutional control as either public or private, publicly reported research expenditures and secured foundation funding, and institutional administrative capacity. Institutions will include those falling under the identified Carnegie Classifications within this study, of whom voluntarily report their annual research expenditures to the federal government by means of the National Science Foundation's Higher Education Research and Development Survey (NSF HERD). The institutions in this study also voluntarily report giving totals to the Voluntary Support of Education (VSE) through the Council for Advancement and Support of Education (CASE). Findings will assist in narrowing down elements to identify what contributes to biases by agency review panels and philanthropic foundation sponsors. It will further support the elements of reputation and administrative capacity used in research and private funding decisions and will help in gaining more insight to what contributes to the perceived elements of reputation and capacities in funding review models.

Population of Study

To provide inclusivity across the diverse institutional types for data representation, the study population includes Carnegie classifications of four-year institutions that are classified as Doctoral Universities, Master's Colleges and Universities, Baccalaureate Colleges, and Special Focus Four-Year. This population includes the U.S. higher education institutions who have

voluntarily reported to NSF HERD and CASE VSE to be analyzed in the data collection. The resulting sample contains 603 institutions of higher education, of which 374 were public and 229 were private. Within this sample, 415 institutions of higher education reported their secured philanthropic foundation funding. Institutions included in the Carnegie Classifications data of the study population reported at least $150,000 in research expenditures during FY2016 and reported data to the NSF HERD, GSS, and IPEDs.

Data Sources

Data sources include the published National Science Foundation's Higher Education Research and Development Survey (NSF HERD) FY2016 data that was collected during the FY2017 survey cycle. This report was released in FY2018, as the report released each year is data from two years prior. The NSF HERD is the primary government source of information on separately accounted for research and development expenditures within higher education institutions in the United States, including outlying areas. This data is solicited under the authority of both the National Science Foundation Act of 1950, as amended, and the America COMPETES Reauthorization Act of 2010. The Office of Management and Budget (OMB) control number is 3145–0100 and was set to expire on September 30, 2019. The NSF HERD survey is conducted annually by the National Center for Science and Engineering Statistics (NCSES) within the National Science Foundation (NSF) and is a census of institutions of higher education that expends at least $150,000 in separately accounted for research and development in the fiscal year. The NSF HERD study population includes public and private nonprofit postsecondary institutions in the United States, Guam, Puerto Rico, and the U.S. Virgin Islands that grant a bachelor's degree or higher in any field, annually expends at least $150,000 in separately accounted for R&D, and has geographically separate campuses headed

by a president, chancellor, or equivalent. It is the nation's leading provider of statistical data on the U.S. science and engineering enterprise. The FY2017 survey cycle surveyed 915 institutions and successfully collected FY2016 data from 903 institutions between the months of November 2017 through June 2018 (Gibbons, 2018). NSF distributed the surveys to designated contacts at each qualifying institution, and respondents could choose to respond to the survey through either printing a questionnaire from the Web and submitting a paper survey or using the Web-based data collection system. For both methods, follow up by telephone and e-mail were used. Quality reviews were conducted by NSF and focused on unexplained missing data and explanations provided for changes in previous reporting patterns. If additional explanations or data revisions were necessary, respondents received personalized e-mail messages requesting them to provide necessary revisions before the final processing of data. NSF imputed missing values based on the previous year's data and the reported data of peer institutions of the current cycle (Gibbons, 2018).

Another data source is the Voluntary Support of Education FY2016 report (VSE, 2016) managed by the Council for Advancement and Support of Education. The data for this report is pulled from the VSE Survey and Data Miner, a web-based benchmarking service that provides access to more than 350 variables about charitable giving to educational institutions. The Data Miner provides access to 10 years of survey data from 1,000 and more survey respondents. Data can be organized into tables, graphed, sorted, and then summarized. The survey tool's functionality enables users to create comparison groups of institutions. These groups are designed by querying the system for variables of size, location, control, and giving totals across different engagement categories. Data has been collected by the VSE survey

since 1957 and is considered the definitive source of information on private to education institutions in the United States.

The Integrated Postsecondary Education Data Systems (IPEDs) report provides information from institutions of higher education detailing enrollment, degree conferral, and human resources infrastructure. The National Center for Education Statistics (NCES) is the primary federal entity for collecting and analyzing IPEDs data. NCES is located within the U.S. Department of Education and the Institute of Education Sciences. The National Center for Educational Statistics is a fulfillment of a Congressional mandate to collect, collate, analyze, and report complete statistics on the condition(s) of U.S. education; validate, conduct, and publish reports; and review and report on education activities at both at the national and global levels.

Previously stated, the Carnegie Classification (CC) of Institutions of Higher Education is considered the "dominant classification system" for higher education research and is one of the oldest consistently published rankings that is recognized in classifying university programs and reputations for doctorate-granting universities (Kosar & Scott, 2018). It bases its methodology on publicly available data, including research expenditures, conferred eligible doctoral degrees, faculty composition, and research staffing. Carnegie has periodically updated its methodology to accommodate the changing landscape of research and higher education, and it most recently updated the basic classification system in 2018 to include professional doctoral degrees. The viability of Carnegie has provided universities and funding agencies a consistent and adaptable classification system to base comparisons of research activity across U.S. institutions of higher education. The CC framework is widely used in the study of higher education both to represent and control for institutional differences, as well as

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in the design of research studies to ensure adequate representation of sampled institutions, students, or faculty. The CC data is collected through the National Center for Education Statistics's (NCES) survey, Integrated Postsecondary Education Data Systems (IPED), the NSF HERD, and the Survey of Graduate Students and Postdoctorates in Science and Engineering (GSS).

Variables

Carnegie's basic classifications are ordinal, categorical data including the 33 categories or classifications identified by the Carnegie Classification of Institutions of Higher Education. Of the 33 classifications, 19 classifications rank four-year U.S. higher education institutions. These 19 classification identifiers of the four-year institutions are further grouped into four categories including doctoral universities, master's colleges and universities, baccalaureate colleges, and special focus four-year institutions for this study as reflected in *Table 1*.

Variables in this study include the sample population's institutional Carnegie Classifications, administrative capacity, institutional control variable (public or private), total research expenditures, and their total foundation funding. Carnegie classification and administrative capacity are the independent variables, with Carnegie classification being a categorical, ordinal variable, and administrative capacity being a continuous variable at the ratio level. An independence of observation is present, as institutions can only be ranked in one Carnegie Classification group, thus preventing overlap. Institutional control of public or private also serves as an independent variable, being a categorical, nominal variable for this

study. Research expenditures and foundation funding serve as dependent variables with both

being continuous at the interval level.

Table 1

Condensed Carnegie Classification Groupings of Four-Year Institutions

Carnegie Group	Basic Carnegie Classification
Doctoral Universities	Very High Research Activity High Research Activity Professional Universities
Master's Colleges and Universities	Larger Programs Medium Programs Small Programs
Baccalaureate Colleges	Arts and Sciences Focus Diverse Fields Mixed Baccalaureate/Associate's Colleges Baccalaureate/Associate's Colleges: Associate's Dominant
Special Focus Four-Year	Faith – Related Institutions Medical Schools and Centers Other Health Professions Schools Engineering Schools Other Technology-Related Schools Business and Management Schools Arts, Music, and Design Schools Law Schools Other Special Focus Institutions

Statistical Methodology

A quantitative analysis using IBM SPSS Version 27 will be performed to analyze data

taken from publicly available datasets of NSF HERD, IPEDs, VSE, and CC in order to explore

the relationship between Carnegie Classification rankings, institutional control types,

administrative capacity, and funding levels of institutions of higher education. Specifically,

this study will analyze how universities' reputation of Carnegie Classification rankings, institutional control type, and size of administrative capacities contribute to levels of sponsored research funding and philanthropic foundation funding.

