Constructing an Estimate of Academic Capitalism and Explaining Faculty Differences through Multilevel Analysis

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Abstract

Two broad influences have converged to shape a new environment in which universities must now compete and operate. Shrinking financial resources and a global economy have arguably compelled universities to adapt. The concept of academic capitalism helps explain the new realities and places universities in the context of a global, knowledge-based economy (Slaughter & Leslie, 1997). Prior to this theory, the role of universities in the knowledge economy was largely undocumented. Academic capitalism is a measurable concept defined by the mechanisms and behaviors of universities that seek to generate new sources of revenue and are best revealed through faculty work. This study was designed to create empirical evidence of academic capitalism through the behaviors of faculty members at research universities. Using a large-scale, national database, the researcher created a new measure—an estimate of academic capitalism—at the individual faculty member level and then used multi-level analysis to explain variation among these individual faculty members. This study will increase our understanding of the changing nature of faculty work, will lead to future studies on academic capitalism that involve longitudinal analysis and important sub-populations, and will likely influence institutional and public policy.

Dedicated to Susan I. Burt

and Harold C. Burt

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CHAPTER 1

INTRODUCTION

In 1990, Ernest Boyer published *Scholarship Reconsidered*, an effort to shake convictions that the faculty reward system be based largely on research. In doing so, he framed a debate about how faculty members achieve academic status. For academe and the nation to survive, he argued, colleges and universities needed to be more creative in how they defined what it means to be a scholar (Boyer, 1990). However, in the time since its publication, the allure of academic capitalism—a mechanism to feed economic progress, augment institutional resources, and support professors' expansive research—has proven a formidable countervailing force to Boyer's realignment of professorial priorities. And while institutions have principally recommitted to undergraduate education, they have also bolstered efforts to remain a financially viable enterprise.

Higher education is indeed an expensive enterprise. Funding the enterprise is a much-discussed topic and one of on-going interest to multiple stakeholders. Regardless of reason, the need for money is "a chronic condition of American universities" (Bok, 2003). The maintenance of this condition takes universities in new directions and in many cases dramatically shifts traditional notions of American higher education. Nowhere is this more evident than in the nature and role of faculty.

The nature of faculty work has changed both incrementally and dramatically during more than 370 years of American higher education. The progression has had a winding path since early colonial colleges when "faculty" focus was "pedagogical and pastoral-custodial in nature" (Finkelstein, 1997, p. 22). The American Revolution provided a break from the medieval studies characteristic of the early curriculum and ushered in the age of Enlightenment. The advent of

natural law and subsequent scientific fascination provided direction to the country's forefathers and leaders of educational institutions. The curriculum, and thus professorships, clearly adapted to this movement toward the sciences of the time and preparing a democratic citizenship (Rudolph, 1990).

Young scholars returning from the elite universities of Germany in the 1800s marshaled an era of professionalization and specialization within the disciplines and formed the basis for graduate education (DeVane, 1965). It marked a time "when the tilt in the direction of professional careerists who displaced tutorial generalists became clear"(Schuster & Finkelstein, 2006, p. xvi). The work of faculty, once based in the traditions of theology and ethics, was now rooted in rational causation (Gruber, 1989). The emergence of science, distinct subject areas, and professionalization of knowledge led to direct manifestations of graduate training, research, and publication. Perhaps in response, Ralph Waldo Emerson delivered his lecture "The American Scholar" in 1837 (Emerson, 1901). In it, he envisioned a break from European influences in favor of a purely American identity that saw the world as a whole. Importantly, the aim of Emerson's speech was intended to tie the work of the scholar to nature, books, and action. Clearly his was a divergent direction given the pull towards scientific and technical specialization.

Most important in the line of progression is the rise of the American research university. At the turn of the 20th century, major research universities "had become the corporations of the education industry—organized to gather the lion's share of social resources available to higher education, and committed to produce the most valued educational products for the most important national markets" (Geiger, 1986, p. 1). Subsequently, the importance of scholarship and publications—the products of research—reshaped faculty work and the reward structure.

Prior to this time, promotion of junior faculty was subject to ubiquitous inbreeding and the whim of institution management (Geiger, 1986). It is during this time that the roots of a tenure structure took hold and gained wide acceptance. The currency of faculty shifted from affiliation to research production.

Other important shifts occurred during the late 1800s and early 1900s. For example, the incremental combination of the Mechanics Mutual Protection and the Agricultural College Act of 1862, Morrill Land-Grant Acts (1862 and 1890), G.I. Bill of Rights (1944), and the Higher Education Act of 1965 each contributed to the massification of higher education. The rise of student affairs professionals in early 1900s relieved faculty of duties outside of their core academic pursuits (Saddlemire & Rentz, 1983). Later the establishment of community colleges shifted faculty roles once again. Each of these examples is a notable alteration in the prevailing notions of faculty as scientist-researcher. For many faculty, the diversity of institutions and students bifurcated higher education into opposing research and teaching foci.

In recent decades, more so than any other time, contemporary faculty have witnessed monumental changes to the fundamental roles by which they structure their work. The new Knowledge Economy—the convergence of the Information Age and global competition—has influenced a distinct departure from business as usual within academe (Slaughter & Rhodes, 2004). In particular, faculty have been especially sensitive to external influences leading many to consider themselves independent contractors rather than members of the academic community (J. B. Hirt, personal communication, 2007).

Today, for example, full-time faculty work has been “unbundled” and is more likely to focus on classroom and research activities (Schuster & Finkelstein, 2006). Activities such as advising have been “outsourced” to other professionals (Rentz, 1996). Even the service role of

faculty has largely become undervalued and reserved for post-tenure work (Neumann & Terosky, 2007).

In 1959, Peter Drucker forecast a profound change in the world's economy when he coined the concept of knowledge work. He predicted a fundamental change in the structure of the American workforce as a result of a swell in college graduates who "expect[ed] to move into technical, professional, and managerial work" (p. 52). Drucker (1959) understood that the success of business and the economy was increasingly reliant upon this new worker. Drucker further reflected on the importance of this change and subsequently called it an extreme social transformation (1994). In fact, he posited the new economy may or may not materialize but is much less important than an inevitable new society predicated on changing demographics, immigration, split markets, and a new workforce (Drucker, 2001).

But even the Knowledge Economy is not immune to change. In fact, it is in the throes of a seismic shift from the linear Information Age to a creative, inventive Conceptual Age (Pink, 2005). Drucker's knowledge worker, focused on analyzing and manipulating information, will give way, at least partially, to what Pink describes as a more humanistic pursuit of "high concept" and "high touch" endeavors. It is in this space that the new Knowledge Economy will move from work based on logical and analytical tasks to imaginative and meaningful ones. Nevertheless, the basic premise of the Knowledge Economy remains intact: the product of the worker is new knowledge.

The now ubiquitous term "Knowledge Economy" used to describe the current state of our economy may suffer as undefined jargon. Sensing a need to define the concept, The Work Foundation attempted to establish a "testable" definition (Brinkley, 2006), but seemingly surrendered to the need for multiple definitions to "capture all aspects of the knowledge

economy" (Brinkley, 2006, p. 29). However, together with the Organization for Economic Co-operation and Development (OECD) the group fashioned a set of knowledge intensive industries: high to medium high technology manufacturing, finance, telecommunications, business services, education, and health (Brinkley, 2006). By its own admission of banality, the group did offer that the knowledge economy "is what you get when firms bring together powerful computers and well-educated minds in order to create wealth" (Brinkley, 2006, p. 3). Perhaps, then, it must be left to industry experts to develop industry-specific definition. Such is the case in higher education with the arrival of academic capitalism (Slaughter & Rhodes, 2004).

The notion of a Knowledge Economy lends itself to melting the boundaries of the nation-state (Drucker, 2001). In doing so, what emerges is a markedly different environment for competition on a global scale. The movement of knowledge is "more effortless than money" (Drucker, 2001, p. 2). Global competition then transcends the university walls and in fact the nation, as faculty members (the front line troops) work to acquire the resources necessary to continue research and other functions of the university. Instead of trading the manufactured products of the Industrial Age, faculty members compete and trade knowledge.

In what Friedman (2005) calls Globalization 3.0, the world is shrinking from "a size small to a size tiny and flattening the playing field at the same time" (Friedman, 2005, p. 10). Essentially what he advances is that the individual, not a country or an organization, works to collaborate and compete. Subsequently, individuals, even in less developed countries, are able to compete globally. Institutions of higher education are steeped in global competition as they work to integrate into the Knowledge Economy, particularly since its core product is knowledge.

The reaction by higher education to the new knowledge society and competitive global economy has been described as academic capitalism (Slaughter & Rhodes, 2004), marketization

(Kirp, 2003), corporatization (Washburn, 2005), commodification (Briton, 1996), professionalization (Rhodes, 2001), and commercialization (Bok, 2003). Each represents an escalation in university dependence upon new financial resources coupled with market forces. The resulting drift toward private purposes (Zemsky, Wegner, & Massy, 2005), including the production of research (Gumport, 1999), has led to the transformation of the American research university (Rhodes, 2001) and sparked efforts by institutions to become more self-reliant and entrepreneurial (Clark, 2001). While there has been some resistance to this movement away from serving the public good (Kezar, 2005), universities continue to mount efforts to ensure financial growth and stability.

Despite concerns, universities have responded to global competition in several ways. The rise of the entrepreneurial university with a focus on profit centers (Shane, 2004), revenue-producing athletic programs (Bok, 2003), applied research (Greenough, McConnaughay, & Kesan, 2007), patents (Mowery, Nelson, Sampat, & Ziedonis, 2001), research consortia (Holland, 1990), and external grants (National Science Foundation, 2007) has shifted attention away from teaching. Moreover, prestige-building activities, namely sponsored research, have advanced as valued currency for institutions and individual faculty members in the global educational marketplace. Subsequently the competition for external funding continues to grow.

The National Science Foundation (2007), for example, recently reported a decrease in grant acceptances. While at least partially due to larger awards, there has also been a dramatic increase in the number of proposals submitted by researchers. Data relealed a 50% increase in the number of proposals from 20,000 to nearly 31,000 during the most recent 10-year period. Federal funding, in particular funding from the NSF, is one tool universities use to benchmark their research and institutional prestige. Since funding is achieved through the efforts of

individual faculty members it is therefore a highly encouraged activity for new and tenured faculty. For their part, university administrators spend previously unheard amounts of money to recruit world-renowned scientists to join their faculty (McNeill, 2007) thus increasing the likelihood of increased prestige.

Shuster and Finkelstein (2006) offer another response with direct implications for faculty. The overproduction of PhDs has allowed colleges and universities to leverage the academic work of faculty. This leverage allows employers to "dictate work content and performance expectations" (Shuster & Finkelstein, 2006, p. 355) and points to the influence of the academic organization through its reward structure.

The reward structure at any college or university is indicative of its priorities. Decisions are made regarding academic programs, faculty hires, and other strategic imperatives to better position an institution for success. Similarly, reward structures such as tenure can be manipulated to encourage various behaviors. Because time is a finite resource, one might expect to see shifts in the allocation of faculty work for the individual to be best situated to access favorable rewards.

Further evidence of the influence of the academic organization can be seen in the "unbundling" of academic work (Schuster & Finkelstein, 2006). A noticeable shift in faculty work has occurred in recent years. For example, others are doing the work of advising and teaching remedial courses. Further, there has been an increase in postdoctoral hires, adjuncts, and the use of graduate student teaching assistants (TAs). Combined, the reallocation of human capital frees the faculty for higher order, more capitalistic pursuits.

The funding imperative of higher education and the propensity for faculty to adapt lends itself to pressure on the professoriate. First, given the dramatic upending of the role of faculty to

take part in the highly competitive, globalized knowledge economy, we expect to see an adjustment in self-reported work behaviors. However, the longitudinal effect of academic capitalism remains under-investigated. Second, the nested influence of how the academic organization influences faculty work is relatively unknown. Because of the nature of the Knowledge Economy, with its reliance on highly specialized workforce, workers (in this case faculty), must have access to an organization (Drucker, 1994). Of critical importance "[i]n the knowledge society, it is not the individual who performs. The individual is a cost center rather than a performance center. It is the organization that performs" (Drucker, 1994, p. 11). For this reason, the influence of the academic organization must be examined. Academic capitalism, therefore, is a multi-level issue given the intersection of individual pursuits and organizational environments.

Statement of the Problem

To date, researchers have focused attention on intellectual property, patents, licensing, technology transfer, copywriting, and other similar activities attributable to revenue-producing, prestige-building efforts by institutions and faculty. Essentially, the existing research has been indifferent to the influence of these activities on faculty work over time. Subsequently, the effect of academic capitalism, an amalgamation of these activities, on faculty work is unclear, unknown, and understudied.

Despite growing attention, there is surprisingly little investigation of the influence of academic capitalism on the work of faculty members. Research is needed to identify and define the nature of the relationship between academic capitalism and faculty work, whose work is likely to be more heavily influenced by external pressures. Similarly, no studies exist that explore how the influence of academic capitalism might vary by certain demographic, academic

discipline, rank or institutional characteristics. Consequently, further research is needed to examine the nature of the relationship between academic capitalism variables and the work of faculty. This research explores differences between faculty members on the basis of several demographic characteristics such as race, gender, rank and academic discipline. Importantly, this investigation also includes the nested nature of faculty work within institutions.

Purpose of the Study

The purpose of this study was to create a measurable construct of the theory of academic capitalism and to examine individual and organization characteristics of faculty members at doctorate-granting, research universities. Using data from the National Study of Postsecondary Faculty (NSOPF), faculty responses to behavioral items were used to estimate levels of academic capitalism. Further, the study sought to identify critical individual, academic discipline, and university characteristics that contribute to variation in academic capitalism.

Faculty work was defined as a tripartite of research, teaching, and service. These general categories are universally accepted as the "basic constellation of activities" (Schuster & Finkelstein, 2006, p. 76) and by which faculty productivity is measured (Middaugh, 2001; Schuster & Finkelstein, 2006). Arguably, the focus, and perhaps preferences, of faculty work has shifted over time, yet they remain stable constructs of faculty work life.

The concept of academic capitalism was first presented in the landmark work *Academic Capitalism: Politics, Policies, and the Entrepreneurial University* (Slaughter & Leslie, 1997). Prior to this work, the role of universities in the knowledge economy was undocumented. In a follow-up volume, the theory of academic capitalism (Slaughter & Rhoades, 2004) took shape and was defined as "the process of college and university integration into the new economy" (p. 1) and the institutional evolution as marketer. Academic capitalism then becomes a measurable

concept defined by the mechanisms and behaviors of universities, explicitly through faculty members, operating in the Knowledge Economy.

A measurable construct of academic capitalism was operationalized in Chapter 3 of this study. It is a unique variable that was constructed from existing national data on faculty work through combined activities of faculty at all ranks and tenure status. In doing so, the impact of academic capitalism was measured against individual and organizational characteristics that influence faculty at multiple career stages.

Research Questions

The study was designed to explore the following research questions:

1. How can a measure, or individual-level estimate, of the theory of academic capitalism be created using data from the National Study of Postsecondary Faculty (NSOPF:04)?
2. Do individual characteristics such as sex, race/ethnicity, faculty rank, U.S. citizenship, and marital status significantly affect academic capitalism behavior of faculty members at research universities?
3. Do institutional characteristics such as institutional control (i.e., public or private), classification, size of endowment, academic research and development expenditures, and percentages of women and minority faculty members significantly affect the academic capitalism behavior of faculty members at research universities?
4. Do academic area characteristics such as characteristics of the discipline, percentages of women and minority faculty members, and productivity significantly affect the academic capitalism behavior of women and minority faculty at research universities?

These research questions stem from previous research on academic capitalism. Each points to a need for empirical evidence of academic capitalism.

Definition of Terms

Academic capitalism: Generation of external resources from market activities that turn on the selling of academic products, processes, and services (Slaughter & Rhoades, 2004)

Faculty: Academic professionals employed by an institution of higher education to perform duties which include teaching, research, and service.

Faculty rank: The status of faculty in tenure-eligible positions, as defined by the NSOPF:04 survey. For purposes of this study, faculty rank does not include those faculty in non-tenure track positions. The three ranking levels include assistant professor, associate professor, and professor.

Tenure status: A dichotomous variable identified as tenured or non-tenured/tenure track status.

Work: Any combination of teaching, research, and service that meets institution standards for tenure.

Academic fields: Academic disciplines were assigned according to Biglan's (1973) three dimensions: (a) hard or soft, (b) pure or applied, and (c) life or non-life.

Race/ethnicity: A dichotomous variable defined as majority (White, non-Hispanic and Asian/Pacific Islander) and under-represented minority (Black, non-Hispanic, Hispanic, and American Indian/Alaskan Native) as defined by the NSOPF:04 survey.

Sex: A dichotomous variable defined as Male and Female as defined by the NSOPF:04 survey.

Scope of the Study

The scope of this study was to examine faculty engagement in academic capitalism using a nationally representative sample. To achieve this goal, the study employed the National Center

for Education Statistics (NCES) National Study of Postsecondary Faculty survey (NSOPF). Four waves of data have been collected: 1988, 1993, 1999, and 2004. For purposes of this study, only the most recent wave (NSOPF:04) was used to develop an estimate of academic capitalism and construct a model to test variation. NSOPF is designed to provide essential information about "who faculty are; what they do; and whether, how, and why they are changing" (National Center for Education Statistics, n.d.). Using this data allowed me to extrapolate findings about faculty to a national scale.

Multiple levels of data were used to investigate the research questions. First, at the faculty level, the study included non-tenured/tenure track and tenured faculty. The study drew further distinction in that only faculty with full-time appointments; having primary responsibilities in teaching, research, and service; and employed at 4-year, non-profit institutions were considered. Faculty characteristics such as gender and race were explored.

Because the work of faculty is nested within organizational structures including the university and academic discipline, institutional characteristics were investigated. Data from the Integrated Postsecondary Education Data System (IPEDS) were used to determine the influences of the work environment of faculty. While IPEDS data are self-reported by institutions, they provided a reliable basis for comparison.

Significance of Study

There has been much discussion about the changing role of faculty and the type of work in which they engage, particularly academic capitalism. However, little empirical evidence exists to support this claim. This study was designed to create an estimate of academic capitalism for individual faculty. I then determined differences at the individual level and the influence of organization characteristics on academic capitalistic behavior.

The study used multilevel modeling to address aggregation bias to examine if institutional characteristics influence the work of faculty members. Hierarchical Linear Modeling (HLM) allowed for new questions and provided empirical results that "might otherwise have gone undetected"(Raudenbush & Bryk, 2002). In the case of the present study, findings more accurately defined variance at the faculty and organization levels. In doing so, we gain a more complete picture of the impact of academic capitalism.

With its focus on all ranks and tenure status of faculty, the study ascertained the full affect of academic capitalism. Non-tenured/tenure track faculty may be more susceptible to the pressures of the institution. Since they are seeking tenure, faculty members in this group are likely to engage in practices that bring prestige to themselves and subsequently their employing institution. Tenured faculty, however, may be more likely to exploit industry contacts and, because of established research agendas, may be better positioned to engage in academic capitalism. I expected that institutions would create environments that support academic capitalism for both groups.

The present study was significant for several stakeholders. At the institution level, academic leaders gained an understanding of the impact of organization characteristics on academic capitalism. By shedding light on which faculty members are more likely to contribute to academic capitalism, academic leaders are better positioned to make decisions about resource allocation, realign strategic priorities, and develop of new academic programs. Moreover, findings provided evidence to university leaders as they weigh the mission, values, and roles of their institutions and academe.

At the department and program level, faculty members benefited from this study. The findings informed them of the changing nature of faculty work. Department leaders may use this

information to assess faculty work to align mission, goals, and behavior. Further, faculty members may use findings from this study as a basis for hiring new faculty that best "fit" the department work culture. Most consequentially, the results helped faculty members reflect on their work and help make personal decisions about core professional responsibilities including public service and teaching.

Findings have additional implications for graduate education. Graduate students are considered the front lines of faculty research. During this important period of research training, doctoral students are exposed not only to the technical aspects of research and scholarship, but to the political as well. They witness which behaviors are rewarded and form lasting perceptions of what is truly valued in academe. In other words, the faculty socialization process begins during graduate education. By better understanding the work of faculty, graduate students will come to more fully understand their professional career and can make well-informed choices. Knowing the impact of academic capitalism may provide an opportunity to strategize or confront potential problems in the job search process.

This study had implications for future research related to faculty. The creation of an estimate of academic capitalism for individual faculty members generated a line of research that further explores faculty behaviors. Future studies might include focused attention on how faculty work has changed over time. Using previous waves of NSOPF data, the new measure would support a longitudinal analysis. Another interesting study would involve in-depth analysis of academic disciplines that do not expressly rely upon technology transfer, particularly the humanities. A qualitative study of faculty in this area might yield unique insight to the pressures to engage in academic capitalism.

Finally, findings helped inform researchers at the NCES on the development of future versions of the NSOPF survey. If academic capitalism does indeed influence faculty work, refining existing items or adding new ones will be important considerations to more accurately reflect the work of faculty.

Delimitations

As with all research, this study was subject to delimitations. The first was related to the datasets employed, namely the National Study of Postsecondary Faculty. The study was limited to the factors that could be operationalized using items contained in NSOPF:04. Because academic capitalism is not a predefined variable, an estimate was created to approximate it using available items. There is inherent risk in doing so because both the researcher and the reader make assumptions. In addition, other activities that might indicate work in line with academic capitalism might not have been included in the survey.

Organization of the Study

This study was organized around three chapters and two articles for publication in peer-reviewed journals. The first chapter described the topic to be examined, the purpose of the study, the research questions, and the significance and delimitations of the study. Chapter Two reviewed the literature that is relevant to the study including faculty work and academic capitalism. The third chapter described the methodology that were employed to collect data and the data analysis procedures used in this study. The first article focuses on the creation of a new variable called *Estimate of Academic Capitalism*. The second article addresses variation among and between individual faculty as explained by individual and organizational characteristics.

The first three chapters represented the proposed study. Once the data were analyzed, the most compelling findings were used to write the manuscripts that appear in Chapter Four and

Chapter Five. Any shift in the research agenda, research question(s), or methodology were approved by the examining committee.

CHAPTER 2

LITERATURE REVIEW

This study explored the impact of academic capitalism on selected groups of university faculty in the United States. Literature is reviewed in this chapter in five major sections comprised of: (a) the nature of faculty work, (b) individual level influences on faculty work including gender and race, (c) organization level influences on faculty work including institutional culture and sociological forces, (d) academic capitalism, and (e) behavioral indicators of academic capitalism. First, it is important to define the nature of faculty work where teaching, research, and service are widely accepted as the tripartite of faculty activity. The second section identifies individual, faculty-level characteristics that have been identified in the literature as having an impact on work. In the third section, similar treatment is given to organization-level characteristics. Fourth, the theory of academic capitalism is discussed. Finally, important faculty behaviors are identified that are indicative of academic capitalism. To conclude the chapter, I provide a summary and springboard the reader to the methodology of this study.

The review of literature in this chapter is designed to examine the constructs of faculty work and to support a conceptual model that may improve our understanding of the impact of academic capitalism on such work. Academic capitalism is a relatively new theory in higher education and to date has been understudied. There is little empirical evidence to substantiate if or how it has influenced the nature of faculty work; nor have measurable differences been documented across important faculty groups and organization types.

The Nature of Faculty Work

The development, preservation, and transmission of knowledge is a fundamental function of higher education and the core of faculty work (Schuster & Finkelstein, 2006). This function is

manifest in the academic career path, which begins with graduate study, progresses through the academic ranks and tenure (assistant professor and associate professor), and culminates in a full professorship. At each step, individual performance and productivity is evaluated based on a highly contextualized mix of teaching, research, and service responsibilities. Each organization (university) develops a process, both formal and informal, which rewards its faculty for engaging in the activities it considers most valued. It is through these professional priorities that faculty members "sustain or weaken the intellectual and social environment of the college" (Boyer, 1987).

The "holy trinity" (Schuster & Finkelstein, 2006) of faculty responsibility and work have shifted in recent years. Specifically, organizational reward structures and how faculty choose to spend their time stems from academic capitalism, the primary focus of this study.

Faculty Work Defined

Faculty work is well documented in the literature where the broad activities—teaching, research, and service—are measurable pursuits. This "constellation of activities" (Schuster & Finkelstein, 2006) is representative of internal and external modules of faculty work that have changed little over time and is what distinguishes faculty from other professions. However, specific tasks have changed. For example, with few exceptions faculty no longer are required to supervise student residence halls or minister to the community as they did in the eighteenth and nineteenth centuries (Rentz, 1996). The influence of the German model seeped into American universities and forged a new era rooted in a search for truth through science (Rudolph, 1990). After World War II, new tasks emerged which required faculty attention to institutional governance, service within academic disciplines, and community involvement (Schuster & Finkelstein, 2006). Today, faculty work is influenced by government as higher education is

increasingly expected to help drive national and regional economies through research (Becker & Lewis, 1993; Bessette, 2003; State of Michigan, 2004).

Leslie (2002) called teaching a "core value" of higher education. It is perhaps the most simple to elucidate and commonly understood task performed by faculty. Students enroll in courses for academic credit. Faculty manage those courses to transmit knowledge, assist students in the learning process, and measure knowledge gain. Considerable research has been devoted to understanding what and how students learn (e.g., Bandura, 1977; Baxter Magolda, 1990; Hmelo-Silver, 2004; King & Kitchener, 1994), learning styles (e.g., Kolb, 1981), assessing and measuring learning (e.g., Contreras-McGavin & Kezar, 2007; Palomba & Banta, 1999; Pintrich, Smith, Garcia, & McKeatchie, 1991), the influence of pedagogy and the classroom environment (e.g., Blanchard & Hersey, 1977; Freire, 1970; Greeson, 1988; Rogers, 1983), the influence of academic discipline (e.g., Kolb, 1981; Nelson Laird, Shoup, Kuh, & Schwarz, 2008), and student learning outcomes (e.g., Pascarella & Terenzini, 2005). Among others, Link, Swann and Bozeman (2007) and Bland, Center, Finstad, Risbey, and Staples (2006) each showed that faculty devote considerable time to classroom responsibilities—approximately one-quarter to one-half of work depending on other responsibilities.

While teaching is the transmission of knowledge, research is the creation of it. Houston, Meyer, and Paewai (2006) noted an "interdependence of teaching and research" (p. 17). However, the relationship between the two has been described as either synergistic and complementary or antagonistic and competing (Jenkins, 2004). Romainville (1996) called for a more flexible definition of the balance between teaching and research. He went as far as suggesting individual preference and ability drive faculty work and that balance be achieved at the department level.

Research productivity may look different at different institution types and varies by academic discipline (Blackburn & Bentley, 1993). For example, the generation of new knowledge may take place in a scientific laboratory (physical sciences) or an art studio (fine arts) depending on the discipline. While publications, federal funding, and patents are encouraged at the research university, staying current in one's field to enhance the teaching function is central at the community college (Townsend & Twombly, 2007).

It is generally accepted, however, that research is central to the higher education enterprise and forms "the basis of support of both the instructional and public service functions" (Wodarski, 1990, p. vii). More to the heart of the matter, the "renown of a university (name, advancement, reputation) is based on its research output and not the quality of its teaching" (Romainville, 1996, p. 139). The discovery of new knowledge is a motivator for faculty (Boyer & Cockriel, 2001) and is the extension of faculty curiosity and learning (McClafferty, 2000). For its part, the institution dictates what is valued in research by way of its reward structure, namely the promotion and tenure process, and access to resources (Bland, et. al., 2006).

The service role of faculty is not clearly defined but is historically embedded in the mission of colleges and universities (Ward, 2003). Service evokes a commitment to social responsibility and engagement with the community. It is marked by a movement in the mid-nineteenth century from faculty being proponents of religion to proponents of culture (Schuster & Finkelstein, 2006). After the 1966 *Statement on Government of Colleges and Universities*, faculty became more engaged in the governance of their institutions and played an increasingly important role in making difficult decisions (Eckel, 2000). Today, service is considered a "highly differentiated external service to their discipline and the cause of higher education" (Schuster & Finkelstein, 2006, p. 76). These encompass wide-ranging activities involving external

professional organizations; local, state, and federal communities and governments; and other public service related to a faculty members discipline and academic expertise. Faculty are also expected to engage in internal service, most frequently in organization governance (e.g., program, department, college, and campus-wide committee structures). The service function of faculty, however, remains under-valued and under-studied (Neumann & LaPointe Terosky, 2007).

The importance of this study is to contribute to a better understanding of faculty work. Clearly there are external pressures from universities and academic disciplines that contribute to the types of work in which faculty choose to engage. Because a multi-level analysis is used in the present study, multiple levels of variables were employed to explain variation in faculty activity in academic capitalism. First, I examined the literature on individual-level and organization-level influences on faculty work. Second, I looked more specifically at the literature on academic capitalism.

Individual Level Influences on Faculty Work

Faculty members' intrinsic and extrinsic characteristics shape who they are, affect their experience, and guide behavior. Sex, race, faculty rank and similar descriptive characteristics form a complex matrix of individual characteristics. These demographic characteristics clearly influence faculty salary (Toutkoushian, Bellas, & Moore, 2007), job satisfaction (Seifert & Umbach, 2008), and research productivity (Stack, 2004). Two characteristics—sex and race—are a primary interest in this study as they have been shown to define academic careers (Johnson-Bailey & Cervero, 2008).

Gender issues have plagued the professoriate, particularly in male-dominated academic areas—namely science, technology, engineering and mathematics (STEM) fields. Glazer-

Raymos (1999), among others, pointed to the disproportionately small number of women in tenure and tenure track faculty positions. Even among those in such positions, the tenure rate is significantly lower for women. This is particularly disconcerting given the large numbers of women in the faculty pipeline (i.e., graduate education). Johnsrud and Des Jarlais (1994) found that women experience a more negative climate that is the result of perceived heavier workloads and less institutional and department support. Others point to the effect of the paternalistic nature of departments and universities in shaping the work expected of women faculty who want to advance (Tierney & Bensimon, 1996). In fact, Clark and Corcoran (1986) argue that women have an "accumulated disadvantage" in academic careers that results from professional socialization and mentoring/sponsorship relationships. Other researchers provide evidence that women are subject to difficult choices that remain largely unsupported by employing institutions as they grapple with personal and professional choices for the duration of their academic careers (Philipsen, 2008).

Race may play a similar role in the experiences of faculty. Each stage of the academic career—beginning with the hiring process, through the transition to academe, and extending to retention in the profession—is riddled with barriers and isolation (Myers, 2002). Recent literature suggests race contributes to differences in job satisfaction (Seifert & Umbach, 2008), faculty appointments (i.e., tenure track vs. non-tenure track) (Schuster & Finkelstein, 2006), perception of equitable treatment (Schuster & Finkelstein, 2006), time allocations in academic labor (Link, Swann, & Bozeman, 2008), types of academic fields selected and career choices (i.e., faculty vs. non-faculty) (Golde & Dore, 2001), and salaries (Toutkoushian, Bellas, & Moore, 2007).

Literature also suggests that under-represented minority faculty experience different sets of work expectations (Tierney & Bensimon, 1996) and experience compounding stress to prove intellectual competence, switching identities, entertaining students in the classroom, and generally feeling unwelcome (Bonner, 2004). Trower and Chait (2002) describe an unaccommodating culture in the academic workplace while Hughes (as cited in Gappa, Austin, & Trice, 2007) more specifically identifies the physical and emotional stresses of racism in and out of the classroom. Similar to women faculty, minorities reported significant tenure pressure and a lack of preparation for the faculty role (Johnsrud & Des Jarlais, 1994)

Organization Level Influences on Faculty Work

The context of work is important. Classic organization theory (e.g., Lawrence & Lorsch, 1967) pointed to the link between environmental demands and effective organizations. Recent research on the influence of organization culture and climate on creativity and innovation suggests that individuals in an organization contribute to a collective culture defined distinctly as organizational learning or the learning organization (Ortenblad, 2001). De Geus (1998) suggested that the speed with which an organization learns is its only competitive advantage. This advantage is linked to an organization's ability to create knowledge through creativity and innovation (Popadiuk & Choo, 2006) and on building competence to undermine competitors' innovation (Kambil, Eselius & Monteiro, 2000).

More specific to higher education and faculty work, the collective work of Burton Clark points to the profound influences of professional, discipline, and institutional cultures on faculty work. Clark (1987) observed that while academic culture is "fragmented into a thousand and one parts" (p. 105), there is "common cause…and…broad principles of academic conduct" (p. 105). But while this professional culture and identification is significant, the influence of academic

discipline and institutional setting are central to our understanding of faculty and their work. In comparison, matters of race, gender, religion, age, and political affiliation have relatively inconsequential explanatory powers.

Austin (1990) identified four subcultures that influence faculty work: the academic profession, the discipline, the academy as an organization, and the institution. Importantly, the institution "defines the institutional career, strongly affecting the duties, opportunities, rewards, relationship to the discipline, and prestige the faculty member experiences" (p. 66). The institution, therefore, affects how faculty members spend their time.

Tierney and Rhodes (1993) similarly describe five sociological forces, or cultures, that shape faculty behavior—national, professional, disciplinary, individual, and institutional. Nowhere is faculty socialization more important than within the institution. The "terrain of the college or university" (Tierney & Rhodes, 1993, p. 15) is where the other forces are played out and it offers clues to acceptable behaviors reinforced through the "ritual process of tenure and promotion" (Tierney & Rhodes, 1993, p. 41).

The impact of the academic disciplines is carried out both internal and external to the university. Within a university, employment policies, structures for evaluation and rewards, and communication patterns vary widely from one academic unit to another (Gappa, Astin, & Trice, 2007). The disciplines also have influences that vary across universities. Each discipline has a unique set of traditions, values, and expectations. Faculty typically establish a principal professional identity within a discipline. The key to promotion and tenure is through publications in peer-reviewed publications that are rooted in the disciplines.

The combined body of research, spanning several decades, points to the need to account for organization level influences on faculty work. The use of institution control (i.e., public or

private), Carnegie Classification, size, and other similar characteristics is common in higher education research. Additional characteristics such as institutional percentages of women and underrepresented minority faculty will be germane to the present study.

While shaped by organizations, the core activities of faculty have remained relatively constant over time. However, expectations from the university and external stakeholders shift the execution of those responsibilities to best meet institutional and societal needs. For example, the Knowledge Economy, driven by the production of new knowledge for commercial innovation, prompts such a shift. This is particularly true in STEM fields where knowledge is easily transformed into tangible goods that can be sold in the global market. Subsequently, faculty work is aligned to maximize the production of new knowledge, engage in entrepreneurial activities, and create profitable links to the market.

Academic Capitalism

A leading explanation about the changing nature of higher education, and faculty work, is academic capitalism. Slaughter and Rhoades (2004) identify this theory as seeing "groups of actors—faculty, students, administrators, and academic professionals—as using a variety of state resources to create new circuits of knowledge that link higher education institutions to the new economy" (p. 1). More simply stated, academic capitalism is "the pursuit of market and marketlike activities to generate external revenues" (Slaughter & Rhoades, 2004, p. 11). Universities are compelled to pursue revenue-producing practices to augment financial resources, boost organization prestige in the market, and enhance their standing in a competitive and global environment. But more importantly, Slaughter and Rhoades see academic capitalism as a way for universities to connect with the world.

Differing from previous explanations about higher education connections to the economy, academic capitalism links universities to the "new economy" or "knowledge economy." Universities are best suited to exploit the new economy because of their human capital and well-established systems to conduct research. While others have described the phenomenon as university entrepreneurship (Libecap, 2005), academic entrepreneurship (Shane, 2004), academic-industry relations or AIRs (Anderson, 2001), capitalizing knowledge (Etzkowitz, Webster, & Healey 1998), technology transfer (Siegel & Phan, 2005), marketization (Kirp, 2003), and commercialization (Bok, 2003), the core concept is the same—universities and their faculties engage in behaviors that link to industry to generate wealth and prestige.

The theory of academic capitalism is identified in the work of Slaughter and Rhoades (2004) that expands the earlier work of Slaughter and Leslie (1997). Academic capitalism expands beyond the work of faculty and includes the impact of state and federal policy as well as the entanglement of students, administrators, trustees and other stakeholders. Accordingly the new economy "treats advanced knowledge as raw material that can be claimed through legal devices, owned, and marketed as products or services" (Slaughter & Rhoades, 2004, p. 15). The protection of this raw material is achieved through patents, copyrights, and trademarks. The goal, then, is for university owned "trade secrets" to be sold in the marketplace for a profit. Subsequently, the university directs faculty work toward seeking these profits from external, industry sources. In fact, most research universities have adopted formal mission statements and established technology transfer offices to achieve this goal (Markman, Phan, Balkin, & Gianiodis, 2005).

It is widely understood that academic capitalism is the result of four events in 1980 that eased technology transfer from universities to industry (Renault, 2006). First, federal funding for

university research declined to two-thirds of academic research and development funding. Second, the Bayh-Dole Act of 1980 allowed for the commercialization of inventions arising from federally supported research. Third, the first spin-off company originating in university research on biotechnology showed how collaboration between public and private entities could be achieved. Fourth, the Supreme Court decided in *Diamond v. Chakrabarty* (1980) that live, human-made microorganisms were patentable. Combined, these four events led to a wave of new university mechanisms, namely the technology transfer processes, that provided the underpinnings of academic capitalism.

Importantly, actors (in this case faculty) *initiate* academic capitalism. They are not simple bystanders but rather active participants. There is likely a perception among faculty members that because of rising tuition costs and shrinking state subsidies new streams of external revenue must be produced to sustain the academic enterprise (Slaughter & Rhoades, 2004). Renault (2006) asserts three possible institutional influences on this decision: (a) policy-based incentives, (b) the researcher's discipline, and (c) norms of the university. The discipline and the university pull researchers in opposing directions with the former clinging to traditional activities and the latter encouraging entrepreneurial ones.

Academic capitalism may impact sub-groups of faculty in differing ways. A study by Metcalfe and Slaughter (2008) sought to better understand the ways women might be affected by academic capitalism. They claim a "differential success" of women in the academy where there has been significant expansion in professional support/service and executive/administrative/managerial positions; however, women have not yet achieved parity in faculty positions. While women have gained ground on men in terms of the number of positions and salary, an alternative hierarchy is emerging that is dominated by men. Men are moving to

entrepreneurial units (e.g., centers and institutes) to recapture their historic privilege in the academy. This puts them closer to university technical and financial resources which leads to benefits such as summer salaries, consulting opportunities, educational/research partnerships, networks for future partnerships, spin-offs, and royalties (Metcalfe & Slaughter, 2008).

Further, they posit women are not well situated to access the market. In general, there are fewer women in STEM fields, a higher concentration of women at less prestigious institutions where support mechanisms are less developed, and women may be less attuned to opportunities to participate in academic capitalism (Metcalfe & Slaughter, 2008). In support of other researchers (e.g., Whittington & Smith-Doerr, 2005), Metcalfe and Slaughter explain that women are less likely to engage in the commercialization process; however, this may be by choice. Women might choose to reject academic capitalism in favor of teaching and research/publishing as a way to achieve work-life balance. But this choice may be influenced by a social and ethical obligation to contribute to the public good and avoid "closing down the network of public policies and agencies that made possible women's entry into the academy" (Metcalfe & Slaughter, 2008, p. 101).

Others in higher education are not immune to the impact of academic capitalism. One consequence of academic capitalism may be the use of graduate students as tokens of exchange with industry (Slaughter, Campbell, Holleman, & Morgan, 2002). Slaughter, et. al. (2002) takes an ominous view that graduate student participation in academic capitalism leads to delays in publishing and graduation and that students are indoctrinated to the commodification of research.

However, Mendoza (2007) looked more deeply at how relationships between industry and academic departments influence the socialization of graduate students. Beyond financial support, she found that graduate students benefited from interacting with industry, enjoyed

positive student-advisor relationships, and reported increased involvement with their department. Mendoza foreshadows a shift in academic culture that stems from academic capitalism. Graduate students in her study indicated that partnerships with industry were a "vehicle to achieve the traditional outcomes of the academic profession" (p. 90).

While graduate students at research universities are directly affected by academic capitalism through relationships with faculty, the research university is not the only institution type with faculty seeking the benefits offered by academic capitalism. Levin (2006) studied faculty at community colleges and pointed to a rising tension between educational and economic values. Faculty in this environment seem to recognize a shift to move their institutions closer to the market by favoring business and not students (i.e., shifting from education to training). So while the connection to the knowledge economy and economic globalization does not involve an academic research enterprise, faculty work is "configured or framed within an economic and competitive context" (p. 84).

Academic capitalism is manifested in the types of activities faculty choose to spend their time doing. Several key faculty behaviors are indicative of academic capitalism—external grants, patents/licensing, consulting, and distance education. These four behaviors are found in the literature on faculty work and next described.

Behavioral Indicators of Academic Capitalism

External Grants

Shrinking state budget allocations to higher education have been linked to efforts to capture new funding sources (Leslie, 1995). To increase revenue streams, colleges and universities turned to privatization strategies (Zumeta, 2004). Research grants from external sources, particularly federal agencies such as the National Science Foundation and National

Institutes of Health, became important because academic researchers' host universities capitalized on charging "facilities and administrative", or indirect, costs (Office of Management and Budget, 2000; United States General Accounting Office, 1995). These costs are the "nonscience expenses that a university incurs from the presence of research on its campus" (Greenberg, 2007, p. 14) and are used to augment institutional budgets on a cost average basis (Massy, 1990). Subsequently, universities use institutional mechanisms to drive the research mission. For example, the tenure process or the provision of seed money (Gappa, Austin, & Trice, 2007) may be used to leverage human capital.

Extramural funding has become a precondition for conducting research in some fields (Shuster & Finkelstein, 2006). However, competition for this funding has increased. The National Science Foundation (NSF) conducted an examination of its funding award mechanisms and found funding rates had decreased from 30% to 21% in the years 2000-2006 despite a budget increase of 44% (NSF, 2007). While the average size of awards increased, the number of successful proposals dropped. Concurrently, the total number of proposals submitted increased 50% between 1999 and 2004. This increase was partially attributed to principle investigators (PIs) submitting multiple proposals and "shopping" proposals to more than one unit at NSF.

Shuster and Finkelstein (2006) noted the gender difference in external funding has nearly disappeared and described a "pattern of increasing gender convergence in research and scholarly activity" (p. 104). They reported institutional type, academic field, and gender-field interactions assert greater influence. Not surprisingly, faculty at research and other doctoral universities have the greatest involvement, as do those in STEM fields, which enjoy higher levels of federal funding. However, a gender gap remains in certain fields including the health sciences and engineering (Shuster & Finkelstein, 2006).

Patents and Licensing

The University and Small Business Patent Procedures Act, 35 USC §200-212 (1980), generally known as the Bayh-Dole Act, gave universities clear title to patents for academic research and imposed a duty on academic scientists to pursue licensing as a condition of federal research dollars (Greenberg, 2007). Passed largely as a professional courtesy to outgoing U.S. Senator Birch Bayh and surviving a presidential veto, the landmark legislation is considered "most inspired" and has been emulated by other countries (Stevens, 2004). Patents and licensing subsequently became valued extensions of scientific research because of their potential for institutional revenue (Thursby & Thursby, 2003), financial rewards for individual faculty members (Shane, 2004), and as a source of regional economic development (Allen, Link, & Rosenbaum, 2007; Stevens, 2004).

While traditional forms of technology transfer such as academic papers account for 90% of knowledge transfers from universities to the public (Agrawal & Henderson, 2002), efforts to commercialize and profit from academic research continued to rise dramatically through the 1990s (National Science Board, 2006) and peaked around 2002 before dipping slightly (National Science Board, 2008). In 2006, the Association of University Technology Managers reported the technology transfer activities of 189 American academic institutions (including universities and research institutions). Combined, these institutions filed more than 11,620 new patent applications and signed more than 5,000 new licenses. These efforts resulted in more than 550 new startup companies (AUTM, 2007).

Patents and licenses are distinct efforts to commercialize research. A patent grants property rights to the inventor by providing legal protection of intellectual property. According to the United States Patent and Trademark Office (USPTO), a patent gives the patentee "the right

to exclude others from making, using, offering for sale, selling or importing the invention" (USPTO, 2005). Licenses "transfer rights acquired for a specific technology to another organization" (AUTM, 2006, p. 30). A patent, therefore, is the mechanism to protect an invention while a license is an agreement to move that invention to industry.

Differences in patent production by faculty and institutions have been identified in the literature. Researchers have suggested differences by gender (Whittington & Smith-Doerr, 2005) and age and tenure status (Allen, Link, & Rosenbaum, 2007). Findings seem to indicate older men with tenured academic rank have a greater propensity to patent inventions.

Others have pointed to organizational and policy mechanisms as key drivers in patent production. Bercovitz and Feldman (2004) posit organizational motivators such as graduate training, department chair leadership, and cohort socialization affect a faculty member's decision to participate in technology transfer activities. Institutional policy also has a profound impact on technology transfer. University policy statements determine levels of support (managerial and financial) and selectivity for projects (Roberts and Malone, 1996). Institutional structural factors such as the creation of a technology transfer office or redirecting academic/research foci towards the market can also increase patent production (Dai, Popp, & Bretschneider, 2005). External to the university, court rulings and shifts in federal policy, many prior to Bayh-Dole, have encouraged faculty to align with industry to commercialize academic research (Mowery, Nelson, Sampat, & Ziedonis, 2001).

Consulting

Consulting has been defined as "the application of professional and scholarly expertise in the community outside one's own academic institution" (Boyer & Lewis, 1985, p. 4) and is seen as an extension of teaching and research. In the early 1980s, consulting behaviors among faculty

members were under close scrutiny and received considerable attention in the literature (e.g., Aggarwal, 1981; Glauser & Axley, 1983, Linnell, 1982; and Patton & Marver, 1979). Consulting practices were largely questioned because of the potential negative impact on faculty time devoted to teaching and research. After examining the literature at the time, Boyer and Lewis (1985) concluded that faculty who consult do not do so at the expense of other university responsibilities and do not earn substantial supplemental income, even in science and engineering.

In comparison, recent literature has provided relatively little attention to the consulting practices of faculty members. This lack of attention likely stems from researchers lack of agreement to categorize consulting as part of faculty service obligations (e.g., Greenbank, 2006) or not (e.g., Neumann & Terosky, 2007). Most of the literature, however, is descriptive in nature. Fairweather (1996) presented a profile of individual faculty members in the top 10% of faculty who engage in consulting practices; however, this profile is not universal across institution types. For example, male faculty members were more likely to be top consultants at research universities, but not other institution types. Similarly, minority faculty members were more likely to consult at all institution types except doctoral-granting. Recent literature also suggests that faculty time devoted to consulting has changed over time. The percentage of faculty members allocating more than 10% of total work time to consulting diminished between 1969 and 1998 (Schuster & Finkelstein, 2006). However, a substantial number of faculty members rely on consulting to augment their salaries with 20% indicating it as a source of income (United States Department of Education, 2001).