To test RQ1, a non-parametric Kruskal-Wallis H Test will be performed for H1 and H2. The Kruskal-Wallis H Test is preferred over the one-way ANOVA due to the dependent variables of research expenditures and secured foundation funding not meeting assumptions of a normal distribution. The results of the test of homogeneity of variances indicate that the variances of the four groups on research expenditures and on foundation funding are significantly different for each, thus the assumption of homogeneity of variances not being met. Outliers were removed at 2 standard deviations above the means, but it still did not provide a normal distribution of the dependent variable or homogeneity of variances. The non-parametric test is deemed the most accurate test to run to test the set of hypotheses. To test H3, a Spearman's rho will be performed to examine the strength and direction of the linear relationship between the two continuous interval level variables of foundation funding and research expenditures. The non-parametric Spearman's rho is preferred over the Pearson's r due to both variables not meeting the assumption of a normal distribution.

To test RQ2, a non-parametric Kruskal-Wallis H Test will be performed for H4. The Kruskal-Wallis H Test is preferred over the one-way ANOVA due to the dependent variables of research expenditures and secured foundation funding not meeting assumptions of a normal distribution. The results of the test of homogeneity of variances indicate that the variances of the four groups on research expenditures and on foundation funding are significantly different for each, thus the assumption of homogeneity of variances not being met. Outliers were removed at 2 standard deviations above the means, but it still did not provide a normal

distribution of the dependent variable or homogeneity of variances. The non-parametric test is deemed the most accurate test to run to test the set of hypotheses.

To test RQ3, a Spearman's *rho* is performed for H5 and H6 to examine the strength and direction of the linear relationship between the continuous interval level variables of research expenditures and administrative capacity and foundation funding and administrative capacity. This test is preferred due to the continuous interval level variables not meeting the assumption of a normal distribution. Interestingly, when the Pearson's *r* is performed alongside of the Spearman's *rho*, the results are similar, thus the recommendation to report the Pearson's *r* correlation in the findings. A Kruskal-Wallis *H* Test will be performed for H7 in order to analyze if funding levels will increase as administrative capacities increase within the categories of the Doctoral Universities, the highest ranked Carnegie Classification group. This will further examine if administrative capacities are relevant to levels of funding in the most funded categories of the Carnegie Classification. The Kruskal-Wallis *H* Test is preferred over the one-way ANOVA due to the dependent variables of research expenditures and secured foundation funding not meeting assumptions of a normal distribution. The results of the test of homogeneity of variances indicate that the variances of the four groups on research expenditures and on foundation funding are significantly different for each, thus the assumption of homogeneity of variances not being met. Outliers were removed at 2 standard deviations above the means, but it still did not provide a normal distribution of the dependent variable or homogeneity of variances. The non-parametric test is deemed the most accurate test to run to test this hypothesis. The Kruskal-Wallis *H* Test is then followed with a Spearman's *rho* to observe the linear relationship of funding and administrative capacity within the categories of the Carnegie Classification's Doctoral Universities group. This test is

preferred due to the continuous interval level variables not meeting the assumption of a normal distribution.

Results of testing each of the three research questions will be detailed in Chapter 4, beginning with a recap of the research questions and their hypotheses, followed by an overview of the study population's demographics, and then organized by research questions and associated hypotheses.

Chapter 4: Results of Quantitative Analysis

Organization of Results

After providing an overview of the study population's demographics, results will be organized by research question and associated hypotheses. Research question one addresses: Does an institution's Carnegie Classification ranking reflect its levels of sponsored research and foundation funding? The first two hypotheses predict that both sponsored research funding and foundation funding will be greater within the Carnegie doctoral institutions as compared to the other four-year school Carnegie Classifications. A non-parametric Kruskal-Wallis H Test will be performed to analyze the distribution of the dependent variables of sponsored research funding and foundation funding between the independent variable of Carnegie Classifications. The third hypothesis of this research question assumes that foundation funding levels will increase as an institution's research and development funding increases. A Spearman's *rho* will be performed to examine the strength and direction of the linear relationship between the two continuous dependent variables. The second research question addresses: Does an institution's control type of public or private relate to the sources of external funding levels as sponsored research or foundation funding? The hypothesis predicts that distributions of sponsored research funding and foundation funding will differ based on institutional control of public or private, with public institutions receiving more sponsored research funding and private institutions receiving more philanthropic foundation funding. Again, a Kruskal-Wallis H Test will be performed to examine the relationship of the continuous dependent variables of sponsored research funding and foundation funding to the independent variable of institutional control types. The third research question asks: Does an institution's administrative capacity reflect its levels of sponsored research and foundation funding? The first two hypotheses predict that the

dependent variables of sponsored research and foundation funding will increase as the independent variable of administrative capacity increases. A Spearman's *rho* will be performed to examine the linearity and strength of the relationship between each of the variables. The third hypothesis assumes that funding levels will increase as administrative capacities increase *within* the categories of the Doctoral Universities, the highest ranked Carnegie Classification group. A Kruskal-Wallis *H* Test will be performed to examine if administrative capacities are relevant to levels of funding in the most funded categories of the Carnegie Classification. A Spearman's *rho* will follow to examine the linearity and strength of the relationship between each of the variables.

Study Population Demographics

The study population includes 603 institutions of higher education, of which 374 are public and 229 are private. These 603 institutions are four-year schools that have reported at least $150,000 in research expenditures during FY2016 to the NSF HERD, NSF GSS, and IPEDs surveys. Within this study population of 603 institutions, 415 institutions of higher education reported their secured philanthropic foundation funding to the Voluntary Support of Education FY2016 report managed by the Council for Advancement and Support of Education. Of the overall 33 Carnegie Classifications, these 603 institutions are classified into one of the 19 rankings of four-year U.S. higher education institutions. They are further classified by Carnegie into one of the Carnegie Classification groupings of Doctoral Universities, Master's Colleges and Universities, Baccalaureate Colleges, or Special Focus Four-Year. The four groupings in this study consists of 296 Doctoral Universities, 162 Master's Colleges and Universities, 64 Special Focus Four-Year, and 81 Baccalaureate Colleges.

Discussion of Results

Research Question 1: Does an institution's Carnegie Classification ranking reflect its levels of sponsored research and foundation funding?

To test the hypotheses that (1) *research and development funding distribution is higher in Carnegie doctoral institutions compared to other four-year Carnegie Classifications,* and (2) *foundation funding distribution is higher in Carnegie doctoral institutions compared to other four-year school Carnegie Classifications*, a Kruskal-Wallis *H* Test was performed. The results of the Kruskal-Wallis *H* non-parametric test showed significant differences in sponsored research funding levels based on Carnegie Classifications (Table 2. $X^2 = 253.14$, df = 3, p < .01). The results also showed significant differences in foundation funding levels based on Carnegie Classifications (Table 2. X2 = 116.15, df = 3, p < .01).

Table 2

Significant Differences in Funding Levels Based on Ranking

	All R&D Expenditures FY2016 (Thousands)	Foundation Funding FY2016 Total
Kruskal-Wallis H	253.14	116.15
df	3	3
Asymp. Sig	0.01	0.01

Note. Kruskal Wallis Test; Grouping Variable: Carnegie Classification four-year condensed groupings.

Significance in differences of funding levels based on sums of ranks between Carnegie Classification groupings of the four-year institutions are relevant for both sources of funding mechanisms.

The results of the post hoc Tamhane's T2 test (see Table 3) showed a significant greater difference in sponsored research funding between the Carnegie doctoral classification and each of the other 3 four-year Carnegie classifications of master's (p < .01), baccalaureate (p < .01), and special focus 4-year (p < .01). The Carnegie special focus 4-year classification also showed a significant greater difference than master's (p < .01) and baccalaureate (p < .01).

Table 3

Mean Differences of Sponsored Research Levels Between Rankings

All R&D Expend FY2016 ($Thousands)		Mean Difference	Sig
Doctoral	Masters	183577.49	0.01
	Baccalaureate	187377.13	0.01
	Special Four-Year	103777.95	0.01
Masters	Doctoral	-183577.49	0.01
	Baccalaureate	3799.64	0.40
	Special Four-Year	-79799.54	0.01
Baccalaureate	Doctoral	-187377.13	0.01
	Masters	-3799.64	0.40
	Special Four-Year	-83599.18	0.01
Special Focus Four-Year	Doctoral	-103777.95	0.01
	Masters	79799.54	0.01
	Baccalaureate	83599.18	0.01

Note. Tamhane T2 Post-Hoc Test for multiple comparisons.