Distance Education

Access to higher education is a key issue facing higher education and has several components including financial access, geographic access, programmatic access, and academic access (Heller, 2001). One solution has been to expand access through distance learning (Epper, 1999). States have recognized the high cost of expanding capacity through the traditional, physical campus structure and have subsequently augmented their strategies with electronic capacity building. By the early 2000s, nearly every state was engaged in Internet-based higher education (Epper & Garn, 2003; National Governors Association, 2001; Twigg, 2003). The National Center for Education Statistics (United States Department of Education, 2003) indicated 56% of 2- and 4-year colleges and universities offered distance education courses during the 2000-2001 academic year with more than 3 million enrollments. However, some researchers claim that the rise of instructional technology and distance education "undermines the geographic niches of colleges and universities, greatly expanding the arena of interinstitutional competition" (Shuster & Finkelstein, 2006, p. 330).

Rhodes and Slaughter (2004) conducted a separate study of department heads at public universities. They found evidence of a shift in strategic initiatives that encompass "educational entrepreneurialism" in a game of "academic survivor." In response to state and institutional demands (i.e., shrinking state monies and linking funds to student credit hour production), department heads turned towards practices to maximize student numbers and cost efficiencies (Rhodes & Slaughter, 2004, p. 48). These practices included lowering prerequisite standards, expanding summer school courses, and increasing distance education offerings. Distance education is not about teaching in a new venue or expanding access, but rather creating a revenue-generating product of curriculum and instruction that is copyrighted and marketed to consumers willing to pay for convenience.

Summary

Lewin (1936) famously suggested behavior is a function of a person and his/her environment. The work of faculty is highly influenced by individual characteristics such as gender, race, and academic rank. The environment in which this work is conducted is also highly influential. Organization level characteristics create an important context in which faculty members must operate. Combined, the individual and organization characteristics create a unique circumstance for each faculty member.

These understandings ground the establishment of a new, measurable construct of academic capitalism in this study. In the next chapter, I explain the construction of the dependent variable, an estimate of academic capitalism. From this, a multi-level model was created to explain variation in academic capitalism.

CHAPTER 3

METHODOLOGY

The purpose of this study was to create a measurable construct of the theory of academic capitalism and to examine individual and organization characteristics of faculty at doctorate-granting, research universities. Specifically, the study was designed to explore the following research questions:

1. How can a measure, or individual-level estimate, of the theory of academic capitalism be created using data from the National Study of Postsecondary Faculty (NSOPF:04)?
2. Do individual characteristics such as sex, race/ethnicity, faculty rank, U.S. citizenship, and marital status significantly affect the academic capitalism behavior of faculty members at research universities?
3. Do institutional characteristics such as institutional control (i.e., public or private), classification, size of endowment, academic research and development expenditures, and percentages of women and minority faculty members significantly affect the academic capitalism behavior of faculty members at research universities?
4. Do academic area characteristics such as characteristics of the discipline, percentages of women and minority faculty members, and productivity significantly affect the academic capitalism behavior of women and minority faculty at research universities?

This chapter describes the methodology that was used to achieve these purposes. It begins by providing an overview of the data sources, a summary of data preparation, and a description of the sample and variables. This chapter also presents a discussion of the research approach including the proposed method of data analysis. First, item response theory (IRT) was used to develop a new measurable construct, or individual-level estimate, for academic

capitalism from NSOPF survey items. Next, I provide a description of individual and organization characteristics employed. Finally, I offer an explanation of the use of multilevel modeling, in this case a variation of Hierarchical Linear Models (HLM), as a way to approach the nested nature of faculty work within institutions and academic disciplines.

Data Sources

The National Center for Education Statistics (NCES), managed by the United States Department of Education, provides an array of national data that can aid in the study of postsecondary education issues (Hahs-Vaughn, 2007). The agency maintains 10 survey databases in this area alone. Despite easy access, these databases are underused for scholarly research. A study of research published in leading journals in higher education found 33 of 378 articles (<9%) used national datasets in the period 1999-2003 (Hahs-Vaughn, 2006, Fall).

This research study used data from two NCES sources: the 2004 National Study of Postsecondary Faculty survey (NSOPF:04) and the Integrated Postsecondary Education Data System (IPEDS) for the year NSOPF:04 data were collected (i.e., academic year 2003-2004). A third source of data came from the National Science Foundation's Academic Research and Development Expenditures report (NSF, 2006). The NSOPF:04 data provided level-1 data for individual faculty members while the IPEDS and NSF data provided level-2, or institution level, data. Each of these data sources is addressed below.

NSOPF

The National Study of Postsecondary Faculty (NSOPF) is designed, administered, and analyzed by the NCES for the purpose of providing data on faculty members and their institutions to postsecondary researchers. The survey was administered in four waves: 1988, 1993, 1999, and 2004. NSOPF data are designed to establish a national profile of faculty, their

productivity and workload, and information on institution policies and practices (NCES, 2006). The most recent wave, NSOPF:04, is based on a nationally representative sample of 35,630 faculty and instructional staff at 980 institutions and consists of a faculty frame and an institution frame.

The faculty frame comprises questions to convey the background characteristics, workload, scholarly activities and opinions of individual faculty members. Faculty members were widely defined to include those who were permanent and temporary; full- and part-time; tenured and non-tenured; taught credit or non-credit courses; and interacted with undergraduate, graduate or professional students (NCES, 2006).

The institution frame consists of questions related directly to employing colleges and universities. Sampled institutions "represent all public and private not-for-profit Title IV-participating, degree-granting institutions in the 50 states and the District of Columbia, as reported in the *2002 Integrated Postsecondary Education Data System (IPEDS)* data files" (NCES, 2006, p. iii). Questions related to information on number of faculty employed members, policies and practices, and instructional activities.

IPEDS

The Integrated Postsecondary Education Data System (IPEDS) is of particular interest to the present study. IPEDS "provides a more readily accessible and comprehensive approach to accessing institutional data…than other methods of data collection" (Schuh, 2002, p. 29). This comprehensive dataset advantages the researcher because every institution in the United States is required to provide information. However, one well-known limitation is the interpretation of survey questions by each institutional respondent (Schuh, 2002), which can lead to variations in reporting. Despite this limitation, IPEDS provides an efficient way to compare institutions at the

organization level. For this study, I will use the 2004 Fall Staffing survey to obtain institution level racial/ethnic demographics of faculty and the 2004 Institutional Characteristics survey to capture endowment and other relevant data.

NSOPF Sample Design

NCES used a two-stage sampling methodology for the selection of faculty. First, institutions were selected within 10 institutional strata based on level of degree awarded and control (see Table 1). Second, as shown in Table 2, samples of faculty members were selected within sampled institutions using a stratified systematic sampling in six strata based on race, sex, and full-time status (NCES, 2006). Additionally, NCES researchers exercised a "customized cost/variance optimization procedure, which aimed to identify the allocation that would accommodate all analytical objectives of this survey while minimizing data collection costs" (NCES, 2006, p. 11). This complex design allowed appropriate representation at the institution level and the oversampling of under-represented faculty groups to ensure sufficient representation. A thorough examination of the NSOPF:04 sampling design can be obtained at http://nces.ed.gov/surveys/nsopf.

Data Collection

A variety of efforts were made to collect institution and individual faculty data including a web-based, self-administered questionnaire and telephone interviews. Both institutions and faculty members were provided incentives to participate. In the case of institutions, monetary reimbursement was offered to institutions indicating difficulty in complying. Early completers of the faculty survey as well as selected sample members were offered an unknown incentive to participate.

Table 1

NSOPF:04 Institution Sample Distribution by Degrees Granted

Degree granting	Public	Private not-for-profit	Total
Doctor's	190	110	300
Master's	120	80	200
Bachelor's	30	130	160
Associate's	340	10	350
Other/unknown	10	60	70
Total	680	400	1,080

Table 2

Faculty Sampling Strata within Institution by Race

Faculty Strata	Faculty Race
1	Hispanic
2	Non-Hispanic Black or African American
3	Asian and Pacific Islander
4	Female, full-time employment
5	Male, full-time employment
6	All others

Institutional Data Collection

Institutional data were collected in the period of September 29, 2003 to October 22, 2004. Each institution was asked to appoint an Institution Coordinator (IC) to provide a list of faculty members including name, various individual demographics (e.g., sex, academic discipline, and race/ethnicity), and contact information. The IC was also asked to complete institution data via a web-based survey. Trained telephone interviewers contacted institutions to complete missing questionnaires. Eighty-one percent of institutions completed the institution questionnaire using the Web while the remaining 19% completed it with the assistance of an interviewer. The average time to complete the survey was 35 minutes (NCES, 2006).

Faculty Data Collection

Faculty data were collected in the 9-month period from January 15 to October 6, 2004. Individual faculty members were instructed to complete a web-based survey or to call a toll-free telephone number. After 4 weeks, trained telephone interviewers began to call non-responders. Seventy-six percent completed the faculty questionnaire by using the Web while the remaining 24% completed it with the assistance of an interviewer. Nearly 60% of faculty completed the survey during the early phase and did not require follow-up. The average time to complete a survey was 30 minutes (NCES, 2006).

Sample

It is important to note that data collection for NSOPF:04 was combined with the 2004 National Postsecondary Student Aid Study (NPSAS:04) under a larger 2004 National Study of Faculty and Students (NSoFaS:04). Institution sampling redundancy between the two surveys led to construction of two component surveys with shared institution level data collection. The combined effort reduced data collection time and saved financial resources.

Institution Sample

The institution file contained questionnaire data from 920 institutions. NCES selected 1,080 institutions of which 1,070 were eligible to participate in NSOPF:04. Ninety-one percent (91%) of eligible institutions provided a faculty list and 86% completed the institution questionnaire.

The primary interest of this study is examination of faculty at doctoral granting, research universities. Of the 920 institutions in the sample, 260 doctoral institutions participated (28%). Public doctoral institutions accounted for 65%. Private not-for-profit doctoral institutions accounted for the remaining 35%. The total number of participating doctoral institutions closely approximates the total population of research universities defined by the Carnegie Foundation for the Advancement of Teaching.

Faculty Sample

The faculty data file contains questionnaire data from 26,110 respondents. The faculty sample is a subset of lists provided by participating institutions. Of the 34,330 eligible sample members, 26,110 completed the survey for a response rate of 76% (U.S. Department of Education, 2006).

Stratified systematic sampling was used to select faculty within each faculty stratum defined by race/ethnicity, gender, and employment status (U.S. Department of Education, 2006). Of the 26,110 faculty respondents, 10,620 are employed at doctoral institutions (7,460 at public doctoral and 3,160 at private doctoral). This faculty subset accounts for 40.7% of respondents.

Survey Weights and Design Effects

The sample design results in oversampling of faculty and requires the use of weights to adjust, or estimate, the sample to the population. This design violates a simple random sample

assumption and would lead to underestimating the sampling variance if weights are not appropriately applied to the data. Failure to do so could result in a Type I error. NCES calculated three sets of analysis weights for NSOPF:04: (a) institutions responding to the institution survey (*WTB00*), (b) faculty responding to the faculty survey (*WTA00*), and (c) contextual weights for linking faculty and institutions (*WTC00*). Each weight has been calculated to include several adjustments for multiplicity, nonresponse, and poststratification. Faculty weights are a product of institutional weights and faculty level adjustments. A thorough examination of the NSOPF:04 weights can be obtained at http://nces.ed.gov/surveys/nsopf.

Weighted data must be treated with care to reduce bias toward the characteristics present in the designed strata. Two types of sample weights are commonly used: raw weights and relative weights. The raw weights provided by NCES may yield inaccurate standard error estimates because statistical software packages may be fooled into analyzing a larger sample size than what actually exists (Thomas *et al.*, 2005). As remedy, it is appropriate to use the relative weight. This is achieved through a simple correction to the raw weight. The relative weight is calculated by dividing the raw weight by its mean,

$$w_i / \overline{w}$$

where $\overline{w} = \sum w_i / n$ (Thomas *et al.*, 2005).

With weighting addressed, the design effect of NSOPF:04 must also be considered. The prudent corrective strategy must account for the effects of clustered samples. Sample weights correct for oversampling but not similarities among individuals in a cluster (Thomas *et al.*, 2005). The most appropriate method is to use specialty software such as SUDAAN, WesVar, or PCCARP. The alternative is to use a model-based approach, such as hierarchical linear models, which uses multilevel analysis to take advantage of nested data.

de Leeuw and Kreft (1995) emphasized the "elegant conceptualization" of HLM as ideally suited for studies with a larger number of small groups, in this case faculty members within research universities. This method allows the researcher to study the clustering effect of individuals within groups. Multilevel analysis can account for multistage sampling because variance is partitioned into within- and between-variances (Hahs-Vaughn, 2005).

Missing Data

NCES requires the statistical imputation of all missing data (NCES, 2006). NSOPF:04 achieved a response rate of 76%. Because the faculty response rate was below 85%, a nonresponse bias analysis was performed by NCES. A combination of procedures including weighted sequential hot-deck, cold-deck, and logical imputation was employed to complete missing data. For example, missing values for sex, race, and ethnicity were completed from institution record data (NCES, 2006). Missing values at the institution level were similarly addressed. NCES evaluates imputation results by comparing before and after imputation distributions. This process is more fully explained at http://nces.ed.gov/surveys/nsopf.

Research Design

The outcome variable used in this study is *academic capitalism*. This is a new measure defined by me and based on related literature outlined in Chapter 2 of this study. The model, therefore, will focus on two levels of independent variables to examine how academic capitalism varies among individual faculty members. This research model accounts for the nested nature of faculty members within institutions and academic disciplines. This model further addresses the unique structure of higher education as well as the NSOPF research design. In short, work environment likely affects the behaviors of faculty members. The individual-level independent variables include individual demographics such as sex, race, marital status, and U.S. citizenship.

Human capital variables including academic rank are also included at this level. Because of the structure of higher education, the organization-level independent variables are cross-classified to account for how faculty members are nested in institutions and academic disciplines. These include: (a) organization demographics such as institutional control, classification, size of endowment, research index, percentage of faculty of color, and percentage of women faculty, and (b) academic discipline characteristics such as percentage of faculty of color, percentage of women faculty, and productivity. In the next section, a detailed description of the dependent variable used in this model will be outlined and described (Part I). Independent variables will be treated in Part II.

Dependent Variable

Academic capitalism is a relatively new concept in higher education and to date has been understudied. Under the theory of academic capitalism, universities are compelled to pursue revenue-producing practices to augment financial resources, boost organization prestige in the market, and enhance their standings in a competitive and global environment. Faculty work is subsequently directed toward seeking profits from external sources through their research. Importantly, faculty members initiate academic capitalism. They are not simple bystanders but rather active participants.

The NSOPF:04 survey does not explicitly ask faculty members to report on academic capitalism. It does, however, ask faculty members to report various activities that can be linked to academic capitalism. When combined into a single measure an estimate of behavior in academic capitalism can be determined.

Four variables that hold significant meaning to academic capitalism were identified in NSOPF:04. These variables are number of distance education classes taught (Q35C), recent

patents and software licensing (Q52BG), current funded scholarly activity (Q55), and consulting (Q66D). Each variable will be converted to a dichotomous variable. This conversion will simplify interpretation and allow me to determine behavior in simple "yes" and "no" terms.

To create an estimate of academic capitalism, simple addition of these variables is not a particularly sufficient or accurate measure. Clearly each variable must be weighted in some fashion to express the difficulty in successfully achieving the behavior. More importantly, one can see an apparent rank of each of these activities in terms of relative prestige and importance. It is critical then to establish an accurate measure of proficiency taking into account item attributes. For example, compare two faculty responses. The first indicates she holds a patent and has funded research. The second indicates she teaches distance education and is an external consultant. Each faculty members has an average "score" of .5 on the 4 items. It is impossible to understand which faculty is more proficient in academic capitalism without knowing the difficulty of each item (behavior). Both the portion of participation by an individual (examinee proficiency) and the difficulty of participation for each item (item difficulty) must therefore be considered.

Unfortunately, the literature on academic capitalism does not identify such a rank or weighting scheme so it must be created. Considering this, an analytic approach to constructing a measure of academic capitalism is the first of two parts to the current study and is described next.

Part I: Constructing an Estimate of Academic Capitalism

Perhaps the most critical step in preparing the study is the creation of a new measure for academic capitalism. This can be achieved using Item Response Theory (IRT). IRT, also known as latent trait theory, is based on the work of Georg Rasch (1960). Rasch developed mathematical models designed to study the scientific properties of measurement, which account

for person and item parameters. Essentially, IRT is used to solve practical testing problems. In this case IRT will be used to estimate a person's trait level from responses to test items (Embretson & Reise, 2000).

IRT differs from classical test theory in that it involves a search process for optimal estimates to model behavior (Embretson & Reise, 2000), not simply adding responses to create a "score." Because the construct "academic capitalism" is latent, it must be observed through behavior (or responses) on relevant items found within NSOPF:04. Simple addition or averaging of these items does not make sense. The purpose of measurement, then, is "to provide a reasonable and consistent way to summarize the responses that people make to express their achievements, attitudes, or personal points of view through instruments…" (Wilson, 2005, p. 5). The first step in the process of creating a measure for academic capitalism is to develop a construct model. The construct model is critical to the reliability and validity of the new measure because it will provide evidence to support its intended use (Wolfe & Smith, 2007).

Wilson (2005) suggested a "Four Building Blocks" approach to construct modeling. These building blocks—construct map, items design, outcome space, and measurement model—were largely designed to create an instrument from inception. The present study enlists data from an existing source in which the instrument (NSOPF:04) was previously designed. Wilson's building blocks, therefore, will be closely followed as a framework on which to build a measure of academic capitalism. Relevant steps are described and executed below.

Construct Map

The first step involves constructing a precise purpose and context for an instrument through the use of a construct map. The point of developing a construct map is to conceptualize a construct as a basis for measurement (Wilson, 2005). The construct, or theoretical object of

interest, "academic capitalism" is a latent variable and remains largely unobserved. As with any latent variable, we assume the construct causes responses to test items and from those responses we infer the construct (Wilson, 2005). While there may be a more complex relationship between the construct and the item responses, I am forced to assume a simple relationship until additional research can reveal a more complex one (Wilson, 2005). Further, I assume that the construct extends from one extreme to another. Respondents will fall at any point between the extremes making the underlying construct continuous.

The initial idea of a construct map for academic capitalism is displayed in Figure 1. It shows an underlying continuum or ordering of both respondents and item responses. The left side indicates qualitative differences among respondents while the right side indicates qualitative differences in item responses. The arrow in the middle represents a continuum from increasing to decreasing academic capitalism.

Items Design

The notion of an instrument, particularly in the case of this study, takes new meaning. A subset of items from NSOPF:04 was selected to fit the construct map. Typically, potential items are created based on the construct map and later tested. Since NCES staff previously created the items in NSOPF:04, I relied on prevailing theory in the literature to select items indicative of academic capitalism. Table 3 provides a summary of these items and corresponding support from the literature.

Important to this study is the selection of NSOPF:04 item and their relation to the construct map. Wolfe and Smith (2007) proffer an additionally helpful developmental model. The model facilitates specification of how characteristics of a construct relate to one another.

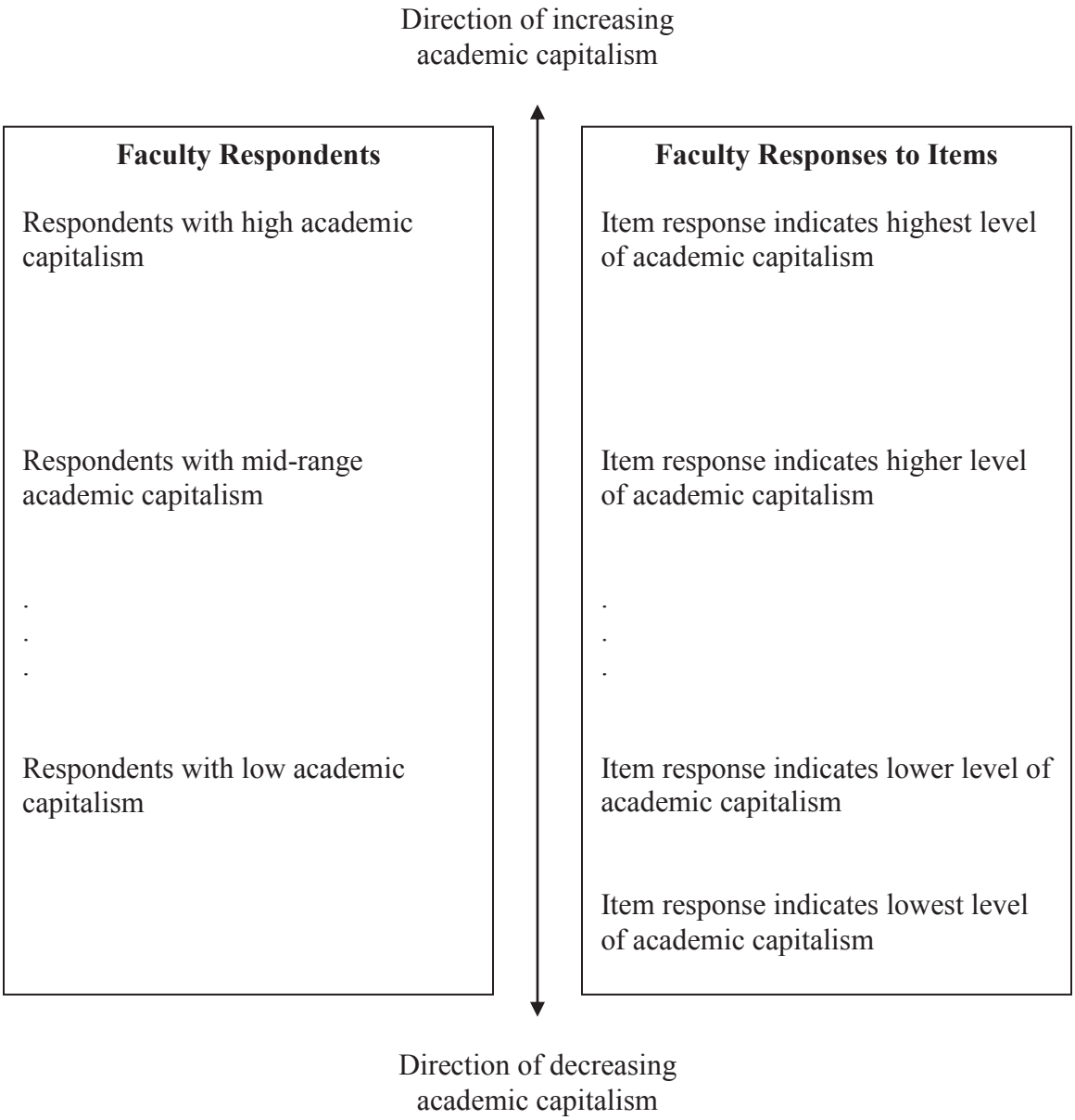

Figure1. Construct map of academic capitalism.

Table 3

Academic Capitalism Items in NSOPF:04 Faculty Instrument

Item	Question	Response options	Support
Q35C	How many [classes] were taught through distance education, either exclusively or primarily?	0=No classes 1=1 class . . . 19=19 classes 20=20 or more classes	pp. 16, 17, 163, 165, 170, and 317[a]
Q52BG	Of your career patents, software products, or other works, how many were done in the last two years?	Typed response	pp. 17 and 113-122[a]
Q55	During the 2003-2004 academic year, are any of your scholarly activities funded?	0=No 1=Yes	pp. 181-188[a]
Q66D	How much were you paid for outside consulting or freelance work?	Typed response	p. 124[b]

Note. [a]From "Academic Capitalism and the New Economy" by S. Slaughter and G. Rhodes, 2004. [b]From "Academic Capitalism: Politics, Policies, and the Entrepreneurial University" S. Slaughter and D. Leslie, 1997.

Further, it describes an individual's progression from low to high proficiency. The model can also be used later in comparing theoretical and empirical item difficulties.

Figure 2 displays a developmental model created for the construct of academic capitalism. Wolfe and Smith (2007) state that such models "make explicit theoretical assumptions about what constitutes higher levels of proficiency in the domain in question, and therefore, serve as an important source of information during the item writing process" (p. 105). This model specifies three levels of increased academic capitalism. The domains shown at the bottom of the figure show the expected mapping of items onto the scale of academic capitalism.

Outcome Space

Developing the outcome space, or item scores, is the next building block. This and the fourth block, the measurement model, are needed to infer the underlying construct from the observed responses to items in the instrument. The outcome space is used to describe behavior and provide qualitatively different ways a respondent responds to an item. In the outcome space, the first step is "to make a decision about which aspects of the response to the items will be used as the basis for the inference, and how those aspects are…scored" (Wilson, 2005, p. 13). I made a decision to dichotomize responses to the selected items and score each as "1" and "0." It is difficult if not impossible to distinguish, for example, the differences in academic capitalism based on a specific amount of consulting dollars earned by a faculty respondent. There are too many confounding contributors (e.g., disciplinary traditions and number of consulting opportunities available). Similarly, certain academic fields lend themselves to more or fewer (or no) patents or licenses. A single patent in one field might be noteworthy while several patents are not uncommon in another.

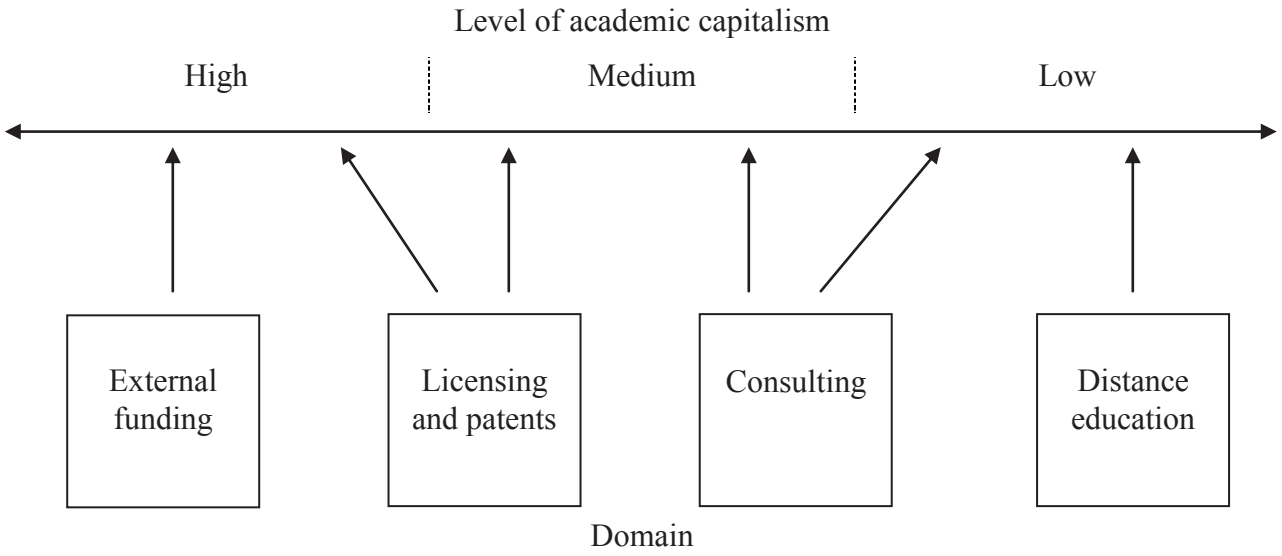

Figure 2. Developmental model of academic capitalism.

For purposes of this study, the outcome space is just two categories: *yes, engaged in behavior* and *no, did not engage in behavior*. Each original response was recoded to reflect the respondent's "success" or "failure" to engage in behavior reflective of academic capitalism and thus allows broad interpretation.

The outcome space becomes a set of scores that indicate the construct and must be related back to the construct map. The second step in developing the outcome space is a process of "providing numerical values for the ordered levels in the outcome space" (Wilson, 2005, p. 69). Accordingly, each respondent will have a set of four values, 0 or 1, to indicate participation in each of the behaviors collected in NSOPF:04.

Measurement Model

With a completed model of a measure of academic capitalism the next step is to construct the new measure of academic capitalism. This step is designed to relate the scored outcomes to the construct through the use of a measurement model (Wilson, 2005). This model is essential to the aggregation of scores across the items and will be expressed at both the item level and the instrument level. Importantly, the model focuses attention on the probability of the observed responses. This is articulated in terms of the respondent's ability (θ) and the item difficulty (β). The logic is that both the respondent and the item hold varying amounts of the construct. However, what is most important is the difference between the respondent's ability and the item difficulty. It is this difference that determines probability. The specific approach I used is appropriate for the binary data in this study and is next explained.

Embretson and Reise (2000) present an IRT model that can be applied to any dichotomous data including behavioral rating scales where item responses are scored into two categories to represent "yes" (1) or "no" (0). Specifically, a unidimensional IRT model is used to

characterize person differences on the single latent trait of academic capitalism. This is typically done through a traditional logistic model that is described next.

Each of the selected items from NSOPF:04 theoretically contributes differently to the construct of academic capitalism. Therefore, a two-parameter logistic model (2PL) will be used (Embretson & Reise, 2000). The 2PL model includes an item discrimination parameter to account for the impact this can have on the difference between trait level and item difficulty. For example, according to Embretson and Reise (2000) a lower discrimination value will have less impact on the probability showing that trait level is less relevant to changes in success. Importantly, this parameter allows for differentiation to occur between respondents with the same total score because success on highly discriminating items leads to the highest trait level estimate (Embretson & Reise, 2000). In short, items are weighted differently. The probability that person *s* affirmatively answers item *i* is given as follows:

$$P(X_{is}=1 \mid \theta_s,\beta_i,\alpha_i)=\frac{\exp[\alpha_i(\theta_s-\beta_i)]}{1+\exp[\alpha_i(\theta_s-\beta_i)]}$$

where

X_{is}=response of person *s* to item *i* (0 or 1)

θ_s=trait level for person *s*

β_i=difficulty of item *i*

α_i=discrimination for item *i*

γ_i=lower asymptote (guessing) for item *i*

Once the probabilities are computed for each item, I will move to computing a trait score. The resulting likelihood of a person's response pattern, or response vector (Wilson, 2005), is the product of the probabilities of each of the four items. I need to account for response of "0" as

well as "1" by subtracting those probabilities from one (1-P_{is}). The likelihood of each set of four responses is as follows:

$$L(\underline{X}_s) = P_{1s}P_{2s}P_{3s}P_{4s}$$

where

$L(X_s)$=the probability of the observed response pattern

P_{is}=the probability of each item response

One final step is necessary to "score" respondents. To do this, the maximum likelihood of a response pattern must be determined which involves a search process of "trying out many estimates and examining their impact on the likelihood of the response pattern" (Embretson & Reise, 2000, p. 56). This requires numerous calculations that will be carried out through the use of computer software. The resulting trait level score for each respondent will be used in Part II of this study.

Reliability and Validity

As with any measure, it is important to provide evidence to support the reliability and validity of the instrument. Constructing this evidence in IRT, however, is different from traditional evidence because reliability is seen as an integral part of validity (Wilson, 2005). For purposes of this study an internal consistency coefficient will be calculated to determine variability. The difference between total variance and variance account for in the model will be used to calculated the proportion of variance accounted for in the model (r), which will provide the appropriate reliability coefficent.

The validity of the measure of academic capitalism will be demonstrated through an integrated approach as described by Wilson (2005), which provides evidence based on instrument content, response processes, and internal structure. First, the process followed to

develop the construct of academic capitalism constitutes "a thorough representation of the content validity evidence for the instrument" (Wilson, 2005, p. 156). This evidence is essential to the other aspects of validity and reliability. This foundation is paramount to the validity argument. Evidence to support response processes is often done during item construction. Typically, a researcher will observe individuals while taking an instrument or conducts exit interviews (Wilson, 2005). Because I used an existing survey, little can be done to provide additional support to validity through the response process.

When I attempt to support the internal structure I will examine evidence to support the construct map and items design. The Spearman rank order correlation will be employed to quantify the differences among items. This statistical test will allow me to analyze the theoretical expectation and empirical results on the construct map. Evidence to support item design is first examined through item analysis, a comparison of means of respondents in different score groups, in this case high, medium, and low. Second, I will also consider Differential Item Functioning (DIF), which examines respondent scores from important subgroups (e.g., sex and race) to see if items behave similarly across different subgroups.

Part II: Testing a Model of Faculty Involvement in Academic Capitalism

With completed construction of an estimate of academic capitalism, I used the new measure as the dependent variable in the study of faculty at research universities.

As previously discussed, unrestricted NSOPF:04 data was obtained through the NCES application process. Survey data from IPEDS and NSF were downloaded from each organization's server and imported to an SPSS dataset. Next, the newly constructed measure of academic capitalism was added to the data set. Once data were imported to SPSS, I prepared the data and created an export file to be used in HLM 6.0, software specifically designed to run

analysis of hierarchical linear models. Data were then imported to HLM 6.0 to run statistical models to address the research questions in this study.

Hierarchical Linear Modeling

Data structures are often hierarchical (Raudenbush & Bryk, 2002). Variables describe individuals, but the individuals are also grouped into larger units. These larger units have descriptive variables too. These larger units can be further grouped into still larger ones, each with another set of descriptive variables. Because of the nature of this study, Hierarchical Linear Modeling (HLM) was used to analyze the data. This type of analysis is particularly well suited for educational research and allowed the researcher to relate the properties of individuals to properties of groups and structures in which the individuals function (Raudenbush & Bryk, 2002). Clearly, individual faculty members are nested within universities and academic disciplines making it possible to use a multi-level technique to look at the links between the levels (Luke, 2004).

Cross-classified Random Effects Approach

Most HLM applications involve data with a hierarchical structure where persons are nested within organizations (Raudenbush & Bryk, 2002). The assumption is that each person belongs to only one organization. Faculty members do not fall neatly into hierarchical structures because academic disciplines span institutions and loyalty to the disciplines may supercede institutions. Quite plainly, faculty share membership with an institution and academic discipline. This complex structure makes it necessary to use a cross-classified model.

Umbach (2008) enlisted a cross-classified random effects model in his study of sex equity in college faculty pay. In it, he posits faculty members are nested simultaneously within disciplines and institutions; therefore a researcher must attend to these cross-classified nestings.

Umbach's model is liberally used as a platform for the present study including some of the independent variables found at level-1 and level-2 (see Figure 3).

Unconditional Model

The first step was to conduct a preliminary analysis through the construction of the unconditional model with no predictor variables.

The level-1 (within cell) unconditional model can be expressed as:

$$Y_{ijk} = \pi_{0jk} + e_{ijk}, \qquad e_{ijk} \approx \mathrm{N}(0,\ \sigma^2),$$

where

Y_{ijk} is the academic capitalism of faculty *i* in university *j* and academic area *k*;
π_{0jk} is the mean academic capitalism of faculty in cell *jk*, that is, faculty employed at university *j* and belonging to academic area *k*; and
e_{ijk} is the random "faculty effect," that is, the deviation of faculty *ijk*'s score from the cell mean.

These deviations are assumed normally distributed with mean 0 and a within-cell variance σ^2.

The indices *i*, *j*, and *k* thus denote faculty, university, and academic areas where there are

i=1,…, n_{ij} faculty within cell *jk*;
j=1,…, *J*= x universities, and
k=1,…, *K*= y academic areas.

The level-2 (between cell) unconditional model is expressed:

$$\pi_{0jk} = \theta_0 + b_{00j} + c_{00k} + d_{0jk},$$
$$b_{00j} \approx \mathrm{N}(0,\ \tau_{b00}),$$
$$c_{00k} \approx \mathrm{N}(0,\ \tau_{c00}),$$
$$d_{0jk} \approx \mathrm{N}(0,\ \tau_{\mathrm{d}00}),$$

where

θ_0 is the grand-mean of all faculty;

b_{00j} is the random main effect of university *j*, that is, the contribution of university *j* averaged

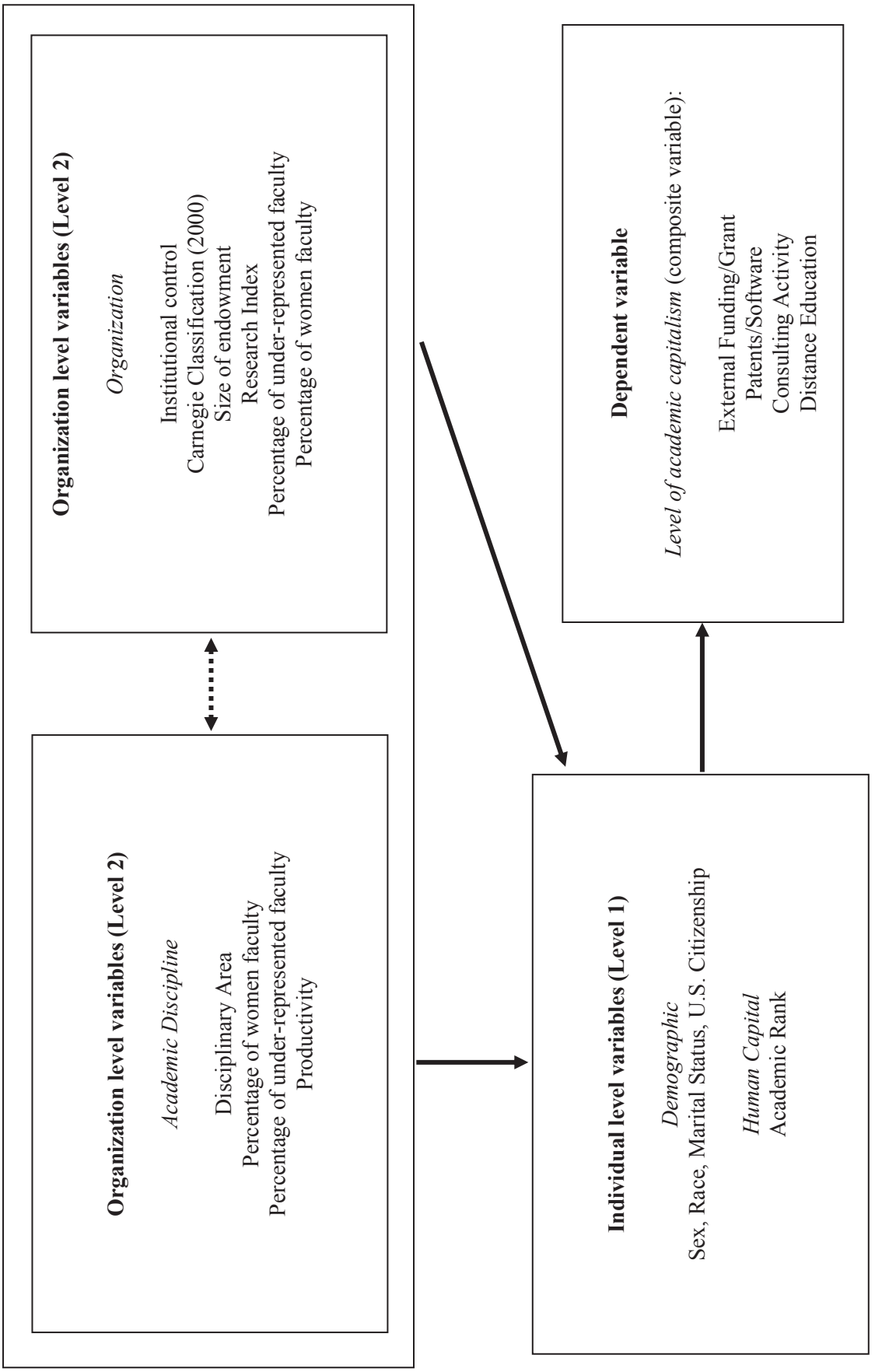

Figure 3. Proposed research model to explain variation in faculty involvement in academic capitalism

over all academic areas, assumed normally distributed with mean 0 and variance τ_{b00};

c_{00k} is the random main effect of academic area k, that is, the contribution of academic area k averaged over all universities, assumed normally distributed with mean 0 and variance τ_{c00}; and

d_{0jk} is the random interaction effect, that is, the deviation of the cell mean from that predicted by the grand mean and the two main effects, assumed normally distributed with mean 0 and variance τ_{d00}.

Substituting the second equation into the first, I created a combined model:

$$Y_{ijk} = \theta_0 + b_{00j} + c_{00k} + d_{0jk} + e_{ijk}$$

This model allowed me to partition the variance in academic capitalism that can be attributed to individual faculty members, academic areas, universities, and academic area-by-university interaction effects. I assumed that this variability is accounted for by measured variables so I next turned to the construction of conditional models that include student, academic area, and university characteristics.

Conditional Models

I next added predictor variables to create conditional models. Because cross-classified random effects models can quickly become complex, it was imperative that models adhere to the principle of parsimony as cell sizes may be small (Raudenbush & Bryk, 2002). This means, for example, that some covariates were constrained not to have random effects.

Level-1 or "Within Cell" Model

Within each university-by-academic area cell, the model specifies a cell mean measure of academic capitalism and several gaps based on sex, race, marital status, academic rank, and

citizenship (see Table 4):

$$Y_{ijk} = \pi_{0jk} + \pi_{1jk}(sex)_{ijk} + \pi_{2jk}(race)_{ijk} + \pi_{3jk}(rank)_{ijk} + \pi_{4jk}(citizen)_{ijk} + \pi_{5jk}(marital)_{ijk} + e_{ijk}$$

Level-2 or "Between-cell" Model

The level-1 coefficients become outcomes in the level-2 model that represents the variation between cells created by crossing universities and academic areas. The level-2 predictors describe the universities, the academic areas, and the interactions between universities and academic areas (see Table 5). The basic modeling framework for level-2 is:

$$\pi_{pjk} = \theta_p + (\beta_p + b_{p1j})X_k + (\gamma_p + c_{p1k})W_j + \delta_p X_k * W_j + b_{p0j} + c_{p0k} + d_{pjk},$$

where

δ_p is the regression slope for the W by X interaction.

Adding specific predictors, the model includes random effects and becomes:

$$\begin{aligned}\pi_{0jk} = {} & \theta_0 + (\gamma_{01} + c_{01k})(control)_j + (\gamma_{02} + c_{01k})(Carnegie)_j + (\gamma_{03} + c_{01k})(endow)_j \\ & + (\gamma_{04} + c_{01k})(research)_j + (\gamma_{05} + c_{01k})(univ\%race)_j + (\gamma_{06} + c_{01k})(acad\%race)_j \\ & + (\gamma_{07} + c_{01k})(univ\%sex)_j + (\gamma_{08} + c_{01k})(acad\%sex)_j + b_{00j} + c_{00k} + d_{0jk}\end{aligned}$$

The fully combined (level-1 and level-2) mixed model is:

$$\begin{aligned}Y_{ijk} = {} & \theta_0 + \theta_1 a_{ijk} + \beta_0 X_k + \gamma_0 W_j + \delta_0 X_k * W_j + \beta_1 X_k * a_{ijk} + \gamma_1 W_j * a_{ijk} + \delta_1 X_k * W_j * a_{ijk} + b_{01j} X_k + c_{01k} W_j \\ & + b_{10j} a_{ijk} + c_{10k} a_{ijk} + d_{1jk} a_{ijk} + b_{11j} X_k * a_{ijk} + c_{11k} W_j * a_{ijk} + b_{00j} + c_{00k} + d_{0jk} + e_{ijk}\end{aligned}$$

where

Y_{ijk} is the academic capitalism of faculty *i* in university *j* and academic area *k*;
θ_0 is the grand-mean (model intercept) of all faculty;
$\theta_1 a_{ijk}$ is the regression coefficient relating faculty *ijk* to Y_{ijk}
B_0 is the fixed effect of X_k (assumed constant over all universities);
γ_0 is the fixed effect of W_j (assumed constant over all universities);
$\delta_0 X_k * W_j$ is the regression slope for the W by X interaction or the variation explained by the interaction of university and academic area;
$\beta_1 X_k * a_{ijk}$ is the effect for any level-1 predictor (e.g., sex) relating faculty *ijk* to Y_{ijk};

Table 4

Summary of Individual Level (Level 1) Independent Variables

Variable	Source	Type	Scale
Sex	NSOPF	Dummy code	(Female),Male
Underrepresented	NSOPF	Dummy code	(Underrepresented), Not underrepresented
Marital Status	NSOPF	Dummy code	(Not Married/Partnered), Married/Partnered
Children	NSOPF	Dummy code	(No children), Children
Academic Rank	NSOPF	Dummy code	(Other), Assistant Professor, Associate Professor, Full Professor
U.S. Citizenship	NSOPF	Dummy code	(Non U.S. Citizen), U.S. Citizen

Table 5

Summary of Organization Level (Level 2) Independent Variables

Variable	Source	Type	Scale
Institutional Control	IPEDS	Dummy code	(Private), Public
Carnegie Classification (2000)	IPEDS	Dummy code	(Research Intensive), Research Extensive
Size of endowment	IPEDS	Continuous	Standardized
Research index	IPEDS	Categorical	(Other), Doctoral, High Research, Very High Research
Percentage of faculty of color (university and academic area)	IPEDS	Continuous	Standardized
Percentage of women faculty (university and academic area)	IPEDS	Continuous	Standardized
Productivity	NSOPF	Continuous	Standardized
Academic area	NSOPF	Dummy code	(hard–pure–life (HPL)), hard–pure–non-life (HPN), hard–applied–life (HAL), hard–applied–non-life (HAN), soft–pure–life (SPL), soft–pure–non-life (SPN), soft–applied–life (SAL), and soft–applied–non-life (SAN)

$\gamma_1 W_j * a_{ijk}$ is the effect for any level-2 predictor (e.g., institutional control) relating faculty *ijk* to Y_{ijk};
$\delta_1 X_k * W_j * a_{ijk}$ is the interaction effect relating faculty *ijk* to Y_{ijk};
$b_{01j} X_k$ is the component that accounts for effect of academic area varying randomly over universities;
$c_{01k} W_j$ is the component of the effect of university varying randomly over academic areas;
$b_{10j} a_{ijk}$, $c_{10k} a_{ijk}$, and $d_{1jk} a_{ijk}$ are the residual random effects of universities, academic areas, and university-by-academic area cells;
$b_{11j} X_k * a_{ijk}$ is the component which explains that the effect of university varies randomly over academic areas as it relates faculty *ijk* to Y_{ijk};
$c_{11k} W_j * a_{ijk}$ is the component which explains that the effect of academic area varies randomly over universities as it relates faculty *ijk* to Y_{ijk};
b_{00j} is the random main effect of university *j*, that is, the contribution of university *j* averaged overall all academic areas;
c_{00k} is the random main effect of academic area k, that is, the contribution of academic area k averaged over all universities;
d_{0jk} is the random interaction effect, or the residual between-cell component unrelated to university and academic area;
e_{ijk} is the random "faculty effect," that is, the deviation of faculty *ijk*'s score from the cell mean. These deviations are assumed normally distributed with mean 0 and a within-cell variance σ^2.

Data Preparation

Once NSOPF:04 data was loaded in SPSS, I selected cases that are fulltime, teaching and research faculty at research universities. Next, I reviewed the database for missing cases. While HLM allows for missing cases, I chose to eliminate them from the database. I also reviewed the database to confirm the accuracy of the data. Running descriptive statistics such as means and frequencies allowed me to look for outliers.