Similar to Table 3, the results of the post hoc Tamhane's T2 test (see Table 4) showed a significant greater difference in foundation funding between the Carnegie doctoral classification and 2 of the four-year Carnegie classifications including master's (p < .01) and baccalaureate (p < .01). The Carnegie special focus 4-year classification also showed a significant greater difference than master's (p < .01).

Table 4

Mean Differences of Foundation Funding Levels Between Rankings

Foundation Funding Total FY2016		Mean Difference	Sig
Doctoral	Masters	25541996.00	0.01
	Baccalaureate	20725981.74	0.01
	Special Four-Year	8357986.88	0.72
Masters	Doctoral	-25541996.00	0.01
	Baccalaureate	-4816014.25	0.01
	Special Four-Year	-17184009.12	0.04
Baccalaureate	Doctoral	-20725981.74	0.01
	Masters	4816014.25	0.01
	Special Four-Year	-12367994.86	0.23
Special Focus Four-Year	Doctoral	-8357986.88	0.72
	Masters	17184009.12	0.04
	Baccalaureate	12367994.86	0.23

Note. Tamhane T2 Post-Hoc Test for multiple comparisons.

While sponsored research funding showed significant differences between doctoral universities and each of the other 3 four-year classifications, foundation funding was similar except that it did not show a significant difference between doctoral universities and special four-year institutions. Different than sponsored research funding, significant foundation funding differences were found between baccalaureate institutions and master's institutions, with baccalaureate institutions having greater distributions of foundation funding. Special focus four-year institutions came in as a close second with significant differences of both sponsored research and foundation funding distributions between special focus four-year and master's, and a significant difference in sponsored research funding between special focus four-year and baccalaureate institutions.

The Carnegie doctoral classification reported the greatest sponsored research funding levels (Table 5: mean rank = 410.31), with the special focus 4-year as the second highest (Table

5: mean rank = 298.16). Mean rank reflects the amount of sponsored research funding levels present within each Carnegie grouping. The higher the level of funding in the mean rank, the more funding the Carnegie grouping receives among its institutions.

Table 5

Average Means of Carnegie Four-Year Institutions and Sponsored Research Levels

Carnegie Grouping	N	Mean Rank
Doctoral	296	410.31
Masters	162	178.14
Baccalaureate	80	155.18
Special Focus Four-Year	65	298.16
Total	603	

Note. SPSS Kruskal-Wallis *H* Test – Ranks; Mean Ranks = Research Expenditures 2016

Similar to Table 5, the Carnegie doctoral classification reported the greatest foundation funding levels (Table 6: mean rank = 253.76), with the special focus 4-year as the second highest (Table 6: mean rank = 205.23). Mean rank reflects the amount of foundation funding levels present within each Carnegie grouping. The higher the level of funding in the mean rank, the more funding the Carnegie grouping receives among its institutions.

Table 6

Average Means of Carnegie Four-Year Institutions and Foundation Funding Levels

Carnegie Grouping	N	Mean Rank
Doctoral	241	253.76
Masters	94	96.83
Baccalaureate	58	199.10
Special Focus Four-Year	22	205.23
Total	415	

Note. SPSS Kruskal-Wallis *H* Test – Ranks; Mean Ranks = Foundation Funding Levels 2016.

As expected, the doctoral classification reflected the highest average mean in both sponsored research and foundation funding levels, along with special focus four-year institutions averaging as a close second. It is interesting that the baccalaureate institutions significantly outperformed master's institutions in their mean ranks of foundation funding levels, while both classifications had a close rank in sponsored research.

To test the third hypothesis that *foundation funding levels will increase as an institution's sponsored research funding increases*, a Spearman's *rho* was performed to examine the strength and direction of the linear relationship between the two continuous variables. The results of the Spearman's *rho* correlation showed a significant positive correlation between the two variables (Table 7: $\rho = .698$, $p < .01$). *A Pearson's r was performed alongside the Spearman's rho, but the results were not similar enough to consider the Pearson's r results in the findings.

Table 7

Correlation between Foundation Funding and Sponsored Research Levels

		All R&D Expenditures FY2016 ($Thousands)	Foundation Funding FY2016
All R&D Expenditures FY2016 ($Thousands)	Correlation Coefficient	1.000	.698
	Sig. (2-tailed)		0.01

Notes. Correlation is significant at the 0.01 level (2-tailed); SPSS Spearman's *rho* Correlation.

A direct linear relationship was found between foundation funding levels and sponsored research funding levels, as results revealed that foundation funding increases as sponsored research funding increases at an institution (See Figure 1).

Figure 1: Relationship of Foundation and Sponsored Research Funding Levels
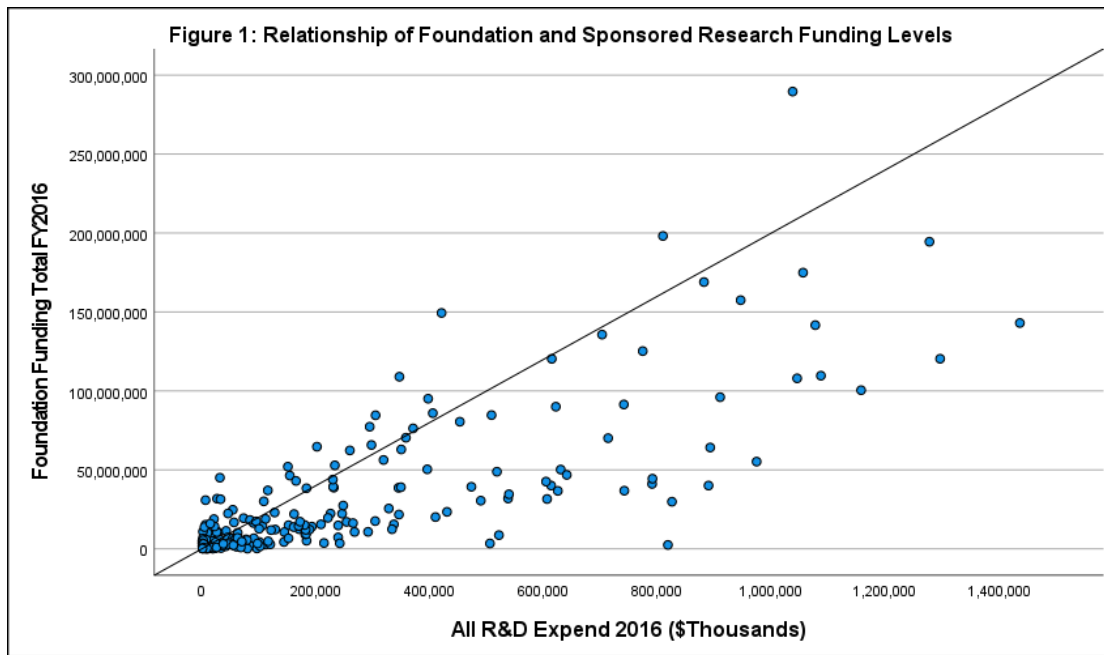
The Kruskal-Wallis *H* test results supported the hypotheses that both sponsored research funding and foundation funding distribution is higher in Carnegie doctoral institutions compared to other four-year school Carnegie classifications. Other significant findings from this test

included special focus four-year schools being successful in securing both sponsored research and foundation funding, coming in as a close second to the doctoral institutions, and that baccalaureate institutions outperformed the master's institutions in foundation funding. Thus, the null hypotheses are rejected. The third hypothesis was supported by the results of the Spearman's *rho*, finding that as foundation funding levels increased at an institution, the institution's research expenditures showed a similar increase in levels, thus they are related and the null hypothesis is rejected.