I next computed a productivity measure for each faculty which was used as a Level-2 predictor. Using data from NSOPF:93, Porter and Umbach (2000) developed a basic measure of productivity using publications over a 2-year period and the dollar amount of external research funding. As with Porter and Umbach, I summed the number of articles published in referred professional or trade journals, creative works published in juried media, and the chapters in

edited volumes. The second measure of productivity was the raw dollar amount of external research funding, which excludes funds from the institution. Each of these will be averaged for each academic area.

Data were then sorted by university and academic field to group faculty. NSOPF:04 faculty respondents were asked to select from among 32 principal fields of teaching. To simplify the data and analysis, responses were recoded to fit Biglan's (1973) scheme which differentiates academic fields in terms of three dimensions: (a) hard or soft, (b) pure or applied, and (c) life or non-life. These categories have been used in previous studies (Nelson Laird, Shoup, Kuh, & Schwarz, 2008; Perna, 2001; Smart & McLaughlin, 1978) where the effect of academic disciplines are considered a factor in determining outcomes such as teaching and learning, faculty reward structures, and faculty salaries. Using Biglan's scheme, Nelson Laird, et.al (2008) developed a matrix of disciplines (see Table 6). They assigned academic fields based on degree of consensus on knowledge and methods (hard or soft) and focus (life or non-life, pure or applied): The resulting eight groups are: "hard–pure–life (HPL), hard–pure–non-life (HPN), hard–applied–life (HAL), hard–applied–non-life (HAN), soft–pure–life (SPL), soft–pure–non-life (SPN), soft–applied–life (SAL), and soft–applied–non-life (SAN)" (Nelson Laird, et.al., 2008, p. 477). For purposes of analysis, the model contained measures of the Biglan dimensions as well as all possible interaction terms. This is consistent with the study conducted by Nelson Laird, et.al. (2008).

With data preparation complete, I created export files for analysis in each stage of the study. First, data were imported to a statistics package designed for IRT. Once the new measure for academic capitalism was created for each faculty respondent, it was added to the main dataset. Export files were then created for level-1 and level-2 data in SPSS that were used in

Table 6

Disciplinary Areas by Biglan Categories

	Hard	Soft
Pure-Life	Biology (general)	Anthropology
	Biochemistry or biophysics	Ethnic studies
	Botany	Political science (incl. gov't, int'l rel.)
	Environmental science	Psychology
	Microbiology or bacteriology	Sociology
	Zoology	
	Kinesiology	
Pure–Non-life	Astronomy	Art, fine and applied
	Atmospheric science (incl. meteorology)	English (language and literature)
	Chemistry	History
	Earth science (incl. geology)	Language and literature (except English)
	Mathematics	Music
	Physics	Philosophy
	Statistics	Theater or drama
		Geography
Applied–Life	Speech	Theology or religion
	Medicine	Business education
	Dentistry	Elementary/middle school education
	Veterinarian	Music or art education
	Pharmacy	Physical education or recreation
	Agriculture	Nursing
		Allied health/other medical
		Social work
		Family Studies
		Criminal justice
Applied–Non-life	Aero-/astronautical engineering	Journalism
	Civil engineering	Accounting
	Chemical engineering	Business administration (general)
	Electrical or electronic engineering	Finance
	Industrial engineering	Marketing
	Materials engineering	Management
	Mechanical engineering	Architecture
	General/other engineering	Urban planning
		Economics
		Communications
		Public administration

Note. From "The Effects of Discipline on Deep Approaches to Student Learning and College Outcomes," by T. F. Nelson Laird, R. Shoup, G. D. Kuh, and M. J. Schwarz, 2008. *Research in Higher Education, 49*, p. 475.

HLM 6.0. The data files were then be imported to HLM 6.0 and employed in analysis of the second and third research questions.

Analysis of Research Questions

Two stages of analysis were used in this study. The first stage required the construction of the new measure of academic capitalism and the second was designed to create a model to explain faculty behavior.

The first research question posed in the study asked how a measure of academic capitalism could be created. This question represented the central hypotheses that a combination of variables collected through the NSOPF:04 instrument will yield an estimate of academic capitalism at the individual faculty level. This question is best addressed through the use of Item Response Theory (IRT).

To attend to the second and third research questions, I ran a hierarchical linear model procedure to determine individual and institution characteristics that best explain variation in academic capitalism. The dependent variable was Academic Capitalism and set up as a continuous variable. The level-1 independent variables included faculty characteristics such as sex and academic rank. Level-2 variables included university and academic area characteristics, for example research activity and percentages of women and minority faculty. I determined if and where the level-1 and level-2 independent variables influenced faculty engagement in academic capitalism.

In conclusion, the purposes of this study were to: (a) establish an empirical measure of academic capitalism, and (b) shed light on individual and institution characteristics that

contribute to variation in individual academic capitalist behavior. The methodology described in this chapter is deemed sufficient to address the questions posed in the study.

Manuscripts for Publication

Two manuscripts were developed and will be submitted for review in leading publications. The nature of this study lends itself nicely to dissemination of a newly created measure of academic capitalism and reporting findings on a model to explain the extent of faculty involvement. The first article focuses on measuring academic capitalism. Considerable attention was afforded to the construction of this latent variable as well as reliability and validity of the measure. The second article employs the newly created measure of academic capitalism with intention to explain variation among faculty. Planned submissions to *The Journal of Higher Education* and *The Review of Higher Education* will occur following successful defense of this dissertation.

The first manuscript was written and will be submitted for review to *The Journal of Higher Education*. It focuses on constructing a measure of academic capitalism. The journal is peer-reviewed and published by The Ohio State University Press with the expressed goal to "combine disciplinary methods with critical insight to investigate issues important to faculty, administrators, and program managers" (The Ohio State University Press, n.d.-a). Additionally, the editors have conveyed their desire to "…respond most favorably to manuscripts that evidence both a freshness of vision and a vitality that may be informed by, but certainly go beyond, methodological qualities" (The Ohio State University Press, n.d.-b).

Manuscripts submitted for review must be formatted in accordance with the current edition of *Publication Manual of the American Psychological Association* (currently the 5th edition). Additional requirements include, an abstract of 50 words or less, a limit of 30 pages,

and removal of all self-identifying references and notes. Criteria for selection includes form, writing style and readability, logical development, appropriate length, and appropriateness of stated objectives. The editors request only one hard copy of the manuscript be sent to the editorial offices. The expected length of time for review is three months with publication of accepted manuscripts within one year.

The second manuscript to be submitted to *The Review of Higher Education* largely centers on a model to explain the extent of faculty involvement in academic capitalism. The anticipated robustness of data and findings lend a high level of credibility expected by this journal.

The Review of Higher Education is considered a leading research publication in the study of higher education issues. Published by the Association for the Study of Higher Education, it is designed for an audience of scholars, academic leaders and public policymakers. Articles are selected for publication "according to the significance of the problem or theory examined, the rigor and appropriateness of the scholarship, and the clarity with which ideas and information are presented" (The Johns Hopkins University Press, n.d.).

Among the editorial board's author guidelines include the use of current edition of *Publication Manual of the American Psychological Association* and an expected page limit not to exceed 30 pages. Importantly, the author is requested to refrain from personally identifiable information to facilitate a blind review.

The Review of Higher Education editorial board recently announced a transition from paper to electronic submission of manuscripts. All submissions, beginning in January 2008, must be submitted using the ScholarOne system. The web-based system will be used at each step of the review process—submission, reviewer comments, revisions, resubmission, and publication

decisions. To initiate the process, authors are required to create an account via the ScholarOne website.

Running head: CHAPTER FOUR: ITEM RESPONSE THEORY ANALYSIS

Chapter Four: Academic Capitalism: An Item Response Theory Analysis of NSOPF:04

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Abstract

Despite growing attention to the role of higher education in the Knowledge Economy, little is known about the function of faculty members. One leading theory, Academic Capitalism, is largely predicated on the work of the faculty to turn research into dollars. This study investigated the creation of an individual-level, continuous measure of Academic Capitalism for faculty members at American research universities. Using Item Response Theory, results of the study indicate a single measure can be created from responses to behavioral items found in the National Study of Postsecondary Faculty (NSOPF). Findings from this study were determined to be adequate for research purposes and will contribute to future studies on the work of university faculty members.

Chapter Four: Academic Capitalism: An Item Response Theory Analysis of NSOPF:04

A leading explanation about the changing nature of higher education and faculty work is academic capitalism. Slaughter and Rhoades (2004) identify this theory as "the pursuit of market and marketlike activities to generate external revenues" (Slaughter & Rhoades, 2004, p. 11). Universities are compelled to pursue revenue-producing practices to augment financial resources, boost organization prestige in the market, and enhance their standing in a competitive and global environment.

Differing from previous explanations about connections between higher education and the economy, academic capitalism links universities to the "new economy" or "knowledge economy." Universities are best suited to exploit the new economy because of their human capital and well-established systems to conduct research. While others have described the phenomenon as university entrepreneurship (Libecap, 2005), academic entrepreneurship (Shane, 2004), academic-industry relations or AIR (Anderson, 2001), capitalizing knowledge (Etzkowitz, Webster, & Healey 1998), technology transfer (Siegel & Phan, 2005), marketization (Kirp, 2003), and commercialization (Bok, 2003), the core concept is the same—universities and their faculties engage in behaviors that link to industry to generate wealth and prestige.

Problem

Academic capitalism is a relatively new concept in higher education and to date has been understudied. Most studies have been qualitative (Mendoza, 2007; Metcalfe & Slaughter, 2008) and a quantifiable measure at the faculty level is absent in the literature. A quantifiable measure of academic capitalism is needed to conduct further research on the behavior of faculty in various academic areas and at different universities.

Purpose

The purpose of this study was to create a measurable construct of the theory of academic capitalism. The intended use of this measure is for research and not individual diagnosis. Using data from the National Study of Postsecondary Faculty (NSOPF), I posit a reliable individual-level estimate can be created using Item Response Theory (IRT). I suggest that faculty members who are involved in academic capitalism are more likely to engage in specific, measurable behaviors. I expect these faculty members are influenced by external pressures created by universities, which directs faculty work through various reward systems. IRT allowed me to estimate a trait level for each faculty member which can be used in further research.

Research Question

The study is designed to explore the following research question: Can a useful measure, or individual-level estimate, of the theory of academic capitalism be created using data from NSOPF?

Academic Capitalism

The theory of academic capitalism is identified in the work of Slaughter and Rhoades (2004), which extended earlier work by Slaughter and Leslie (1997). In the 2004 treatise, Slaughter and Rhoades expand the notion of academic capitalism to include the effect of state and federal policy as well as the entanglement of students, administrators, trustees and other stakeholders. Accordingly, the new economy "treats advanced knowledge as raw material that can be claimed through legal devices, owned, and marketed as products or services" (Slaughter & Rhoades, 2004, p. 15). The protection of this raw material is achieved through patents, copyrights, and trademarks. The goal, then, is for university owned "trade secrets" to be sold in the marketplace for a profit. Subsequently, university administrators direct faculty work toward

seeking these profits from external, industry-based sources. In fact, most research universities have adopted formal mission statements and established technology transfer offices to achieve this goal (Markman, Phan, Balkin, & Gianiodis, 2005).

Importantly, actors (in this case faculty) *initiate* academic capitalism. They are not simple bystanders but rather active participants. There is likely a perception among faculty members that because of rising tuition costs and shrinking state subsidies, new streams of external revenue must be produced to sustain the academic enterprise (Slaughter & Rhoades, 2004). Renault (2006) asserts three possible institutional influences on this perception: (a) policy-based incentives, (b) the researcher's discipline, and (c) norms of the university. The discipline and the university pull researchers in opposing directions with the former clinging to traditional activities and the latter encouraging entrepreneurial ones.

Academic capitalism is manifested in the types of activities on which faculty choose to spend their time. Several key faculty behaviors are indicative of academic capitalism—patents/licensing, consulting, external grants, and distance education. These four behaviors are found in the literature on faculty work (e.g., Aggarwal, 1981; Association of University Technology Managers, 2007; Bercovitz & Feldman, 2004; Epper, 1999; Epper & Garn, 2003; Fairweather, 1996; Glauser & Axley, 1983; Linnell, 1982; Patton & Marver, 1979; Rhodes & Slaughter, 2004; Shane, 2004; Shuster & Finkelstein, 2006; Twigg, 2003; Whittington & Smith-Doerr, 2005) and form the underpinnings of the present study, which is described next.

Method

To complete the study, several steps were required. In this section, I describe Item Response Theory (IRT), and the sample and instrument used. The study used IRT to analyze

select items from NSOPF. Through the analysis which is next described, a single measure of academic capitalism was constructed.

Item Response Theory

IRT, also known as latent trait theory, involves mathematical models designed to make statistical adjustments to deal with error in test scores (van der Linden & Hambleton, 1997). Most measurement scholars consider latent trait models to be divided into two groups: Rasch models and IRT models. First, early work by Rasch (1960) developed models designed to study the scientific properties of measurement for the purpose of developing test theory. Second, Birnbaum's 2- and 3-parameter models, published in Lord and Novick's classic Statistical Theories of Mental Test Scores (1968), sought to provide statistical theory for ability and item parameter estimation (van der Linden & Hambleton, 1997). In essence, these authors showed that IRT could be used to model the probability of the interaction between a test item and the examinee/respondent. This information could then be used as a basis for psychological measurement and later in determining trait or ability levels (Embretson & Reise, 2000). In this study, IRT was selected to model test data from an existing instrument and used to estimate a person's Academic Capitalism trait level from responses to those test items.

IRT differs from classical test theory in that it involves a search process for optimal estimates to model behavior (Embretson & Reise, 2000), not simply adding responses to create a "score." Because the construct "academic capitalism" is latent, it must be observed through behavior (or responses) on relevant items found within NSOPF. Simple addition or averaging of these items does not make sense because the difficulty of these items varies. The purpose of measurement, then, is "to provide a reasonable and consistent way to summarize the responses

that people make to express their achievements, attitudes, or personal points of view through instruments…" (Wilson, 2005, p. 5).

Bock (2003) suggested "tests and scales are instrumental in making behavioral phenomena accessible to quantitative analysis…they serve to operationalize constructs derived from theory" (p. 620). In this case, I sought to determine the fit of an IRT model to the survey items. In other words, the items were analyzed to measure the association between item response and an underlying latent trait conceptualized as academic capitalism.

The purpose of IRT modeling is to develop a relationship between individual differences on a latent variable, denoted by θ, and the probability of responding in a particular item category (Hall, Reise, & Haviland, 2007). The "trait level" is assumed to cause differences in item response behavior among individuals. Importantly, the model focuses attention on the probability of the observed responses. This model is essential to the aggregation of scores across the items and is expressed at both the item level and the instrument level. This is articulated in terms of the respondent's ability (θ) and the item difficulty (β), sometimes called a threshold parameter. The logic is that both the respondent and the item hold varying amounts of the construct. However, what is most important is the difference between the respondent's ability and the item difficulty. It is this difference that determines probability. Items can also be evaluated and described in terms of a discrimination (α) parameter.

Since each item theoretically contributes differently to the construct, in this case academic capitalism, a two-parameter logistic model (2PL) can be used (Embretson & Reise, 2000). The 2PL model includes item difficulty, which is the point on the latent scale where the respondent has a 50% chance of an affirmative response to the item. It also includes a slope parameter, item discrimination (α), to account for the impact this can have on the difference

between trait level and item difficulty. For example, according to Embretson and Reise (2000) a lower discrimination value will have less impact on the probability showing that trait level is less relevant to changes in success. Importantly, this parameter allows for differentiation to occur between respondents with the same total score because success on highly discriminating items leads to the highest trait level estimate (Embretson & Reise, 2000). In short, items are weighted differently.

For example, Figure 1 graphically models three hypothetical items with different parameters in what are known as item characteristic curves (ICC). These lines are regressions of item score on a trait variable (i.e.,θ). The items have discriminations of .5, 1, and 1 and difficulties of 1, -1, and 1. Items 2 and 3 have the same discrimination (e.g., slope) so changes in trait level has a similar impact on probability. A low discrimination, as in Item 1, results in less information about the latent trait. It becomes clear how item discrimination "weights" each item in trait estimation and that a person with a higher trait level has a greater probability of an affirmative response.

IRT is known as "strong modeling" because two important assumptions must be met to estimate item parameters: local independence and dimensionality (Embretson & Reise, 2000). Although these cannot be directly assessed, indirect evidence can be. First, local independence is the assumption that holding the trait level constant results in responses to items which are independent of other responses. Performance on one item does not influence performance on another item. Dimensionality is the second assumption and means that the model contains the "right number of trait level estimates per person for the data" (Embretson & Reise, 2000, p. 189). Appropriate dimensionality is achieved when one trait estimate is present for each individual.

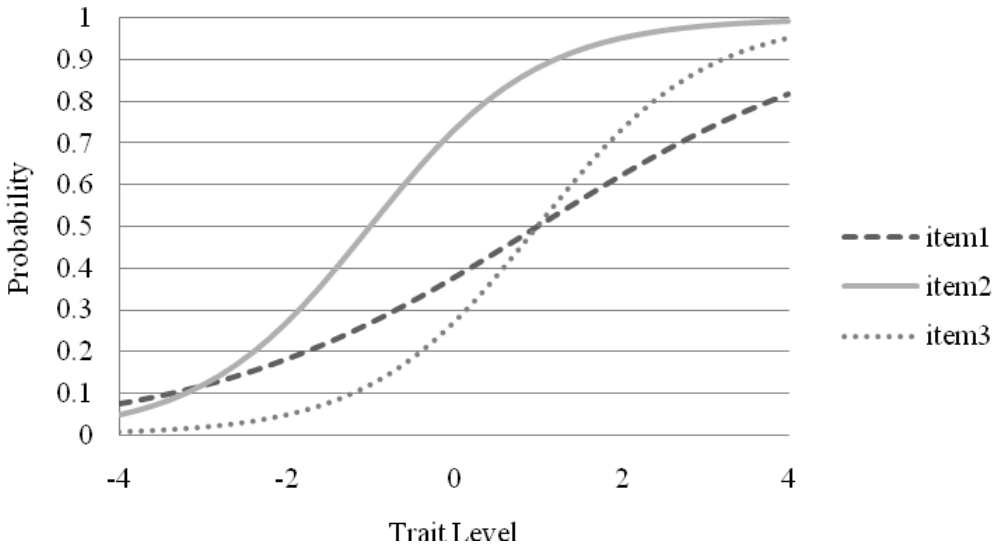

Figure 1. Example item characteristics curves for varying discriminations.

Sample

The data are responses to selected items in NSOPF by a nationally representative sample of faculty members at research universities. The sample contains responses from 9,720 faculty members from both research intensive and research extensive universities, as defined by the Carnegie Classification

Instrument

NSOPF is designed, administered, and analyzed by the NCES for the purpose of providing data on faculty members and their institutions to postsecondary researchers. The survey was administered in four waves: 1988, 1993, 1999, and 2004. NSOPF data are designed to establish a national profile of faculty, their productivity and workload, and information on institution policies and practices (Heur, Kuhr, Fahimi, Curtin, Carley-Baxter, & Green, 2005). The most recent wave, NSOPF:04, was based on a nationally representative sample of 35,630 faculty and instruction staff at 980 institutions and consists of a faculty frame and an institution frame.

The faculty frame comprises questions to convey the background characteristics, workload, scholarly activities and opinions of individual faculty members. Faculty members were widely defined to include: permanent and temporary; full- and part-time; tenured and non-tentured; those who taught credit or non-credit courses; and those who interacted with undergraduate, graduate or professional students (Heur, et al., 2005).

The NSOPF:04 survey does not explicitly ask faculty members to report on academic capitalism. It does, however, ask faculty members to report various activities that can be linked to academic capitalism. When combined into a single measure an estimate of behavior in academic capitalism can be calculated.

Four variables hold significant meaning to academic capitalism and were identified in NSOPF:04. These variables are number of distance education classes taught (Q35C), recent patents and software licensing (Q52BG), current funded scholarly activity (Q55), and consulting (Q66D). The items in the NSOPF:04 data set were recoded as dichotomous variables so that a score of 0.00 indicated the respondent answered the item in a manner consistent with lower levels of academic capitalism (i.e., did not engage in that activity) and a score of 1.00 indicated the respondent answered the item in a manner consistent with higher levels of academic capitalism (i.e., engaged in that activity). This conversion simplified the interpretation of behavior in simple "yes" and "no" terms.

To create an estimate of academic capitalism, simple addition of these variables was not a particularly sufficient or accurate measure. Each variable must be weighted in some fashion to express the difficulty in successfully achieving the behavior. More importantly, one can see an apparent rank of each of these activities in terms of relative prestige and importance. It was critical then to establish an accurate measure of proficiency, taking into account item attributes. For example, compare two faculty responses. The first indicates she holds a patent and has funded research. The second indicates she teaches distance education and is an external consultant. Each faculty members has an average "score" of 0.50 on the 4 items. It is impossible to understand which faculty is more proficient in academic capitalism without knowing the difficulty of each item (behavior), which is essentially a location on the latent scale. Both the portion of participation by an individual (examinee proficiency) and the difficulty of participation for each item (item difficulty) must therefore be considered.

Unfortunately, the literature on academic capitalism does not identify such a rank or weighting scheme so it must be created. Considering this, an analytic approach to constructing an estimated measure of academic capitalism was needed. IRT was selected for this purpose.

Software

M*plus* (Muthén & Muthén, 2007) was used in the analysis of the underlying assumptions of IRT. The software is capable of performing analysis of continuous and categorical variables. It is particularly well suited for Confirmatory Factor Analysis (CFA). CFA is used to model the academic capitalism construct with the 4 measured indicators previously identified. It is used to examine an assumed factor structure where "(a) the theory comes first, (b) the model is then derived from it, and finally (c) the model is tested for consistency with the observed data" (Raykov & Marcoulides, 2006, p. 117).

The BILOG-MG (Scientific Software International, 2008) program is designed for item parameter calibration and respondent scoring. It allows the researcher to estimate IRT models using dichotomous data. BILOG is run in three phases (Embretson & Reise, 2000): (a) basic item descriptive statistics, (b) item calibration, and (c) scoring respondents. BILOG provides output for item difficulty (b_i) and discrimination (α).

Evaluation of Assumptions

Each of the two assumptions were evaluated before analysis of the IRT model was conducted. First, because the items selected for this study were not practically linked (e.g., a "correct" response to an item is necessary to respond to another item) it is safe to assume the local independence assumption had not been violated. Second, appropriate dimensionality was determined. In a unidimensional model, as required in this study, all items load on a single factor. The model assumes that a set of items measure a single continuous latent construct.

Confirmatory Factor Analysis (CFA) is used in measurement models (e.g., scale development) to assess the relationship between observed measures and a latent variable (Brown, 2006). It is frequently used to verify the number of underlying dimensions of an instrument. CFA was selected to assess the dimensionality assumption necessary for IRT analysis. De Ayala and Hertzog (1991) showed that CFA may be used for such assessment and others (e.g., Schatschneider, Francis, Foorman, Fletcher, & Mehta, 1999) have applied the procedure in their research.

CFA requires a strong empirical and conceptual foundation to determine an underlying structure through empirical analysis (typically exploratory factor analysis) as well as on theoretical grounds (Brown, 2006). After an extensive review of the literature on the selected variables (i.e., patents/licensing, consulting, external grants, and distance education), I used a two-step approach to test the proposed CFA model. First, I conducted an exploratory factor analysis (EFA) using half of the data to determine the number of factors present. Next I determined how well the observed measures reflected academic capitalism, the single latent construct central to the study, by assessing the CFA model with the remaining data. The EFA analysis was conducted using SPSS version 16 and confirmed in M*plus* version 5.0 (Scientific Software International, 2008). The CFA analysis was conducted using M*plus*.

Brown (2006) suggests that the acceptability of a model can be evaluated by goodness-of-fit and the interpretability and strength of parameter estimates. The parameters for a unidimensional model are the factor loadings and the error variances and covariances. The original 4-item model is over-identified ($df = 2$). The number of known information in the input matrix (10 parameters) exceeds the freely estimated model parameters (8 parameters). Further

analysis via EFA indicated that the more appropriate model is a 3-item model, or just-identified, so named because it provides zero degrees of freedom ($df = 0$).

The item *Distance Education* was theoretically tenuous. The literature did not suggest a strong link between academic capitalism and the faculty behavior of engaging in distance education. As indicated in Tables 1, 2, and 3, EFA further revealed that the item loaded on a second factor, therefore I made a decision to drop *Distance Education* from the model. The remaining items—*Patents*, *External Funding*, and *Consulting*—loaded favorably on a single factor. These items were used in an appropriately specified model for CFA analysis.

Goodness-of-fit indices did not apply and are therefore unnecessary for the one-factor model with 3 variables (Brown, 2006). With large samples such as this one ($n = 9720$), it was likely the χ^2 statistic would be significant (Bentler & Bonett, 1980; Marsh, Balla, & McDonald, 1988) and lead to false interpretation. Interpretability and strength of parameter estimates, however, were evaluated and are shown in Table 4.

The goal of CFA was to find a "set of factor loadings…that yield a predicted covariance matrix…that best reproduces the input matrix" (Brown, 2006, p. 72). Generally a maximum likelihood (ML) is used; however, in the case of categorical/binary (dichotomous) indicators, robust weighted least squares (WLSMV) was the best option (Brown, 2006). The sample variance-covariance matrix was analyzed using M*plus*. Evaluation of standardized residuals indicated no localized points of strain. Unstandardized, standardized and completely standardized parameter estimates are presented in Table 4. All freely estimated unstandardized parameters were statistically significant ($p < .001$). Figure 2 displays the factor loadings, which indicated that the items were related to the latent factor (R^2s = .37, .34, and .13).

Table 1

Exploratory Factor Analysis Correlations

	EX. FUNDING	PATENT	CONSULTING	DISTANCE ED.
EX. FUNDING	-			
PATENT	.148	-		
CONSULTING	.111	.120	-	
DISTANCE ED.	.002	.014	.033	-

Table 2

Total Variance Explained

Number of Components	Initial Eigenvalues		
	Total	% of Variance	Cumulative %
1	1.256	31.41	31.41
2	1.002	25.05	56.46
3	0.891	22.27	78.73
4	0.851	21.27	100.00

Table 3

Exploratory Factor Analysis Component Matrix

	Component	
Variable	1	2
EX. FUNDING	.651	-.185
PATENT	.668	-.098
CONSULTING	.610	.113
DISTANCE ED.	.121	.972

Table 4

Parameter Estimates from the One-factor CFA Model of Academic Capitalism

	Estimates	S.E.	Est./S.E.	Std	StdYX
Academic Capitalism by					
PATENT	1.000	.000	999.000	.612	.612
EX.FUNDING	0.951	.165	5.749	.582	.582
CONSULTING	0.595	.081	7.388	.364	.364
Variances					
AC	.374	.075	4.955	1.0	1.0
Residual Variances					
PATENT	.626				
EX.FUNDING	.662				
CONSULTING	.867				
R-SQUARE					
Observed Variable	R-Square				
PATENT	.374				
EX.FUNDING	.338				
CONSULTING	.133				

Note. Estimates, unstandardized parameter estimate; S.E., standard error; Est./S.E., test statistic (z value); Std, standardized parameter estimate; StdYX, completely standardized parameter estimate.

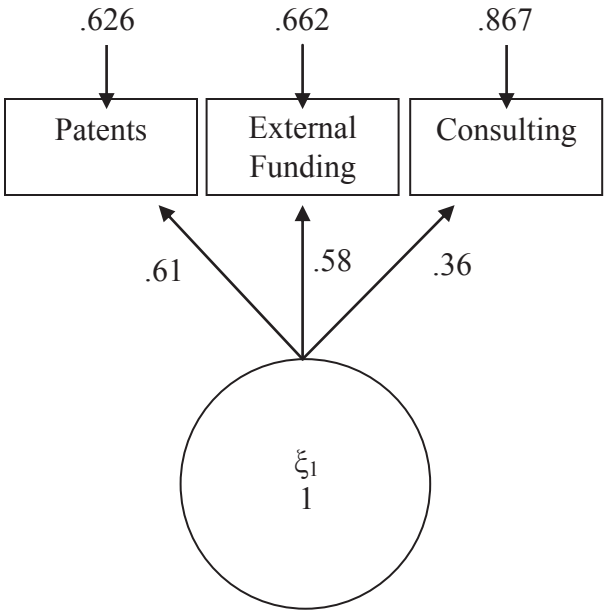

Figure 2. Completely standardized parameter estimates from the one-factor CFA of Academic Capitalism.

Results

Descriptive Statistics

The average summed score for all respondents is 0.8 and a standard deviation of 0.8. Table 5 shows the frequency of all summed scores. As expected, the sample distribution of summed scores had a strong negative skew with most respondents indicating lower engagement in selected activities indicative of academic capitalism. While total score runs counter to the use of IRT, it is important here only to demonstrate CTT and provide the reader additional information. The Kruder-Richardson KR-20 coefficient, a measure of reliability, for the three-item subscale was 0.27. The short test length (3 items) is largely responsible for the low value.

Descriptive statistics of the individual items in the academic capitalism subscale are shown in Table 6. The average score for respondents who endorsed the item in a direction consistent with higher levels of academic capitalism is shown in the column titled "average when item endorsed." Larger differences between this score and the scale average of 0.83 indicate the respondent is likely to endorse more of the other items in the scale; thus, respondents report more academic capitalism behaviors when they endorse the item. The proportion of the 9,720 faculty members in the sample who endorsed the item in a direction consistent with higher levels of academic capitalism is provided in the column marked "proportion endorsed." The proportion of respondents endorsing an item is typically an indication of the amount of the trait measured by the test that was needed to endorse the item (e.g., item difficulty). The correlation measure in the last column indicates the relationship between the item and total score. Item 1 (Patents/licensing) is least related to the total score and items 2 (Funded research) and 3 (Consulting) have the highest relationship with the total scale score. The size of these correlations, however, may be somewhat misleading given the disproportional split in the dichotomous responses. An extreme

Table 5

Frequency Distribution of Total Score.

Total Score	Frequency	Percent	Cumulative Percent
0	4140	42.6	42.6
1	3800	39.0	81.6
2	1550	15.9	97.5
3	240	2.4	100.0
Total	9720	100.0	

Note. Analysis was conducted with actual sample; however, per NCES requirements for unweighted samples, sample size is reported by rounding to the nearest 10.

Table 6

Classical Test Theory Item Analysis

Item	Three item subscale average	Average when item endorsed	Proportion endorsed (*n*=9,720)	Point-biserial correlation (item-scale)
PATENT	.78	2.19	.064	.462
EX. FUNDING	.78	1.51	.385	.728
CONSULTING	.78	1.57	.333	.698

split such as the one found with item 1 severely restricts the maximum value (McNemar, 1962; Lipsey & Wilson, 2000).

Item Response Theory Analysis of Data

With a completed model of a measure of academic capitalism the next step was to construct the new measure of academic capitalism. This step was designed to relate the scored outcomes to the construct through the use of a measurement model (Wilson, 2005). Birnbaum (1968) presented an IRT model that can be applied to any dichotomous data including behavioral rating scales where item responses are scored into two categories to represent "yes" (1.00) or "no" (0.00). Specifically, a unidimensional IRT model was used to characterize person differences on the single latent trait of academic capitalism. This was carried out through the previously-described two-parameter logistic model (2PL). The probability that person *s* affirmatively answered item *i* was given as follows:

$$P(X_{is}=1 \mid \theta_s, \beta_i, \alpha_i) = \frac{\exp[\alpha_i(\theta_s - \beta_i)]}{1+\exp[\alpha_i(\theta_s - \beta_i)]}$$

where

X_{is}=response of person *s* to item *i* (0 or 1)

θ_s=trait level for person *s*

β_i=difficulty of item *i*

α_i=discrimination for item *i*

The *expected a posteriori* (EAP) method was used to estimate trait level. This method enabled a "numerical calculation of the mean and variance of the posterior distribution" (Bock & Mislevy, 1982, p. 432; see also Bock & Aitkin, 1981), or the predicted distribution of scores given a particular response pattern. For a given case, then, EAP provided an expected value of the posterior probability distribution of latent trait scores. EAP is a "noniterative procedure"

which "provides a finite trait level estimate for all response patterns—even all endorsed and not-endorsed response patterns" (Embretson & Reise, 2000, p. 177). This method focuses on the weighted mean of the probability distribution (Bock & Mislevy, 1982).

Fitting the IRT Model

Item parameters were estimated using Bilog-MG (Scientific Software International, 2008b). For each item there was one threshold parameter estimate (b_1) and one item discrimination parameter estimate (a). The b_1 parameter indicates the location on the latent trait continuum. The a parameter specified the steepness or slope. Displayed in Figure 3, the resulting Item Characteristic Curves (ICC) show the probability of an affirmative response as a function of the latent trait academic capitalism. A person with a higher level of academic capitalism is more likely to respond to an item.

First, I evaluated the item discrimination parameters as shown in Table 7. Items with higher discrimination have a larger a parameter. While these values were not exceptionally high (a = .996, .607, .392), they nevertheless indicated different strengths of relationship between the item and latent trait. The item *PATENT* (a = .996) had the highest value and therefore did a better job distinguishing among individuals who are high and low on academic capitalism. Typically, discrimination values above 1.00 indicate measurement precision for individuals with θ estimates close to the population average.

Next, I examined the threshold parameters (θ) in Table 7. This parameter shows the trait level necessary to have a .50 probability of obtaining a positive level of academic capitalism. In other words, higher thresholds indicate a higher level of individual academic capitalism is necessary to achieve a positive score. The scale for this parameter has a mean of zero and variance of one, similar to a Z-score scale. It was clear that the item *PATENT* (θ = 2.22) required

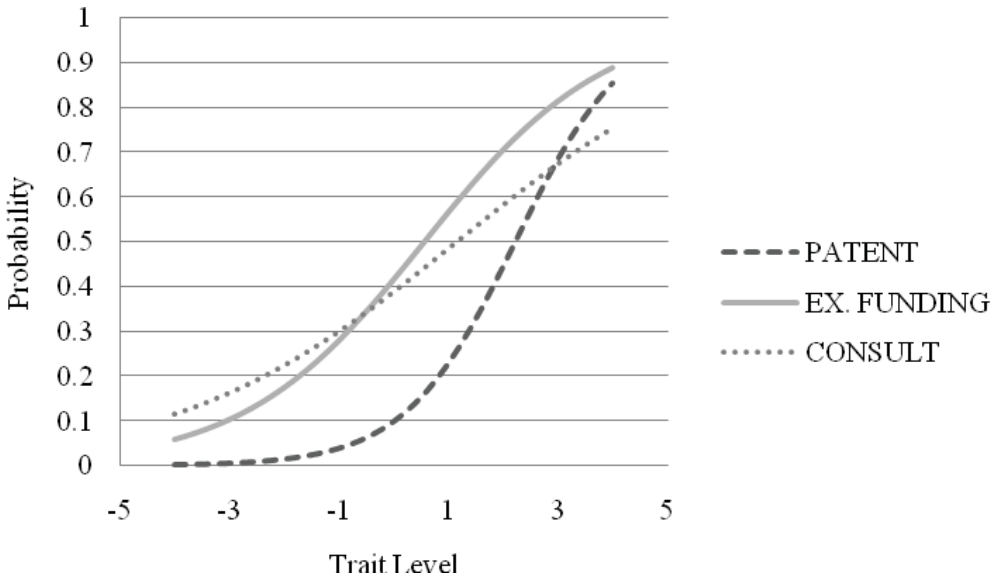

Figure 3. Item Characteristic Curve for PATENT, EX. FUNDING, and CONSULTING

Table 7

Item Parameter Estimates

Item	*Slope (α)*	$b_1(\theta)$
PATENT	.996	2.224
EX. FUNDING	.607	0.558
CONSULTING	.392	1.150

an individual to have a high level of academic capitalism to engage in that behavior while the other items, *FUNDING* (θ = 0.56) and *CONSULT* (θ = 1.15), required lower levels. It is important to note that all of the threshold parameters are positive, which is an indicator that these items work best among individuals in higher trait ranges. This suggests the 3-item variable is measuring a relatively high end of academic capitalism. These variable do, however, seem to cover a wide range from 0.50-2.00 standard deviations.

Item and Scale Information

In IRT, psychometric information is evaluated with information curves for both items and scale. The item discrimination parameter (α) determined the amount of information and was peaked around the threshold parameter (θ). That is, a higher amount of discrimination generates more information. Threshold parameters that are close together have a peaked information curve while parameters that are not close are spread out and relatively flat. The item information curves for the three items are shown in Figure 4. The IIC for PATENT (a = 0.996, b_1 = 2.22) was highly discriminating as indicated by the dramatic peak. By comparison, the IIC for CONSULT (a = 0.392, b_1 = 1.15) is flat. Given that information is relative to the squared discrimination value (Embretson & Reise, 2000), PATENT provided more than 2.5 times information than FUNDING and six times more information than CONSULT. Of particular note, the IIC for PATENT was positively skewed. This indicated the item only discriminated among individuals in the higher trait range of academic capitalism. Or, quite possibly this item was too difficult to achieve for most faculty.

Finally, I examined the scale information curve displayed in Figure 5. Since item information is additive across items within a scale, this aggregated curve provided a window to the precision of the measurement. A precise measurement is indicated when information is high

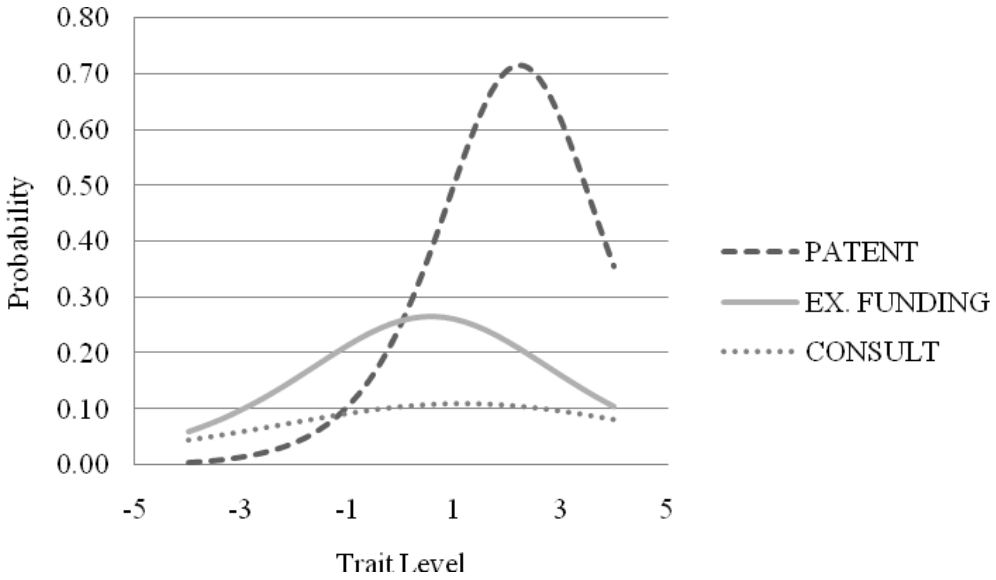

Figure 4. Item Information Curves for PATENT, EX. FUNDING, and CONSULTING

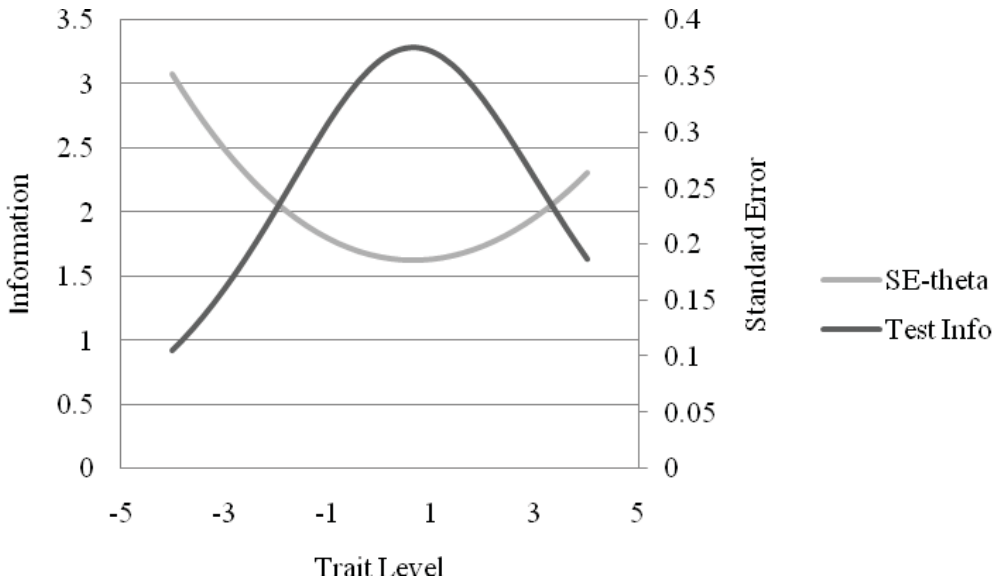

Figure 5. Scale Information Curve for Academic Capitalism

and standard errors are low. As shown in Figure 5, as the information increases, standard error decreases. This was a good indicator of the relative precision of this measure.

Scoring

According to Embretson and Reise (2000), in IRT, "the difference between a person's trait level and the item's difficulty has direct meaning for the probability of endorsement" (p. 127). The difficulty of an item therefore equals a person's trait level which is measured when the probability of endorsing an item reaches .50. Since the goal of this study was to determine an estimate of academic capitalism for individual faculty, I used the IRT model to score individuals in the sample on a latent-trait variable.

Given the number of items (3), each faculty member had one of eight response patterns. As shown in Table 8, each response pattern has a trait level estimate (θ) and standard error. The expected a posteriori (EAP) method was used to compute these θ estimates. This process places the faculty member in a most likely position on the latent-trait (academic capitalism) continuum. I note that standard errors for the response patterns are high. In this case, standard errors are high because of the limited amount of information provided by the short, 3-item instrument (Embretson & Reise, 2000).

Table 9 provides example group comparisons on academic capitalism. It is evident that there are differences based on gender (men and women), academic rank (assistant, associate, and full professor), and the focus of the academic discipline (applied and pure). While these provide a simple comparison to demonstrate the new estimate of academic capitalism, a more complex analysis warrants further study.

Table 8

Expected A Posteriori (EAP) Trait Level Estimates and Standard Errors

Pattern Number	Pattern[a]	Number of Faculty with Response Pattern[b]	Percent of Faculty with Response Pattern	θ	*SE*
1	111	240	2.4	1.6814	.7501
2	110	180	1.8	1.3000	.7641
3	101	90	0.9	1.0838	.7749
4	011	1280	13.1	0.6742	.7986
5	100	120	1.2	0.6716	.7987
6	010	2050	21.1	0.2349	.8256
7	001	1630	16.8	-0.0188	.8410
8	000	4140	42.6	-0.5062	.8694

Note. [a]The response pattern for the three items is ordered. The first position represents the item PATENT, the second position is the item EX. FUNDING, and the third position is the item CONSULTING. [b]Analysis was conducted with actual sample; however, per NCES requirements for unweighted samples, sample size is reported by rounding to the nearest 10.

Table 9

Mean Academic Capitalism Trait Levels by Selected Groups

	n	*M*	*SD*
Men	5910	.0746	.58
Women	3810	-.1112	.46
Professor	2580	.1934	.58
Associate Professor	1990	.0765	.56
Assistant Professor	2090	.0228	.52
Applied	4830	.0148	.56
Pure	4710	-.0026	.53

Note. Analysis was conducted with actual sample; however, per NCES requirements for unweighted samples, sample size is reported by rounding to the nearest 10.

Discussion

The goal of this study was to explore the possibility of measuring academic capitalism by using Item Response Theory to analyze selected items from the National Survey of Postsecondary Faculty (NSOPF). NSOPF was not designed to measure academic capitalism specifically, but rather to better understand the attitudes and behaviors of college and university faculty. By selecting faculty at research universities, I developed an empirical measure of academic capitalism that can be used in further research and the development of an instrument designed to measure a wider range of academic capitalism. It is important to note the sample used was faculty working at research universities. Any discussion here with reference to a mean on the latent trait is generalizable only to this specific group.

The present investigation demonstrated that three of the selected items from NSOPF:04 are indicators of a unidimensional trait. The remaining item *Distance Education* was dropped from the model. The literature did not suggest a strong link between academic capitalism and the faculty behavior of engaging in distance education. I argue the reward of distance education (namely revenue from tuition and fees) accrues to the university and not the individual faculty. In fact, there is likely a *dis*incentive for faculty in the forms of additional work generated by greater numbers of students and translating a course from a traditional (physical) to alternative (virtual) classroom.

As expected, individual faculty members who held a patent or license for their research displayed higher levels of academic capitalism. This is most evident when comparing the trait level of those who responded only to PATENT (response pattern 5) with those who responded jointly to EX. FUNDING and CONSULTING (response pattern 4). Keeping in mind the metric used had a mean of 0.00 and standard deviation of 1.00, trait levels are nearly identical (θ =

0.6716 and 0.6742 respectively). Further, the four patterns with affirmative responses to PATENT offered a higher trait level, which underscored the literature on the significance of this behavior.

Arguably, the trait levels may be underestimated given the conversion from continuous to dichotomous variables. It is plausible that a faculty member with numerous patents has a higher trait level than those with only one patent. Similarly, a faculty member with millions of dollars in external funding might score higher than one with a couple thousand dollars in grants. Given this, results here are only a preliminary indicator of academic capitalism. In fact, the purpose of this study was to develop an estimate, not a pinpoint measure, which could serve to launch additional studies to confirm these findings and differentiate trait levels among faculty members.

The analysis also included item and scale information, which indicated the scale information was peaked at one end of the trait continuum. This pointed to a scale construct that measured well on the "high" end. I note the positive skew, which may be indicative of a measure best used for individuals with higher trait levels because the scale is more precise at that end of the trait continuum. It is likely this was a result of the sample. Faculty members at research universities are more inclined, and rewarded, for their work in the areas this scale measured. In addition, faculty members in the sample were representative of a wide range of academic areas. The very nature of some disciplines likely influences the behaviors of the faculty. For example, it is assumed that faculty members in applied sciences would be more likely to hold a patent whereas faculty in the humanities would not. However, this may also be a result of converting items from a continuous to a dichotomous measure. Regardless, the characteristics of this information were expected and appropriate.

To date, the literature has focused on specific aspects of academic capitalism, but researchers have yet to tie these together or offer a possible solution to understanding academic capitalism at the individual faculty member level. This analysis showed that three measured behaviors—patents and licensing, external funding, and consulting—may at the very least provide a good indicator, or estimate, of academic capitalism.

Implications

Given the large standard errors indicated in Table 8, this measure is not useful for individual diagnosis. It is irresponsible to use it for individual faculty evaluation and would be presumptuous to suggest using it for practical matters beyond research and broad policy issues. However, while individual ability estimates are imprecise, group estimates are adequate for research. As is the study's intent, the measure is designed to inform additional research and perhaps aid in the development of a new instrument designed to measure academic capitalism.