Research Question 2: Does an institution's control type of public or private relate to the source(s) of external funding levels it secures as sponsored research or foundation funding?

To test the hypothesis that *distributions of sponsored research funding and foundation funding will differ based on institutional control type of public or private, with public institutions receiving more sponsored research funding and private institutions receiving more philanthropic foundation funding*, a non-parametric Kruskal-Wallis *H* Test was performed. The results of the Kruskal-Wallis *H* non-parametric test showed significant differences in sponsored research funding levels based on institutional control type (Table 8. $X^2 = 34.81$, df $= 1$, p $< .01$). The results also showed significant differences in foundation funding levels based on institutional control type (Table 8. $X^2 = 9.70$, df $= 1$, p $< .01$).

Table 8

Significant Differences in Funding Sources Based on Public and Private

	All R&D Expenditures FY2016 (Thousands)	Foundation Funding FY2016 Total
Kruskal-Wallis H	34.81	9.70
df	1	1
Asymp. Sig	0.01	0.01

Note. Kruskal Wallis Test; Grouping Variable: Institutional Control Type.

The results of the Kruskal-Wallis *H* Test in Table 8 are further supported by public institutions having reported the greatest sponsored research funding levels (Table 9: mean rank = 410.31) and private institutions having reported the greatest foundation funding levels (Table 10: mean rank = 231.14).

Table 9

Ranks of Institutional Control Groups and Sponsored Research Levels

Institutional Control Group	N	Mean Rank
Public	296	410.31
Private	162	178.14
Total	603	

Note. SPSS Kruskal-Wallis *H* Test – Ranks.

Table 10

Ranks of Institutional Control Groups and Foundation Funding Levels

Institutional Control Group	N	Mean Rank
Public	255	193.48
Private	160	231.14
Total	415	

Note. SPSS Kruskal-Wallis *H* Test – Ranks.

The Kruskal-Wallis *H* test results supported the hypotheses that distributions of sponsored research funding and foundation funding will differ based on institutional control type of public or private, with public institutions receiving more sponsored research funding and private institutions receiving more philanthropic foundation funding. Thus, the null hypothesis is rejected and the resource dependency theory by institutional control type is supported in this study.

Figure 2: Relationship of Foundation and Sponsored Research Funding Levels
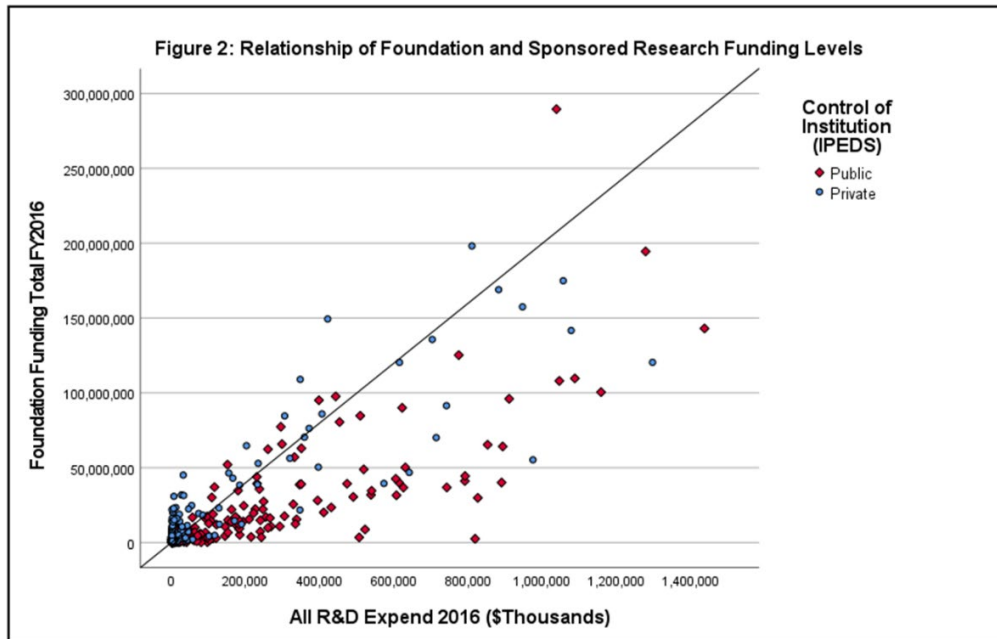
A direct linear relationship was found earlier between foundation funding levels and sponsored research funding levels (See Figure 1). Upon further examination, data reveals that the source of funding differs based on the institutional control type. As reflected in Figure 2, public institutions in this study's sample receive more sponsored research funding and private institutions receive more foundation grant funds.

Research Question 3: Does an institution's administrative capacity reflect its levels of sponsored research and foundation funding?

To test the hypothesis that *sponsored research funding distribution will increase as institutional administrative capacities increase*, a Spearman's *rho* was performed to examine the strength and direction of the linear relationship between the continuous interval level variables. The results of the Spearman's *rho* correlation showed a significant positive correlation between the two variables (Table 11: $\rho = .918$, $p < .01$).

Table 11

Correlation between Sponsored Research Funding and Administrative Capacity

		All R&D Expenditures FY2016 ($Thousands)	Administrative Capacity
All R&D Expenditures FY2016 ($Thousands)	Correlation Coefficient	1.000	.918
	Sig. (2-tailed)		0.01

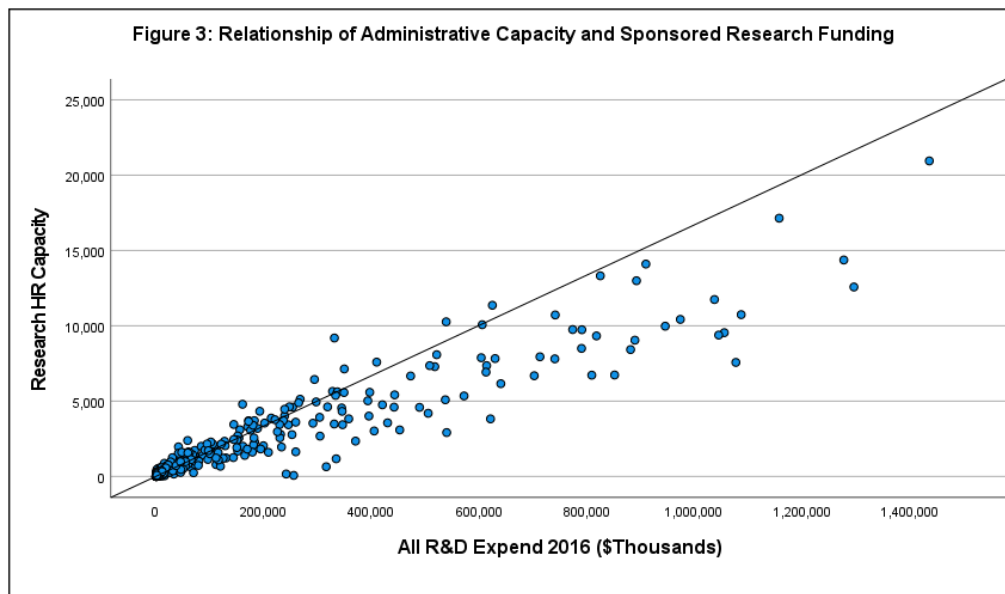*Notes.* Correlation is significant at the 0.01 level (2-tailed); SPSS Spearman's *rho* Correlation.

The Pearson's *r* correlation also showed a significant positive correlation between the two variables (Table 12: $\rho = .948$, $p < .01$). *A Pearson's *r* was performed alongside the Spearman's rho, thus the recommendation to report the Pearson's *r* correlation in the findings.

Table 12

Correlation between Sponsored Research Funding and Administrative Capacity

		All R&D Expenditures FY2016 ($Thousands)	Administrative Capacity
All R&D Expenditures FY2016 ($Thousands)	Pearson Coefficient	1	.948
	Sig. (2-tailed)		0.01

Notes. Correlation is significant at the 0.01 level (2-tailed); SPSS Pearson's *r* Correlation.