Future research on faculty work will benefit from greater understanding of influential forces on individual faculty work, particularly those that are external to the university. While the work of Slaughter and Leslie (1997) and Slaughter and Rhodes (2004) provided the language for understanding academic capitalism, this study advances a mechanism to measure it at the individual level. The creation of an estimate of academic capitalism for individual faculty members might generate a line of research that further explores faculty behaviors. Future studies might include focused attention on how faculty work has changed across time. Using previous waves of NSOPF data, the new measure can support a longitudinal analysis. Another important area of investigation might involve in-depth analysis of academic disciplines that do not expressly rely upon technology transfer, particularly the humanities. A mixed methods study of faculty in this area might yield unique insight to the pressures to engage in academic capitalism.

New research on important sub-populations is also required, including underrepresented and women faculty. Particular research emphasis on these groups of faculty in STEM (Science, Technology, Engineering, and Mathmatics) fields is necessary to understand that unique environment. This is of vital interest to organizations such as the National Academies as well as individual universities, which have recognized the value in expanding the faculty and creating opportunities for women and minorities to succeed.

Findings from this study will inform researchers at the NCES on the development of future versions of the NSOPF survey. If academic capitalism does indeed influence faculty work, refining existing items or adding new ones will be important considerations to accurately reflect the work of faculty. NCES aims to create an instrument that creates a national profile to include faculty productivity and university policy. Adding questions related to faculty perceptions of their work environment (e.g., pressure to perform certain work functions or institutional culture) and influential university policy would bolster future iterations of NSOPF.

The usefulness of these findings to the development of a new, independent instrument to study academic capitalism must also be noted. The three-item test demonstrated here provides a measure at the upper-end of the academic capitalism continuum. Given this, a new instrument must consider the prior work of faculty members such as post-doctoral positions, published research and unsuccessful grant applications. It is likely that early indicators of academic capitalism exist. Academic capitalism is also likely influenced by the number of graduate assistants, the size of research or lab space, and other resources available to a faculty member. The instrument might also collect data on faculty work environment. This domain includes institutional prestige and reputational activities such as rate of publication and investment choices in student quality and research (Brewer, Gates, & Goldman, 2002). Questions related to

activities at the individual and organization level, both successful and unsuccessful endeavors, would create a better measure throughout the ability scale.

The implications for policy at the university, state, and national levels are numerous and implicitly intertwined. A recent study conducted by the National Bureau of Economic Research (Aghion, Dewatripont, Hoxby, Mas-Colell, & Sapir, 2009) suggested:

> [A]utonomy and market competition improve universities' research output more when those universities can see that research effort is richly rewarded through merit-based competitions. In other words, policy makers may have a role to play by focusing universities' competition on research, as opposed to politics or other activities. Universities are induced to use their autonomy productively when they operate in a high stakes, competitive research environment (p. 25).

With these findings in mind, university leaders might continue to look to policies that support and encourage research output. Findings from this study may provide a tool that will afford new data to academic leaders who will be better positioned to make decisions about resource allocation, realigning strategic priorities, and development of new academic programs. Moreover, university leaders must now weigh the mission, values, and roles of their institutions and academe in an environment that is dependent on innovation. This is a critical point because clearly not all faculty members will be, or should be, positioned to contribute to this type of research output, namely patents.

Limitations

As with all research, this study is subject to several limitations. The first is related to the use of a large, national dataset for secondary data analysis. Regardless of controls implemented,

there are likely sampling issues. For example, it is possible that individuals who chose to participate in the study are different from those who did not participate.

Second, the use of NSOPF in particular presents noteworthy limitations. NSOPF used a two-stage sampling process of institutions and faculty. The same sampling issue mentioned at the individual level holds at the institution level. Institutions that chose not to participate cut off individual faculty responses. The study is also limited to a single factor that could be operationalized using items contained in NSOPF:04. Because academic capitalism is not a predefined variable, an estimate had to be created to approximate it using available items. There is inherent risk in doing so because both the researcher and the reader make assumptions. In addition, other activities that might indicate work in line with academic capitalism might not have been included in the survey. Examples include funded research collaboration with faculty at other universities, particularly those in other countries, differentiating applied and basic research, the development of a research institute or center, and holding equity in and/or the formation of a start-up company related to their research.

Finally, this study is limited to tenure and tenure-track faculty at research universities. Results should be interpreted as such and it is difficult to make conclusions that are generalizable to faculty at other institution types or non-tenure-track faculty at research universities.

Conclusion

Academic capitalism is a measurable concept defined by the mechanisms and behaviors of universities that seek to generate new sources of revenue and are best revealed through faculty work. This study was designed to create empirical evidence of academic capitalism through the behaviors of faculty members at research universities. Using a large-scale, national database, I was able to create a new measure—an estimate of academic capitalism—for individual faculty

members. This study will increase our understanding of the changing nature of faculty work, will lead to future studies on academic capitalism that involve longitudinal analysis and important sub-populations, and will likely influence institutional and public policy.

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Chapter Five: Academic Capitalism: Explaining Faculty Differences through Multi-level Analysis

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Abstract

Two broad influences have converged to shape a new environment in which universities must now compete and operate. Shrinking financial resources and a global economy have arguably compelled universities to adapt. The concept of academic capitalism helps explain the new realities and places universities in the context of a global, knowledge-based economy. Prior to this theory, the role of universities in the knowledge economy was largely undocumented. Academic capitalism is a measurable concept defined by the mechanisms and behaviors of universities that seek to generate new sources of revenue and are best revealed through faculty work. This study was designed to create empirical evidence of academic capitalism through the behaviors of faculty members at research universities. Using a large-scale, national database, I created an estimate of academic capitalism at the individual level and then used multi-level analysis to explain variation among faculty members. This study increased our understanding of the changing nature of faculty work, will lead to future studies on academic capitalism that may involve longitudinal analysis and important sub-populations, and may influence institutional and public policy decisions.

Chapter Five: Academic Capitalism: Explaining Faculty Differences through Multi-level Analysis

In 1990, Ernest Boyer published *Scholarship Reconsidered*, an effort to shake convictions that the faculty reward system should be based largely on research. In doing so, he framed a debate about how faculty members achieve academic status. For academe and the nation to survive, he argued, colleges and universities needed to be more creative in how they defined what it means to be a scholar (Boyer, 1990). However, in the time since its publication, the allure of academic capitalism—a mechanism to feed economic progress, augment institutional resources, and support professors' expansive research—has proven a formidable countervailing force to Boyer's realignment of professorial priorities. And while universities have principally recommitted to undergraduate education, they have also bolstered efforts to remain a financially viable enterprise.

Higher education is an expensive industry. Funding it is a much-discussed topic and one of on-going interest to multiple stakeholders. Regardless of reason, the need for money is "a chronic condition of American universities" (Bok, 2003). The maintenance of this condition takes universities in new directions and in many cases dramatically shifts traditional notions of American higher education. Nowhere is this more evident than in the nature and role of faculty.

The rise of the entrepreneurial university with a focus on profit centers (Shane, 2004), revenue-producing athletic programs (Bok, 2003), applied research (Greenough, McConnaughay, & Kesan, 2007), patents (Mowery, Nelson, Sampat, & Ziedonis, 2001), research consortia (Holland, 1990), and external grants (National Science Foundation, 2007) has shifted attention away from teaching. Moreover, prestige-building activities, namely sponsored research, have advanced as valued currency for institutions and individual faculty members in

the global educational marketplace. Subsequently the competition for external funding continues to grow (The National Science Foundation, 2007).

The funding imperative of higher education and the faculty's propensity to adapt lends itself to pressure on the professoriate. First, given the dramatic upending of the role of faculty to take part in the highly competitive, globalized knowledge economy, one can expect to see an adjustment in self-reported work behaviors. However, the effect of academic capitalism remains under-investigated. Second, the nested influence of how the academic organization influences faculty work is relatively unknown. Because of the nature of the Knowledge Economy, with its reliance on highly specialized workforce, workers (in this case faculty) must have access to an organization (Drucker, 1994). Of critical importance "[i]n the knowledge society, it is not the individual who performs. The individual is a cost center rather than a performance center. It is the organization that performs" (Drucker, 1994, p. 11). For this reason, the influence of the academic organization must be examined. Academic capitalism, therefore, is a multi-level issue given the intersection of individual pursuits and organizational environments.

Statement of the Problem

To date, researchers have focused attention on intellectual property, patents, licensing, technology transfer, copywriting, and other similar activities attributable to revenue-producing, prestige-building efforts by institutions and faculty. Essentially, the existing research has been indifferent to the influence of these activities on faculty work. Subsequently, the effect of academic capitalism, an amalgamation of these activities, on faculty work is unclear, unknown, and understudied.

Despite growing attention, there is surprisingly little investigation of the influence of academic capitalism on the work of faculty members. Research is needed to identify and define

the nature of the relationship between academic capitalism and faculty, whose work is likely to be influenced by external pressures. Similarly, no studies exist that explore how the influence of academic capitalism might vary by certain demographic, academic discipline, rank or institutional characteristics. Consequently, further research is needed to examine the nature of the relationship between academic capitalism and the work of faculty.

Purpose and Research Question

The purpose of this study was to examine individual and organization characteristics of faculty members at doctorate-granting, research universities. This study was guided by the question: Do individual, institution, and academic discipline characteristics significantly affect the academic capitalism behavior of faculty members at research universities? Previous studies (Kniola, unpublished) have shown how faculty responses to behavioral items in the National Study of Postsecondary Faculty (NSOPF) can be used to estimate individual trait levels of academic capitalism. However, these trait levels are for research purposes only and not for individual diagnosis. This study used a newly created measure as a dependent variable and sought to identify critical individual, academic discipline, and university characteristics that contribute to variation in academic capitalism.

Conceptual Framework

The concept of academic capitalism was first presented in the landmark work *Academic Capitalism: Politics, Policies, and the Entrepreneurial University* (Slaughter & Leslie, 1997). Prior to this work, the role of universities in the knowledge economy was undocumented. In a follow-up volume, the theory of academic capitalism (Slaughter & Rhoades, 2004) takes shape and is defined as "the process of college and university integration into the new economy" (p. 1) and the institutional evolution as marketer. Academic capitalism then becomes a measurable

concept defined by the mechanisms and behaviors of universities, explicitly through faculty members, operating in the knowledge economy.

Differing from previous explanations about higher education connections to the economy, academic capitalism links universities to the "new economy" or "knowledge economy." Universities are best suited to exploit the new economy because of their human capital and well-established systems to conduct research. While others have described the phenomenon as university entrepreneurship (Libecap, 2005), academic entrepreneurship (Shane, 2004), academic-industry relations or AIR (Anderson, 2001), capitalizing knowledge (Etzkowitz, Webster, & Healey 1998), technology transfer (Siegel & Phan, 2005), marketization (Kirp, 2003), and commercialization (Bok, 2003), the core concept is the same—universities and their faculties engage in behaviors that link to industry to generate wealth and prestige.

Importantly, actors (in this case faculty) *initiate* academic capitalism. They are not simple bystanders but rather active participants. There is likely a perception among faculty members that because of rising tuition costs and shrinking state subsidies new streams of external revenue must be produced to sustain the academic enterprise (Slaughter & Rhoades, 2004). Renault (2006) asserts three possible institutional influences on this decision: (a) policy-based incentives, (b) the researcher's discipline, and (c) norms of the university. The discipline and the university pull researchers in opposing directions with the former clinging to traditional activities and the latter encouraging entrepreneurial ones.

Academic capitalism may impact sub-groups of faculty in differing ways. For example, a study by Metcalfe and Slaughter (2008) sought to better understand the ways women might be affected by academic capitalism. They claim a "differential success" of women in the academy where there has been significant expansion in professional support/service and

executive/administrative/managerial positions; however, women have not yet achieved parity in faculty positions. While women have gained ground on men in terms of the number of positions and salary, an alternative hierarchy is emerging that is dominated by men. Men are moving to entrepreneurial units (e.g., centers and institutes) to recapture their historic privilege in the academy. This puts them closer to university technical and financial resources that leads to benefits such as summer salaries, consulting opportunities, educational/research partnerships, networks for future partnerships, spin-offs, and royalties (Metcalfe & Slaughter, 2008).

The goal of this study was to contribute to a better understanding of faculty work. Clearly there are external pressures from universities and academic disciplines that contribute to the types of work in which faculty choose to engage. Because a multi-level analysis was used, multiple levels of variables were employed to explain variation in faculty engagement in academic capitalism.

Individual Level Influences on Faculty Work

Faculty members' intrinsic and extrinsic characteristics shape who they are, affect their experience, and guide behavior. Sex, race, faculty rank and similar descriptive characteristics form a complex matrix of individual characteristics. These demographic characteristics clearly influence faculty salary (Toutkoushian, Bellas, & Moore, 2007), job satisfaction (Seifert & Umbach, 2008), and research productivity (Stack, 2004). Two characteristics—sex and race—are a primary interest in this study as they have been shown to define academic careers (Johnson-Bailey & Cervero, 2008).

Organization Level Influences on Faculty Work

The context of work is important. Classic organization theory (e.g., Lawrence & Lorsch, 1967) pointed to the link between environmental demands and effective organizations. Recent

research on the influence of organization culture and climate on creativity and innovation suggests that individuals in an organization contribute to a collective culture defined distinctly as organizational learning (Örtenbald, 2001). De Geus (1998) suggested that the speed with which an organization learns is its only competitive advantage. This advantage is linked to an organization's ability to create knowledge through creativity and innovation (Popadiuk & Choo, 2006) and to building competence to undermine competitors' innovation (Kambil, Eselius & Monteiro, 2000).

More specific to higher education and faculty work, the collective work of Burton Clark points to the profound influences of professional, discipline, and institutional cultures on faculty work. Clark (1987) observed that while academic culture is "fragmented into a thousand and one parts" (p. 105), there is "common cause…and…broad principles of academic conduct" (p. 105). But while this professional culture and identification is significant, the influence of academic discipline and institutional setting are central to our understanding of faculty and their work. In comparison, matters of race, gender, religion, age, and political affiliation have relatively inconsequential explanatory powers.

Clark's work is supported by others. Austin (1990) identified four subcultures that influence faculty work: the academic profession, the discipline, the academy as an organization, and the institution. Importantly, the institution "defines the institutional career, strongly affecting the duties, opportunities, rewards, relationship to the discipline, and prestige the faculty member experiences" (p. 66). The institution, therefore, affects how faculty members spend their time.

Tierney and Rhodes (1993) described five sociological forces, or cultures, that shape faculty behavior—national, professional, disciplinary, individual, and institutional. Nowhere is faculty socialization more important than within the institution. The "terrain of the college or

university" (Tierney & Rhodes, 1993, p. 15) is where the other forces are played out and it offers clues to acceptable behaviors reinforced through the "ritual process of tenure and promotion" (Tierney & Rhodes, 1993, p. 41).

The combined body of research, spanning several decades, points to the need to account for organization level influences on faculty work. The use of institution control (i.e., public or private), Carnegie Classification, size, and other similar characteristics is common in higher education research. Additional characteristics such as institutional percentages of women and underrepresented minority faculty were germane to the present study.

Methods

Sample

Multiple levels of data were used to investigate the research question. First, at the faculty level, the sample included 9,290 non-tenured/tenure track and tenured faculty members at 230 research universities in 30 academic disciplines. The study draws further distinction in that only faculty with full-time appointments; having primary responsibilities in teaching, research, and service; and employed at 4-year, non-profit institutions were considered. The reader should be mindful that analysis was conducted with the actual sample; however, per NCES requirements for unweighted samples, sample size is reported by rounding to the nearest 10.

Instruments

Data for this study came from the National Study of Postsecondary Faculty (NSOPF), Integrated Postsecondary Education Data System (IPEDS), and National Science Foundation (NSF). The scope of this study was to examine faculty engagement in academic capitalism using a nationally representative sample. To achieve this goal, I used NSOPF for individual level data. Four waves of data have been collected: 1988, 1993, 1999, and 2004. For purposes of this study,

only the most recent wave (NSOPF:04) was used to develop an estimate of academic capitalism and construct a model to test variation.

NSOPF:04 is based on a nationally representative sample of 35,630 faculty and instruction staff at 980 institutions. NSOPF data collection was designed to establish a national profile of faculty, their productivity and workload, and information on institution policies and practices (NCES, 2006). Using this data allowed me to extrapolate findings about faculty to a national scale.

The second source of data was IPEDS because it "provides a more readily accessible and comprehensive approach to accessing institutional data…than other methods of data collection" (Schuh, 2002, p. 29). This comprehensive dataset advantages the researcher because every institution in the United States is required to provide information. However, one well-known limitation is the interpretation of survey questions by each institution respondent (Schuh, 2002), which can lead to variations in reporting. Despite this limitation, IPEDS provides an efficient way to compare institutions at the organization level. For this study, I used the 2004 Fall Staffing survey to obtain institution level racial/ethnic demographics of faculty and the 2004 Institutional Characteristics survey to capture endowment and other relevant data. The third source of data was the NSF which provided total research and development dollars for each university.

Data Collection

Unrestricted NSOPF:04 data were obtained through the NCES application process. Survey data from IPEDS and NSF were downloaded from their respective host organization websites and imported to an SPSS dataset.

Dependent Variable

I used a constructed trait level of academic capitalism as the dependent variable. The NSOPF:04 survey does not explicitly ask faculty members to report on academic capitalism. It does, however, ask faculty members to report various activities that can be linked to academic capitalism. When combined into a single measure, an estimate of behavior in academic capitalism can be determined. The variable is a 3-item construct designed to estimate academic capitalism at the individual level. Using behavioral items from NSOPF:04, I used Item Response Theory (IRT) to determine a trait level for each faculty (Kniola, unpublished). The items—patents and licensing, external funding, and consulting—are grounded in the literature on academic capitalism. Each NSOPF item was converted to a dichotomous variable for analysis. In doing so, I was able to construct a measure in simple "yes/no" terms. The newly constructed measure of academic capitalism is a scale score derived from the probability of a positive response to the survey item. Engaging or not engaging in a particular activity, therefore, is a product of a faculty member's ability and the difficulty of an item.

Individual Level Independent Variables

The individual-level independent variables were individual demographics: sex, race, marital status, children, and U.S. citizenship. Human capital variables (i.e., academic rank and tenure status) were also included at this level.

Organization Level Independent Variables

Because of the structure of higher education, the organization-level independent variables were cross-classified to account for how faculty members are nested in institutions and academic disciplines. These included: (a) organization demographics (i.e., institutional control, research classification, size of endowment, research index, proportion of underrepresented minority

faculty, and proportion of women faculty); and (b) academic discipline characteristics (i.e., proportion of underrepresented minority faculty, proportion of women faculty, and productivity).

The average number of underrepresented faculty members was computed with IPEDS data. The proportion of underrepresented faculty members for an institution was the sum of Hispanic, American Indian, Black, and Native Hawaiian/Native Alaskan divided by the total number of faculty. Faculty identified as multiracial/multiethnic were also included in this group. The proportion of women was similarly computed for each institution. The proportion of underrepresented and women faculty member in each of 32 academic disciplines was calculated using data in NSOPF. The academic disciplines were defined by NCES and faculty respondents identified the most appropriate response to an item on the NSOPF instrument.

Using the NSOPF data, I computed a productivity measure for each faculty which was used as a level-2 predictor. Porter and Umbach (2000) developed two basic measures of productivity from NSOPF:93 using publications over a 2-year period and the dollar amount of external research funding. As with Porter and Umbach, I summed the number of articles published in referred professional or trade journals, chapters in edited volumes, books published, and creative works published in juried media for each faculty member. These were averaged for each academic discipline. I chose not to use external funding as a measure here because it was highly correlated with the dependent variable.

Survey Weights and Design Effects

The NSOPF:04 sample design results in oversampling of faculty. This design violates a simple random sample assumption and could lead to underestimating the sampling variance if weights are not appropriately applied to the data. While NCES calculated raw weights for NSOPF:04 to include several adjustments for multiplicity, nonresponse, and poststratification, a

weight variable is not used in this study because HLM6 software does not include an option for applying weights to cross-classified models. This may be a limitation of the study; however, other researchers (e.g., Umbach, 2008) have tolerated this because of strong study design.

The design effect of NSOPF:04 must also be considered. The prudent corrective strategy must account for the effects of clustered samples. Sample weights correct for oversampling but not similarities among individuals in a cluster (Thomas *et al.*, 2005). A model-based approach, such as hierarchical linear models, which uses multi-level analysis to take advantage of nested data is an appropriate method. de Leeuw and Kreft (1995) emphasized the "elegant conceptualization" (p. 186) of HLM as ideally suited for studies with a larger number of small groups, in this case faculty members within research universities. This method allows the researcher to study the clustering effect of individuals within groups. Multi-level analysis can account for multistage sampling because variance is partitioned into within- and between-variances (Hahs-Vaughn, 2005).

Procedures

Because data structures are often hierarchical (Raudenbush & Bryk, 2002), I used multi-level analysis to answer the research question. In doing so, I was able to examine the concurrent influence of individual level characteristics, universities, and academic disciplines. While variables are often used to describe individuals, the individuals are also grouped into larger units. Similarly, these larger units have descriptive variables.

The nature of this study called for the use of multi-level analysis, specifically HLM, to examine individual and organizational characteristics related to academic capitalism. This type of analysis is particularly well suited for educational research and allowed me to relate the properties of individuals to properties of groups and structures in which the individuals function

(Raudenbush & Bryk, 2002). Clearly, individual faculty members are nested within universities and academic disciplines making it possible to use a multi-level technique to look at the links between the levels (Luke, 2004).

Cross-classified Random Effects Approach

Most multi-level applications involve data with a hierarchical structure where persons are nested within organizations (Raudenbush & Bryk, 2002). The assumption is that each person belongs to only one organization. Faculty members do not fall neatly into hierarchical structures because academic disciplines span institutions and loyalty to the disciplines may supersede institutional affiliations. Quite plainly, faculty share membership with an institution and academic discipline. This complex structure makes it necessary to use a cross-classified model.

Umbach (2008) enlisted a cross-classified random effects model (HCM2) in his study of gender equity in college faculty pay. In it, he posits faculty members are nested simultaneously within disciplines and institutions; therefore a researcher must attend to these cross-classified nestings. Umbach's model was used liberally as a platform for the present study including some of the independent variables found at level-1 and level-2, which are modeled in Figure 1.

Unconditional Model

The first step was to conduct a preliminary analysis through the construction of the unconditional model with no predictor variables, which is the same as a one-way, random effects ANOVA model. This model allowed me to partition the variance in academic capitalism that can be attributed to individual faculty members, academic areas, universities, and academic area-by-university interaction effects. Estimating this model allowed me to compute intra-class correlation (ICC), which presents the proportion of variance in the dependent measure within and

between academic areas and universities. It was determined in this study that variability is accounted for by measured variables so I next turned to the construction of conditional models.

Independent Variables and the Level-1 (Within Cell) Model

The first of these analyses included only level-1 predictors. The coefficients produced based on level-1 predictors provided estimates on the variability in academic capitalism based on individual level variables. The model for level-1 represents the relationships among individual faculty member variables:

$$AC_{ijk} = \pi_{0jk} + \pi_{1jk}(D\_FEMALE)_{ijk} + \pi_{2jk}(D\_MIN)_{ijk} + \pi_{3jk}(D\_REL)_{ijk} + \pi_{4jk}(D\_CHILD)_{ijk} + \pi_{5jk}(D\_CIT)_{ijk} + \pi_{6jk}(D\_ASSOC)_{ijk} + \pi_{7jk}(D\_ASSIST)_{ijk} + \pi_{8jk}(D\_OTITLE)_{ijk} + \pi_{9jk}(D\_TEN)_{ijk} + e_{ijk}$$

Where AC_{ijk} is the dependent variable; π_{0jk} is the intercept; π_{1jk} is a coefficient for the effect of gender on academic capitalism represented by the difference with the reference group (i.e., males) recoded (0=male, 1=female); π_{2jk} is a coefficient for the effect of race/ethnicity recoded (0=majority, 1=underrepresented minority); π_{3jk} is a coefficient for the effect of relationship recoded (0=married/partnered, 1=not married/partnered); π_{4jk} is a coefficient for the effect of having children recoded (0=no children, 1=child/children); π_{5jk} is a coefficient for the effect of citizenship recoded (0=non-U.S. citizen, 1=U.S. citizen); π_{6jk} is a coefficient for the effect of the associate professor rank recoded (0=not associate professor, 1=associate professor); π_{7jk} is a coefficient for the effect of the assistant professor rank recoded (0=not assistant professor, 1=assistant professor); π_{8jk} is a coefficient for the effect of other rank recoded (0=not other rank, 1=other rank); π_{9jk} is a coefficient for the effect of tenure recoded (0=not tenured, 1=tenured); e_{ijk} is the level-1 random effect; and σ^2 is the variance of e_{ijk}. We assume $e_{ijk} \sim N(0, \sigma^2)$.