Figure 3: Relationship of Administrative Capacity and Sponsored Research Funding

A significant linear relationship was found between administrative capacity levels and sponsored research funding levels of institutions. As administrative capacity increased, sponsored research funding levels also increased (See Figure 3).

To test the hypothesis that *foundation funding distribution will increase as institutional administrative capacities increase*, a Spearman's *rho* was performed to examine the strength and direction of the linear relationship between the continuous interval level variables. The results of

the Spearman's *rho* correlation showed a significant positive correlation between the two

variables (Table 13: $\rho = .700$, $p < .01$).

Table 13

Correlation between Foundation Funding and Administrative Capacity

		Foundation Funding Total FY2016	Administrative Capacity
Foundation Funding Total FY2016	Correlation Coefficient	1.000	.700
	Sig. (2-tailed)		0.01

Notes. Correlation is significant at the 0.01 level (2-tailed); SPSS Spearman's *rho* Correlation.

The Pearson's *r* correlation also showed a significant positive correlation between the

two variables (Table 14: $\rho = .736$, $p < .01$). *A Pearson's *r* was performed alongside the

Spearman's rho, thus the recommendation to report the Pearson's *r* correlation in the findings.

Table 14

Correlation between Foundation Funding and Administrative Capacity

		Foundation Funding Total FY2016	Administrative Capacity
Foundation Funding Total FY2016	Pearson Coefficient	1	.736
	Sig. (2-tailed)		0.01

Notes. Correlation is significant at the 0.01 level (2-tailed); SPSS Pearson's *r* Correlation.

A significant linear relationship was found between administrative capacity levels and

sponsored research funding levels of institutions. As administrative capacity increased,

sponsored research funding levels also increased (See Figure 4).

Figure 4: Relationship of Administrative Capacity and Foundation Funding
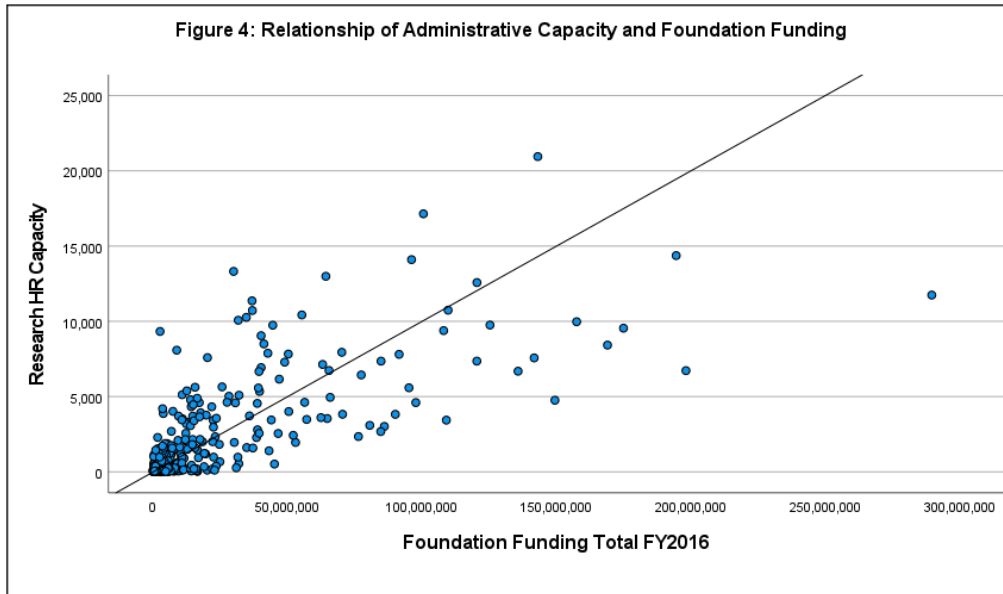
The Spearman's *rho*, further supported by similar findings from the Pearson's *r*, found across both hypotheses that as administrative capacity levels increased, both sponsored research funding and foundation funding levels increased. Administrative capacity and funding levels are found related; thus the null hypotheses are rejected.

To further test the relationship of administrative capacity to funding levels, a non-parametric Kruskal-Wallis *H* Test was performed to test the hypothesis that *funding levels will increase as administrative capacities increase within the categories of the Carnegie Doctoral Universities, the highest ranked Carnegie Classification group.* The results of the Kruskal-Wallis *H* non-parametric test showed significant differences in administrative capacity based on Carnegie Classification doctoral categories (Table 15. $X^2 = 211.52$, df = 2, $p < .01$).

Table 15

Significant Differences in Administrative Capacity and Doctoral Categories

	All R&D Expenditures FY2016 (Thousands)	Foundation Funding FY2016 Total	Administrative Capacity
Kruskal-Wallis H	224.08	126.56	211.52
df	2	2	2
Asymp. Sig	0.01	0.01	0.01

Note. Kruskal Wallis Test; Grouping Variable: 2018 Carnegie Basic Classification, Doctoral Universities.

Similarly, funding levels followed the same data pattern. The results of the Kruskal-Wallis *H* non-parametric test showed significant differences in sponsored research levels based on Carnegie Classification doctoral categories (Table 15. $X^2 = 224.08$, df = 2, p < .01), as well as significant differences in foundation funding levels based on doctoral categories (Table 15. $X^2 = 126.56$, df = 2, p < .01).

Within the doctoral categories, Doctoral Universities: Very High Research Activity reported the greatest administrative capacity (Table 16: mean rank = 228.18), the greatest sponsored research levels (Table 16: mean rank = 230.08), and the greatest foundation funding levels (Table 16: mean rank = 171.86). This category was then followed by Doctoral Universities: High Research Activity in administrative capacity (Table 16: mean rank = 108.56), sponsored research levels (Table 16: mean rank = 108.46), and in foundation funding levels (Table 16: mean rank = 79.51). Finally, Doctoral/Professional Universities averaged at the bottom of the doctoral categories in administrative capacity (Table 16: mean rank = 34.04), sponsored research levels (Table 16: mean rank = 28.69), and foundation funding (Table 16: mean rank = 53.12).

Table 16

Average Means of Administrative Capacity and Funding Levels in Doctoral Categories

Administrative Capacity	N	Mean Rank
DU: Very High Research Activity	125	228.18
DU: High Research Activity	129	108.56
Doctoral/Professional Universities	42	34.04
Total	296	
Sponsored Research Funding	**N**	**Mean Rank**
DU: Very High Research Activity	125	230.08
DU: High Research Activity	129	108.46
Doctoral/Professional Universities	42	28.69
Total	296	
Foundation Funding	**N**	**Mean Rank**
DU: Very High Research Activity	118	171.86
DU: High Research Activity	89	79.51
Doctoral/Professional Universities	34	53.12
Total	241	

Note. SPSS Kruskal Wallis *H* Test Output Ranks.

Results of the average means within doctoral categories further supported that administrative capacity is positively correlated with the Carnegie category level.

A Spearman's *rho* was performed to observe the linear relationship of sponsored research funding levels and administrative capacity *within* the categories of the Carnegie Classification's doctoral universities group. The results of the Spearman's *rho* correlation showed a significant positive correlation between administrative capacity levels and sponsored research levels within the categories of the Carnegie Classification doctoral universities group (Table 17: $\rho = .956$, $p < .01$).

Table 17

Correlation between Administrative Capacity and Sponsored Research Funding Levels

		All R&D Expenditures 2016 ($Thousands)	Administrative Capacity
All R&D Expenditures 2016 ($Thousands)	Correlation Coefficient	1.00	.956
	Sig. (2-tailed)		0.01

Notes. Correlation is significant at the 0.01 level (2-tailed); SPSS Spearman's *rho* Correlation.

The Pearson's *r* correlation also showed a significant positive correlation between the two variables (Table 18: $\rho = .944$, $p < .01$). *A Pearson's r was performed alongside the Spearman's rho, thus the recommendation to report the Pearson's r correlation in the findings.

Table 18

Correlation between Administrative Capacity and Sponsored Research Funding Levels

		All R&D Expenditures 2016 ($Thousands)	Administrative Capacity
All R&D Expenditures 2016 ($Thousands)	Pearson Correlation	1	.944
	Sig. (2-tailed)		0.01

Notes. Correlation is significant at the 0.01 level (2-tailed); SPSS Pearson's *r* Correlation.

A significant linear relationship was found between administrative capacity levels and sponsored research funding levels within Carnegie doctoral categories. As administrative capacity increased, sponsored research funding levels also increased (See Figure 5).

Figure 5: Relationship of Administrative Capacity and Sponsored Research Funding Levels Within Carnegie Doctoral University Categories

A Spearman's *rho* was also performed to observe the linear relationship of foundation funding levels and administrative capacity within the categories of the Carnegie Classification's doctoral universities group. The results of the Spearman's *rho* correlation showed a significant positive correlation between administrative capacity levels and foundation funding levels within the categories of the Carnegie Classification doctoral universities group (Table 19: $\rho = .752$, $p < .01$). *A Pearson's *r* was performed alongside the Spearman's rho, but the results were not similar enough to consider the Pearson's *r* results in the findings.
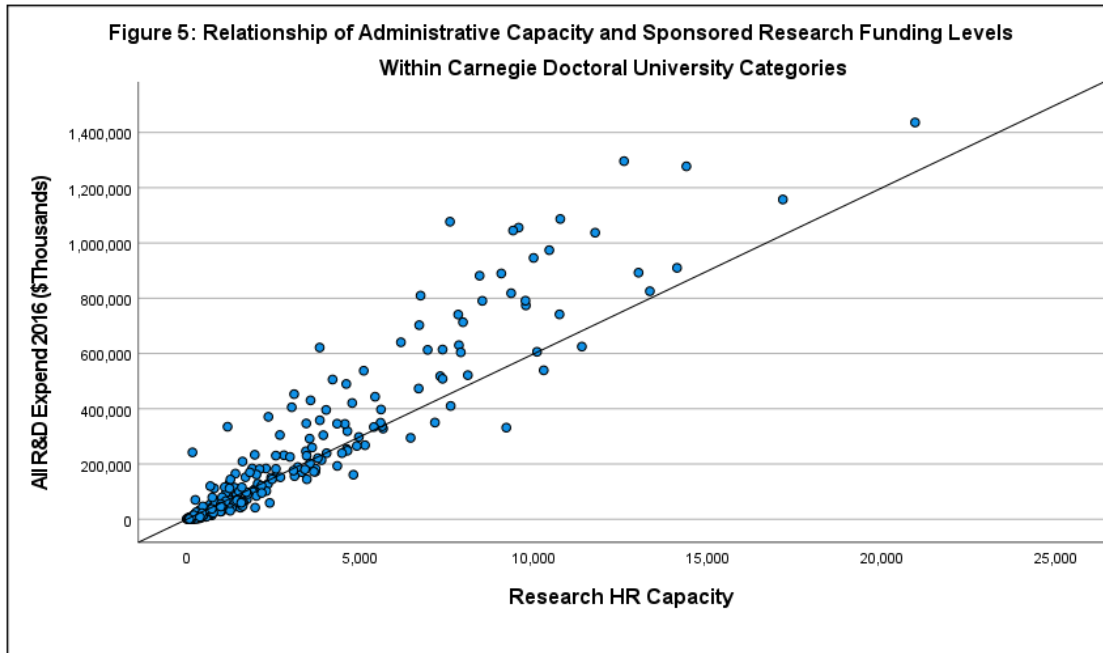
Table 19

Correlation between Administrative Capacity and Foundation Funding Levels

		All R&D Expenditures 2016 ($Thousands)	Administrative Capacity
Foundation Funding Total FY2016	Correlation Coefficient	1.00	.752
	Sig. (2-tailed)		0.01

Notes. Correlation is significant at the 0.01 level (2-tailed); SPSS Spearman's *rho* Correlation.

A significant linear relationship was found between administrative capacity levels and foundation funding levels within Carnegie doctoral categories. As administrative capacity increased, foundation funding levels also increased (See Figure 6).

Figure 6: Relationship of Administrative Capacity and Foundation Funding Levels Within Carnegie Doctoral University Categories
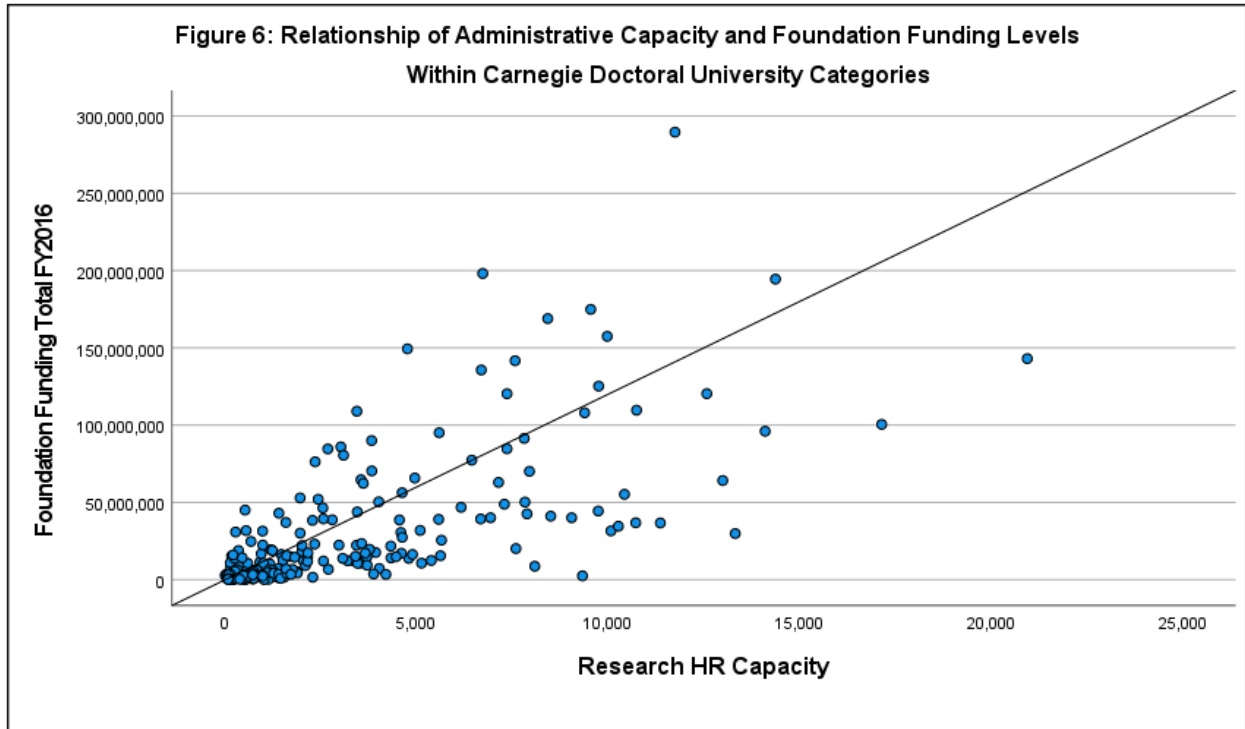
Testing the relationship of administrative capacity and levels of funding across the categories of Carnegie's highest-ranking Classification group, doctoral universities, observes that administrative capacity levels have a direct linear relationship with both sponsored research funding and foundation funding levels. Linearity holds true between levels of administrative capacity and levels of funding across all three hypotheses, thus empirical evidence supports that an institution's administrative capacity does reflect its levels of research and foundation funding and null hypotheses are rejected.

Findings will be further discussed in Chapter 5, basing the discussion of key findings in a theoretical framework, discussing the limitations of the study, tying findings to recommendations

for the funding process, and concluding with a discussion on future research that is to be considered as a result from this study.

Chapter 5: Key Findings and Discussion

Introduction

This dissertation aims to identify how institutional reputation of Carnegie Classification rankings, institutional control type by resource dependence, and size of administrative capacities relate to levels of sponsored research and foundation funding in U.S. institutions of higher education. A quantitative analysis was used to analyze data from publicly available datasets to explore relationships between Carnegie Classification rankings, institutional control types of public or private, administrative capacities, and sponsored research and foundation funding levels of institutions. The study population included Carnegie classifications of four-year institutions classified as Doctoral Universities, Master's Colleges and Universities, Baccalaureate Colleges, and Special Focus Four-Year. Data sources for this study included the Carnegie Classification 2018 Public Data Report, the National Science Foundation's Higher Education Research and Development FY2017 Survey, the U.S. Department of Education's Integrated Postsecondary Education Data Systems 2016-2017 report, and the Council for Advancement and Support of Education's Voluntary Support of Education FY2016-2017 report. This research is necessary to identify what contributes to perceived biases in the funding process and what enables an institution to signal competitiveness to funding sponsors based on the Principal-agent and resource dependency theories. Narrowing the gap of funding distribution by better qualifying minority institutions and faculty researchers for funding competitiveness is important to the profession of research administration for social equity performance in sponsored research and foundation funding. This chapter will provide a discussion of key findings from this study in a theoretical framework, discuss limitations of the study, connect findings with

recommendations for the funding process, and will conclude with a discussion on future research.

Key Findings Summary

Research related to Carnegie Classification's ranking effects on securing both sponsored research and foundation funding is sparse, but the relevance of this research to theoretical frameworks in social equity, economic theory, and administrative structure is supported through relatable topics that have been previously researched and published. The majority of the study's hypotheses were supported through the use of non-parametric tests of the Kruskal Wallis *H* Test and Spearman's *rho*, and the findings have provided insight that helps outline areas of future research, especially in the areas of administrative capacity and organizational response.

Key Findings

Key finding One: An institution's Carnegie Classification ranking has a direct linear relationship with its level of sponsored research and foundation funding. As levels of funding are an indicator in the Carnegie Classification methodology, it is not surprising that the highest ranking group, the doctoral universities, rank the highest in research and development funding compared to the other three four-year institution groupings of master's, baccalaureate, and special focus four-year. Special focus four-year comes in as a close second over master's and baccalaureate. Foundation funding levels varied slightly from the tendencies of sponsored research funding between the four-year Carnegie Classification groupings of this study.

Yet, an interesting find is that while foundation funding does increase with an institution's rank in the Carnegie Classification system with doctoral ranking first and special focus four-year as second, baccalaureate ranked in foundation funding levels over master's. This

could be attributed to the presence of many prestigious, private baccalaureate institutions with low acceptance rates. These institutions produce alumni who go on to be much more successful than average and give back or show loyalty to the institution. While foundation funding levels in this study are based on foundation grant funding, not total giving that includes alumni and private gifting, these alumni go on to serve on influential foundation boards or provide connections to these boards through privilege. This opens the door for these institutions to receive selective invitations to apply for prestigious funding from top foundation agencies and a continued advantage in funding levels.

Overall, this does support that reputation and prestige found in higher classification ranks shows a relationship with higher levels of funding in both sponsored research and foundation funding. It can also indicate that higher classification institutions have a higher research capacity in terms of more faculty researchers, along with these researchers having more time to devote to their research over teaching and service. The goal of baccalaureate, master's, and doctoral high research activity (R2s) institutions is to educate students, resulting in their faculty size being dependent on class sections, or admissions. Their teaching loads include a 4/4, as well as summer instruction, leaving little or no room for research. Faculty at doctoral very high research activity (R1s) institutions may only teach one class a semester or academic year, and they are typically pressured to perform at a high level of research productivity and secure large research grants to generate their salary and fund their labs. This can be tied back to the Matthew effect in which the institutions who have plentiful resources are in a better position to gain additional resources, while the institutions who have historically lacked in resources struggle to secure vital resources in a funding disparity environment (Li & Agha, 2015). This can also be supported by

the Principal-agent theory in which the principal bases partnership decisions on prestige and reputation due to performance accountability and less risk in transaction costs.

Key finding Two: Foundation funding levels do increase at an institution as sponsored research levels increase. This finding further supports the Matthew effect in which institutions who have resources are more adept at securing additional resources. It also supports that reputation and prestige is an indicator of funding competitiveness, as institutions who are successful at securing competitive funding are looked to as less risk in transaction costs within the Principal-agent model and bring further prestige when gained as a partner. One point to consider is that institutions who have access to more resources also may invest more in their staffing and administrative structure to adequately secure both sources of funding, thus leading into the next key finding based on the resource dependency theory and institutional control type.

Key finding Three: Distributions of sponsored research funding and foundation funding differs based on institutional control type of public or private, with public institutions receiving more sponsored research funding and private institutions receiving more foundation funding. Differences in sponsored research funding and in foundation funding were found based on whether the institution's control type was public or private. This is supported by the resource dependency theory in that institutions signal their organizational commitment to sponsors by creating administrative capacity in the form of formal offices and staffing that serve direct functional roles in negotiating and managing the demands of the sponsored research and foundation funding exchange relationships. While this finding was expected based on theory and historical precedence of funding source dependency between public and private institutions, mainly due to governmental control and support, it is interesting

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when thought of in tandem with the previous key finding that foundation funding levels increase when sponsored research funding levels increase at an institution.

This also leads to the *wicked problem* in public management of staffing and capacity, or the chicken and the egg. Does increased administrative capacity lead to more funding or does more funding lead to the need to increase administrative capacity? This can be viewed both from research capacity of faculty researchers and incorporating the administrative capacity levels of research administration and foundation relations. Many institutions are limited or experience barriers in growing their faculty and administrative resources, especially R2's and below. They do not have the chance to strategically grow their numbers to secure more funding. Leadership and governing boards are reluctant to staffing critical areas for securing external sponsored funding, thus presenting strain on existing faculty and staff with growing pains while being expected to climb the ranking ladder.

Another consideration to institutional control type and resource dependency of funding sources is that while private institutions trend in securing more foundation funding, some of the most prestigious private institutions such as Johns Hopkins, MIT, and CalTech, are also the most successful in securing sponsored research funding. These outliers lead in both research *and* foundation funding levels, and this can be associated with their performance and reputation, as well as their historical dependence and administrative structure that they built to secure and maintain their sponsors.

Again, are institutions that have plentiful resources organizing their administrative structure to competitively secure more resources in funding sources? Will this contribute to a wider funding disparity gap in future years based on available resources and the economy?

Key finding Four: As research administrative capacity levels increase, both sponsored research funding and foundation funding levels increase, thus they have a direct linear relationship. This finding is supported by both the Principal-agent theory and resource dependency theories. The funding process of sponsored research agencies and foundations can be explained as a Principal-agent relationship, with the principal being the funding sponsor and the agent being the institution of higher education. The sponsors look to institutions of higher education to deliver outcomes for them that they cannot deliver by or for themselves. The resource dependency theory is based on the principle that the institution of higher education has to engage in transactions with other actors and organizations in its environment in order to successfully acquire external resources, in this case sponsored research and foundation funding. The increasing dependence of institutions on external relationships with funding agencies and foundations to secure funding has required organizations to both create specialized administrative offices and positions and to invest in significant training of faculty and specialized personnel in order for the institution to adequately and competitively secure and manage these relationships. Signaling of organizational commitment and capacity is weighed by the principals, or sponsors, when calculating transaction costs and performance accountability. Again, it can also be considered that institutions with more resources can hire and train more faculty and personnel, thus the ability to more easily secure additional resources.

Key finding Five: Funding levels and administrative capacity levels have a direct linear relationship within the categories of the Carnegie Classification doctoral universities group. Significant differences in administrative capacity were found among the three doctoral group classifications of doctoral university very high research activity, doctoral university high research activity, and doctoral professional universities. The doctoral university very high

research activity classification reported the greatest administrative capacity, sponsored research funding, and foundation funding. It was followed by the doctoral university high research activity in all three variables, and the doctoral professional universities came in last. A large gap was present between the doctoral university very high research activity classification and the doctoral professional universities.

Overall, it is pertinent to mention that with the lack of homogeneity of variances and normal distribution, and how it affected the violation of assumptions, the percentage gaps are telling of the social equity performance revealed in the funding disparities between the classification rankings of institutions and levels of administrative capacity.

Limitations of Study

Limitations in this study included a smaller set of institutionally reported data of foundation funding levels compared to the number who reported their sponsored research funding levels in the dataset. While it is advantageous for an institution to report their research and development expenditures to the federal government, incentives are structured differently for reporting foundation funding. An institution may also not be a member of CASE and this could have potential to affect the reporting structure of private funding receipts. Another limitation for consideration is that organizations are re-classified in the Carnegie Classification of Institutions of Higher Education on an average of every 3 to 5 years, thus as their rankings shift, this can affect the data.

Limitations also included the inability to control for faculty teaching loads. Faculty teaching loads affect research productivity. It would be advantageous to be able to control for this factor, as it is directly affected by the resources of time and effort to write research funding

proposals and foundation funding applications, as well as the time to carry out the research if funded. Teaching loads not only vary between types of institutions, but they also vary within the institution between departments, colleges, and schools.

Recommendations

While accountability and high impact outcomes are important to both sponsored research funding and foundation funding, as they are investments of taxpayer funds and private funds dedicated to fulfilling a mission, it is important to consider how the funding process can begin to make a more concentrated effort in narrowing the funding gap. Referenced earlier in the Washington Post, Moody's Investors Service has reported a growing divide in higher education with large public research universities and other top public schools holding more than 90 percent of the total cash and investments in the higher education sector, as well as the top quarter of colleges and universities among private institutions holding 85 percent of all cash and investments (Selingo, 2018). The indirect cost, or facilities and administrative costs, of doing research is not fully covered by funding agencies, thus institutions must put forward resources to be able to carry out research. With looming budget cuts that institutions are facing from current higher education market conditions and the effects of the global COVID-19 pandemic, we are witnessing cuts to research at institutions who do not fall within the R1, very high research activity institutions. This further magnifies resource disparities and social inequities in the higher education environment. Institutions affected by the funding disparity will be the ones that cut research programs and student research experiences and will have to close their doors or be required to merge into other systems, as we are currently see today in the field of higher education. While closures and bankruptcies of higher education institutions are based on declining enrollments and revenue streams, and not research and foundation funding streams, it

clarifies the social equity gap of resources between the large prestigious universities and the small rural institutions. When an institution of higher education closes its doors, not only are the students and those employed by the institution affected, but the communities of which it serves through engagement and economic vitality are as well. Sponsored research agencies at the federal level have worked to engage funding programs geared for states that secure below the threshold of the top percent that is awarded through the federal government. Yet even with these programs in place, when the funding is awarded, the programs end up going to institutions with the most plentiful resources of the state instead of those who are in most need of instrumentation, student workforce development, and resources for junior faculty to gain a competitive footing. While some of these federal funding programs are under scrutiny by Congress for not showing true economic impact and growth for the states of which they have funded, new program structures need to continue to be explored. Mentoring programs that involve both higher ranked and lower ranked institutions with the prescription of funding levels for each could be considered for a sharing of resources and an immediate increase in administrative capacity through partnerships.

Another recommendation to consider is in the administrative structure of an institution itself in which foundation specialists work closely with the research administration offices to piggyback on how to more effectively strategize to bring in funds together. Many foundation relations and corporate engagement officers are located in institutional advancement offices which are typically separate from research administration offices in the university setting. Breaking boundaries and cultivating a collaborative relationship between both offices can initiate a positive cultural change in support for research growth in both restricted and non-restricted sponsored funding. It can also enable the cultivation of stronger relationships with stakeholders,

sponsors, and industry with the university (Devereux & Blackburn, 2018). Smaller and less

research-intensive institutions tend to experience scarce resources in support of research

administration and foundation relations. Building capacity by partially integrating these offices

can lead to improvement in office productivity, specialization, and fiscal efficacy (Devereux &

Blackburn, 2016). Arkansas State University bridged this gap starting in 2016, and it quickly

became a catalyst in effectively applying for, securing, and managing externally sponsored

funding, including both sponsored research and foundation grants (Devereux & Blackburn,

2018). Arkansas State University's organizational model for integrating research administration

and foundation relations has been presented and published at the national level with both The

National Council of University Research Administrators (NCURA) and The Council for

Advancement and Support of Education (CASE). Resources in administrative capacity for

support of research and sponsored projects are crucial, and often scarce, for institutions who have

historically had smaller sponsored funding levels and are in need for strategies to overcome the

resource and funding disparity.

Bridging the gap between research and advancement at Arkansas State University began

with Follett's group process. This process provided both research administration and

advancement's foundation relations a united vision and a means to create capacity that neither

office could have created alone (Devereux & Blackburn, 2018). As smaller institutions

experience lean staffing levels, resource creativity is crucial. Devereux and Blackburn (2018)

embraced Follett's "power-with" management theory to emphasize the importance of open

communication through an integrated and informed organization, reducing skepticism and

enabling better decision-making capacities to maximize resources and achieve superior

outcomes. Management of structural change efforts were made both at the surface for visibility

to campus and beneath the surface to build a strong foundation for the partial integration of the research and advancement offices (Devereux & Blackburn, 2016). For research administration, the cultivation of the relationship between the faculty researcher and the program officers of the various funding agencies is critical, along with forming strong relationships between the institution's research office and the policy or grants management offices of federal and other sponsoring agencies. For foundation relations, it is about building personal connections by reaching out and making direct introductions to foundation representatives, as well as cultivating relationships with alumni who serve on the various foundation and philanthropic boards. The divide and conquer mechanism through this model also incorporates opportunities for when foundations or philanthropic sponsors have funding mechanisms that may come out of both restricted research and philanthropic grants. Both offices strategize and make team visits to cultivate this relationship (Devereux & Blackburn, 2016). While both offices may have had a precedence of claiming numbers for reporting and are territorial, ways to administratively report joint efforts and work toward a common goal of securing externally sponsored funding may be an answer to signaling to sponsors the organizational commitment for bettering institutional opportunities. This model represents best practices in administrative capacity to address social equity and funding disparities through the Principal-Agent and resource dependency theories by signaling to sponsors a shared vision and unity in institutional approaches based on priorities and stewardship of funds.

Another recommendation for the more predominantly undergraduate institutions or less-research active universities is the integration of research development into the research administration structure. This can be a direct response in seeking the advancement of equity in administrative capacity by making a purposeful and deliberate attempt to better qualify the

institution for increased sponsored funding competitiveness. Related to the resource dependency

theory, the university's responsiveness to public accountability demands of societal

responsiveness requires creative resources and new management models to meet the expected

contributions to the public and its communities (Devereux, 2019). New models are restructuring

research administration capacity to go beyond administrative functions of managing proposal

submissions and are emerging with research development roles that work alongside faculty

researchers to develop competitive proposals and coordinate communication with funding

agencies. The typical research administrator role has been to stay abreast of federal guidance

and university compliance, thus providing a natural segue for expertise in negotiating new

methods of research partnerships, collaborations, and funding. The resources of the research

administration office are a pathway and asset for research development, and if effectively

utilized, can turn out to be an institutional catalyst for growing administrative capacity and

engagement for funding competitiveness.

Future Research

Future research that has been inspired from this study will include the exploration of

university commitment and response to administrative structure and capacity to increase

sponsored research and foundation funding levels. A survey is the next step, directed at chief

fundraising and chief research officers of institutions who received a change in Carnegie

Classification in January of 2018. This survey will be administered to gain insight to

administrative response, investment, and commitment to administrative capacity, as well as

perceived reputation change leading to an increase of research and private funds received by the

institution since the change in rank. Important to research administration is knowing how to

effectively administer capacity in research administration and development offices to adequately

fulfill administrative functions, or transactional costs, for growth in research and sponsored

funding.

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