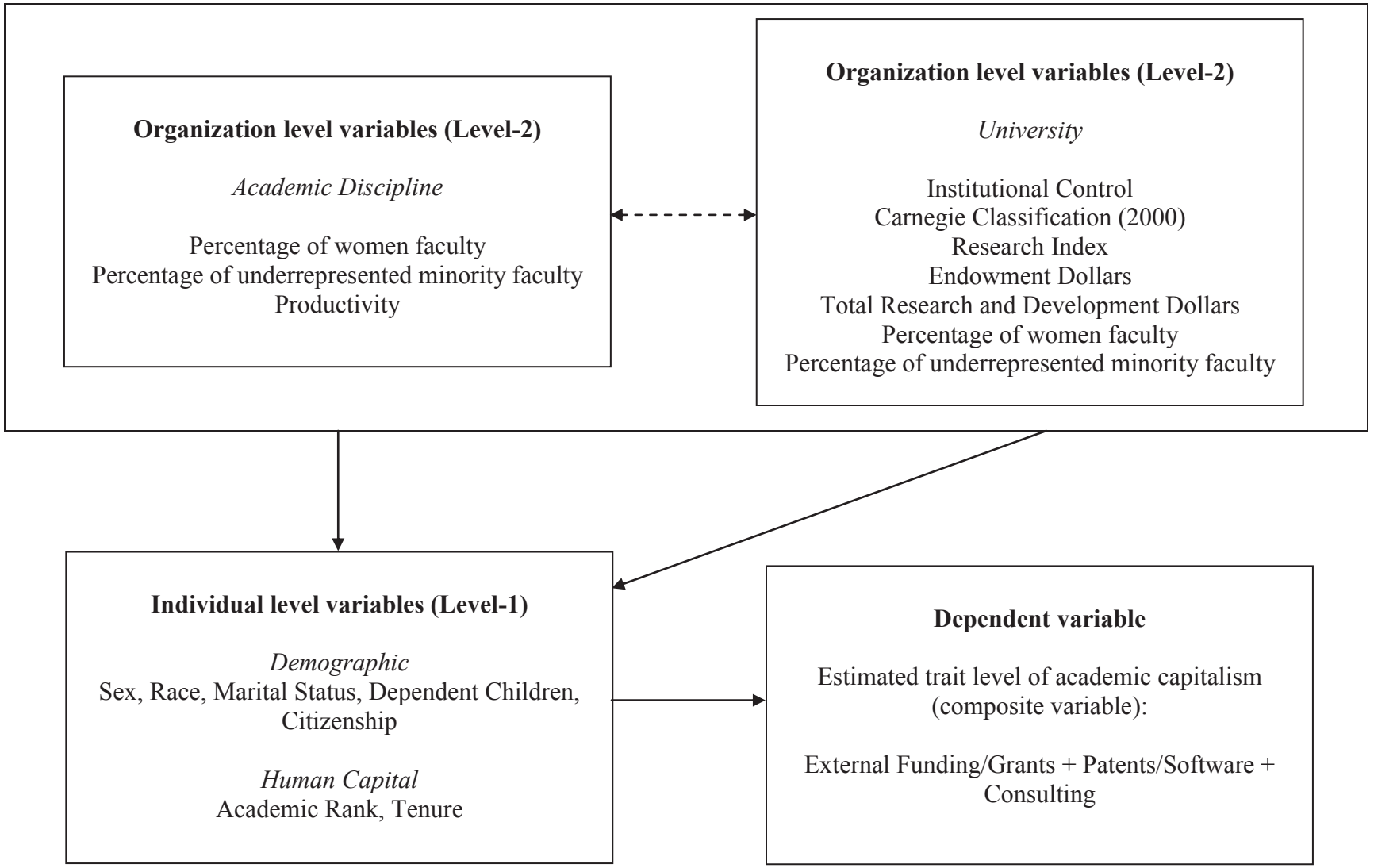

Figure 1. Research model to explain variation in faculty involvement in Academic Capitalism

i denotes the faculty member , *j* denotes institution, and *k* denotes the academic area. Within each university-by-academic area cell, the model specifies a cell mean measure of academic capitalism and several gaps based on sex, race, academic rank, citizenship, children, and marital status. Table 1 provides descriptive statistics of each variable.

Independent Variables and the Level-2 (Between Cell) Model

Variation that is attributed to institution and academic discipline effects was assessed using the cross-classified random effects model, which fully combines level-1 and level-2 predictors in a mixed model. The level-1 coefficients became outcomes in the level-2 model that represents the variation between cells created by crossing universities and academic discipline. The level-2 predictors shown in Table 2 and Table 3 create a matrix which describes the universities (rows), the academic areas (columns), and the interactions between universities and academic areas. The basic modeling framework for level-2 is:

$\pi_{0jk=}\theta_0 + \gamma_{01}(CONTROL) + \gamma_{11}(BASIC2000) + \gamma_{12}(SQ\_ENDOW) + \gamma_{13}(SQ\_TOTRD) + \gamma_{14}(PER\_WMN) + \gamma_{15}(PER\_MIN) + \gamma_{16}(DISP\_PROD) + b_{00j} + c_{00k}$.

Where θ is the grand-mean (model intercept) of all faculty, the expected value of π_{pjk} when all explanatory variable are zero; CONTROL is a dummy code indicating public or private; BASIC2000 indicates research level according to Carnegie Classification; SQ_ENDOW is the square root of university endowment dollars; SQ_TOTRD is the square root of university total research dollars; PER_WMN is the percentage of women faculty in the academic discipline; PER_MIN is the percentage of underrepresented minority faculty in the academic discipline; and DISP_PROD is the mean productivity in the academic discipline. θ_0 is the mean trait level of all universities; γ_{01} is the mean trait level of private universities, γ_{11} is the mean trait level of very high research universities, γ_{12} is the mean trait level at the average

Table 1

Frequency and Percentage of Sample for Individual Level Categorical Variables (N =9290)

Variable	*n*	%
Gender		
Male	5,680	61.2
Female	3,610	38.8
Race		
Underrepresented Minority	690	7.4
Non-underrepresented Minority	8,600	92.6
Marital Status		
Married/partnered	8,160	87.8
Unmarried/single	1,130	12.2
Children		
Children	4,800	51.7
No Children	4,490	48.3
U.S. Citizenship		
Citizen	8,280	89.1
Non-citizen	1,010	10.9

Table 1 (continued)

Frequency and Percentage of Sample for Individual Level Categorical Variables (N =9290)

Variable	*n*	%
Rank		
Professor	2,510	26.9
Associate Professor	1,930	20.7
Assistant Professor	2,020	21.7
Tenure		
Tenured	3,900	42.0
Not-tenured/tenure track	5,390	58.0

Note. Analysis was conducted with actual sample; however, per NCES requirements for unweighted samples, sample size is reported by rounding to the nearest 10.

university endowment dollars, γ_{13} is the mean trait level at the average university total research and development dollars, γ_{14} is the mean trait level at the average percentage of women faculty in an academic discipline, γ_{15} is the mean trait level at the average percentage of underrepresented minority faculty in an academic discipline, γ_{16} is the mean trait level at the average productivity within the academic discipline. We assume that $b_{p0j} \sim N(0, \tau_{pb00})$, $c_{p0k} \sim N(0, \tau_{pc00})$, and that the effects are independent of each other.

However, the vector b_{pqj} is assumed multivariate normal with a mean zero and a full covariance matrix τ. The vector c_{prk} is assumed multivariate normal with a mean vector zero and full covariance matrix Δ.

Results

The sample size for this study was 9,290 faculty members within 230 universities and 30 academic disciplines. Frequencies and percentages of all individual level categorical variables are presented in Table 1. Table 2 shows frequencies and percentages of organization-level categorical variables and Table 3 shows the descriptive statistics of all organization-level continuous variables.

The sample is largely representative of the population of faculty members at research universities with nearly 39% (n = 3,610) female, 7.4% (n = 690) underrepresented minority, and 87.8% (n = 8,160) married/partnered. Faculty rank was evenly disbursed with 2,510 (26.9%) at the rank of full professor, 1,930 (20.7%) at associate professor, and 2,020 (21.7%) at assistant professor. The remaining 30.6% (n = 2,840) held a title other than those typical of tenure/tenure track faculty. Tenure status was also representative. The sample included 42% (n = 3,900) tenured/tenure-track faculty and 58% (n = 5,390) non-tenured/tenure track faculty.

Table 2

Frequency and Percentage of Sample for Organization Level Categorical Variables (N=230)

Variable	*n*	%
Institutional Control		
Public	150	65.8
Private	80	34.2
Carnegie Classification (2000)		
Research Extensive	140	61.5
Research Intensive	90	38.5
Research index		
RU/Very High	90	39.4
RU/High	90	40.7
Doctoral	40	17.3
Other	10	2.6

Note. Analysis was conducted with actual sample; however, per NCES requirements for unweighted samples, sample size is reported by rounding to the nearest 10.

Table 3

Descriptive Statistics of Organization Level (Level-2) Continuous Independent Variables

Variable	*n*	*Mean*	*SD*	*Minimum*	*Maximum*
University Variables					
Size of endowment (square root dollars)	230	18,519.39	19,721.64	606.37	158,290.73
Total Research and Development (square root dollars)	230	9,779.54	6,841.69	.00	29,143.73
Percentage of women faculty	230	.34	.074	.12	.76
Percentage of underrepresented minority faculty	230	.16	.11	.02	.85
Academic Area Variables					
Percentage of women faculty	30	.38	.21	.00	.77
Percentage of underrepresented minority faculty	30	.06	.08	.00	.4
Productivity	30	30.7	21.0	.00	121.13

Note. Analysis was conducted with actual sample; however, per NCES requirements for unweighted samples, sample size is reported by rounding to the nearest 10.

The faculty sample was affiliated with public universities (n = 150, 65.8%) and private universities (n = 80, 34.2%). The initial selection criteria were based on the 2000 Carnegie Classification. More than 61% (n = 140) universities in the study were Research Extensive. In terms of Research Index, a descriptor of research activity provided by the Carnegie Foundation, 39.4% (n = 90) universities were RU/Very High, 40.7% (n = 90) were RU/High, and 17.3% (n = 40) were doctoral. University endowment and total research and development dollars (square root values are used) varied widely (M = \$18,519, SD = \$19,721; M = \$9,779, SD = \$6,841 respectively. The percentile of women (M = .34, SD = .07) and percentile of underrepresented minority (M = .16, SD = .11) for each university was also included.

The faculty sample was also affiliated with 30 academic disciplines in which the percentile of women (M = .38, SD = .2), percentile of underrepresented minority (M = .06, SD = .08), and productivity (M = 30.7, SD = 21.0) are reported.

I used the trait level of academic capitalism as the dependent variable. The coefficients presented in Table 4 are a function the probability a faculty member had engaged in certain behaviors (i.e., patents/licensing, external grants, and consulting). Trait level scores are a logit scale centered on zero with a standard deviation of one. These scores indicate the faculty member's chance of engaging in behaviors; positive values indicate above-average performance while negative values indicate below-average performance. The higher a person's trait level, the more likely she is to successfully complete each behavior.

I first considered the unconditional (no predictors) model where variance was partitioned among individual faculty members, university, and academic discipline. At level-2, the random effect associated with the university-by-academic area interaction was eliminated because the cell sizes were too small. The analysis is shown as Model 1 in Table 4. This initial analysis

allowed me to estimate three intra-unit correlations. First, the intra-university correlation is the correlation between outcomes of two faculty members in the same academic area but at different universities:

$$\text{corr}\left(Y_{ijk}, Y_{i'jk'}\right) = \frac{\hat{\tau}_{b00}}{\hat{\tau}_{\text{b00}} + \hat{\tau}_{c00} + \hat{\sigma}^2} = \frac{.006}{.006 + .03 + .25} = .022$$

It is estimated to be 0.022 thus indicating about 2.2% of the total variance lies between universities. Second, the intra-academic discipline correlation is the correlation between outcomes of two faculty members who are at the same university but in different disciplines:

$$\text{corr}\left(Y_{ijk}, Y_{i'jk'}\right) = \frac{\hat{\tau}_{c00}}{\hat{\tau}_{\text{b00}} + \hat{\tau}_{c00} + \hat{\sigma}^2} = \frac{.03}{.006 + .03 + .25} = 0.10$$

This was estimated at 0.10, thus approximately 10% of the variation lies between academic areas. Third, the intra-cell correlation is the correlation between outcomes of two faculty members who are in the same academic discipline at the same university:

$$\text{corr}\left(Y_{ijk}, Y_{i'jk}\right) = \frac{\hat{\tau}_{b00} + \hat{\tau}_{c00}}{\hat{\tau}_{\text{b00}} + \hat{\tau}_{c00} + \hat{\sigma}^2} = \frac{.006 + .03}{.006 + .03 + .25} = 0.125$$

In this study, about 12.5% of the unconditional variation in academic capitalism lies between universities and disciplines before individual characteristic variables are controlled. Variability in the dependent variable was observed across universities

($\hat{\tau}_{b00} = .006, \chi^2(230) = 404.34, p = .000$) and academic disciplines

($\hat{\tau}_{c00} = .03, \chi^2(30) = 919.52, p = .000$).

Next, individual demographic and human capital variables were added to level-1. Unstandardized coefficients of the "within cell model" are presented in Model 2 of Table 4. All level-1 predictors were grand-mean centered (i.e., $X_{ij} - X_{..}$), meaning the variables were centered around the grand mean and the intercept was interpreted as the mean for the group *j*.

Table 4

HCM2 Results for Three Models

	Model 1			Model 2			Model 3		
(a) Fixed Effects	Unconditional Model			Level-1 Predictors Only Model			Final Model		
Predictor	*Coeff.*	*se*	*t Ratio*	*Coeff.*	*se*	*t Ratio*	*Coeff.*	*se*	*t Ratio*
Intercept	-.04	.03	—	-.02797	.03096	—	-.04452	.02392	-1.861
Female				-.04358	.01253	-3.479**	-.04037	.01244	-3.246**
Underrepresented Minority				-.03973	.02226	-1.785	-.03063	.02537	-1.207
Marital Status				-.00029	.01866	-0.016			
Children				.0496	.0122	4.063***	-.04962	.01138	4.360***
U. S. Citizenship				-.02373	.01913	-1.241			
Associate Professor				-.07337	.01698	-4.322***	-.08274	.01659	-4.986***
Assistant Professor				-.04359	.02541	-1.715	-.09566	.02277	-4.201***
Other Title				-.24667	.02481	-9.944***	-.32469	.02805	-11.575***
Tenure				.09293	.02155	4.312***			
University Variables									
Institutional Control							.017560	.02009	0.874

Table 4 (continued)

HCM2 Results for Three Models

	Model 1			Model 2			Model 3		
(a) Fixed Effects	Unconditional Model			Level-1 Predictors Only Model			Final Model		
Predictor	*Coeff.*	*se*	*t Ratio*	*Coeff.*	*se*	*t Ratio*	*Coeff.*	*se*	*t Ratio*
Carnegie Classification Research Index							-.01990	.01649	-1.207
Size of endowment (dollars)							-.000000	.000001	-0.392
Total Research and Development (dollars)							-.000001	.000002	-0.302
Percentage of women faculty									
Percentage of underrepresented minority faculty									
Academic Area Variables									
Percentage of women faculty							-.04186	.09958	-0.420

Table 4 (continued)

HCM2 Results for Three Models

	Model 1			Model 2			Model 3		
(a) Fixed Effects	Unconditional Model			Level-1 Predictors Only Model			Final Model		
Predictor	*Coeff.*	*se*	*t Ratio*	*Coeff.*	*se*	*t Ratio*	*Coeff.*	*se*	*t Ratio*
Percentage of underrepresented minority faculty							1.02779	.31766	3.236**
Productivity							.00185	.00053	3.441***
(b) Variance Components Parameter		*Estimate*			*Estimate*			*Estimate*	
Universities									
Var (b_{00j}) = τ_{b00}		.006			.004			.003	
Academic Areas									
Var (c_{00k}) = τ_{c00}		.03			.02			.012	
Faculty Members									
Var(e_{ij}) = σ^2		.25			.24			.23	

*p<.05, **p<.01, ***p<.001

This model fits the constant plus individual characteristics. After adding these variables, I again observed variability in the dependent variable across universities ($\hat{\tau}_{b00} = .004, \chi^2(230) = 364.19, p = .000$) and academic disciplines ($\hat{\tau}_{c00} = .02, \chi^2(30) = 743.29, p = .000$). However, several characteristics did not significantly contribute to increased academic capitalism. These were subsequently dropped from the final model.

In the final model, I added level-2 predictor variables for universities and academic disciplines. Fixed effect variables were added to the level-1 model and evaluated one at a time. Each statistically significant variable was retained and added to the final model for analysis. A similar process was followed for the random effects testing variation across universities and academic disciplines (i.e., slopes-as-outcomes model). The resulting final model is presented in Table 4.

Several level-1 covariates were significantly related to academic capitalism. With the exception of one, *dependent child*, all coefficients were negative. Those faculty who are most likely to engage in academic capitalism are male, not a member of an underrepresented race, and have achieved the rank of full professor. Interestingly, the addition of a child has a positive effect on academic capitalism ($\gamma_{04} = 0.049$, $t(7570) = 4.36$, $p = .000$). The positive coefficient here is nearly identical to the negative coefficient for gender ($\gamma_{01} = -0.04$, $t(7570) = -3.25$, $p = .002$). The implications of this will be discussed later.

Perhaps most notable among the level-1 variables is the lack of significance for the fixed effect of underrepresented minority coefficient ($\gamma_{02} = -0.03$, $t(7570) = -1.21$, $p = 0.228$). Minority status was marginally significant in early models so had been retained for the final model because of its importance to research. However, when allowed to vary across universities, this

indicator was significant ($\gamma_{20} = 0.02$, $t(170)$, $p = .004$). Similarly, non-tenured faculty ranks were significant when allowed to vary across academic disciplines. Assistant professors ($\gamma_{50} = 0.004$, $t(30)$, $p = .008$) and professors with other titles ($\gamma_{50} = 0.013$, $t(30)$, $p = .000$) show modest positive gains within certain disciplinary contexts.

Quite unexpectedly, few of the organization level characteristics had any effect on academic capitalism. None of the university characteristics were statistically significant. Noticeably the size of the university endowment and total research dollars had no effect on an individual faculty member's level of academic capitalism. It is arguable this is a result of the relative parity among the type of universities in this study.

It is only in the disciplines that significant effects emerge. First, the percentage of underrepresented minority makes a seemingly dramatic positive impact on academic capitalism ($\beta_{02} = 1.028$, $t(7570)$, $p = 0.002$). Second, the productivity level of a particular discipline had a small effect ($\beta_{03} = 0.002$, $t(7570)$, $p = .001$) on academic capitalism. It is likely that the cumulative effect of productivity over years of work leads to increasing opportunities for academic capitalism. This suggested that the influence of peers within the disciplines may contribute to the expectations to engage in behaviors central to academic capitalism.

A comparison test for this model yielded a difference between deviances of 10, 678.613 - 10,674.449 = 4.2 with 10 df ($p < .001$) and provided evidence about the variability of academic capitalism across universities and disciplines.

Limitations

When considering the results of this study, the reader should be aware of its limitations. First, the NSOPF design relies on oversampling of certain faculty. Statistical analysis is typically carried out by assigning weights to cases. While these weights are provided in the NSOPF

dataset, HLM software does not allow for its use in HCM2 models. As previously mentioned, other researchers (e.g., Umbach, 2008) have tolerated this because of strong study design.

Second, only faculty members at research universities were studied. Faculty members at research universities may be more likely to engage in academic capitalism than colleagues at other institution types. It was for this reason that the sample was selected; however, results of this study are not generalizable. In addition, the design of NSOPF included a sample of institutions so not all research universities, and by default not all faculty at this institution type, were included in this study. Given this, the results are indicative of the work of faculty at research universities.

Third, the dependent variable used in this study is an estimate of academic capitalism and not a pinpoint measure. Faculty respondents were not explicitly asked about academic capitalism nor were other possible indicators of academic capitalism present in the NSOPF instrument (e.g., failed grant proposals). No attempts to measure academic capitalism have been previously attempted by other researchers. While the measure created and used here was developed with rigorous methodology, it best measures the high end of the academic capitalism trait in faculty.

Discussion

This study was designed to investigate individual, university, and academic discipline characteristics that significantly affect the academic capitalism behavior of faculty members at research universities. Findings suggest there are in fact significant individual differences which are likely influenced by individual and organizational characteristics, most notably within the academic disciplines. University characteristics were not significant, largely because this study used one institution type in its sample.

The results of this study indicated that after controlling for university and academic discipline characteristics there were individual level characteristics that affect the trait level of academic capitalism. A sizable gender gap exists, which is consistent with other research findings (Metcalfe & Slaughter, 2008) that women are less likely to engage in academic capitalism. I also noted earlier the positive influence of having a child. One possible explanation of this positive coefficient is that it may be an indicator of the effect of life outside of work. While relationship status was a non-significant indicator in early models and subsequently dropped, the child variable may better indicate the positive effect of having a family, particularly where one spouse does not work outside the home arguably allowing the faculty spouse more time for work. Combined, these findings underscore the importance of university initiatives such as "stop the clock" tenure practices and programs that support work-life balance.

Faculty rank is also highly influential on academic capitalism. The effect of rank seems to indicate the importance of cumulative work. Early research productivity may serve as a platform for later success in academic capitalism. This makes sense for two reasons. First, young faculty members spend much of their time in the scholarly activities necessary for promotion and tenure. This leaves little time to pursue other endeavors. Second, a faculty member's research portfolio grows over time. It is more likely a faculty member will be able to take his or her research to market after many years and many studies have refined his or her work. Of course, young, "super star" faculty may be exceptions to this.

University characteristics were not significant in this study; however, two academic discipline characteristics were significant. This finding is consistent with previous research by Clark (1987) and others who showed the influences of the disciplines over the influences of the university. First, the overall productivity (measured by publications, juried works, etc.) of a

discipline is indicative of an environment with high expectations for scholarly work. While this does not devalue the quantity of work produced in some disciplines, it nevertheless indicates that those with higher levels of productivity tend to engage in academic capitalism.

Second, the percentage of underrepresented minority faculty within an academic discipline provided a most intriguing finding in that as the percentage increased, the level of academic capitalism also increased. This may be indicative of the fields to which this subpopulation gravitates. Closer inspection of my dataset showed a higher concentration of underrepresented minority faculty in applied fields (i.e., academic disciplines that focus on the application of research/knowledge). Slaughter and Rhoades (2004) indicated that these fields are more likely to engage in academic capitalism because they are tightly coupled with markets. Conversely, fewer underrepresented minority faculty are found in pure fields (namely science and mathematics) and adds further evidence to the argument that more needs to be done to encourage minority students to enter the faculty pipeline in these fields.

Since only research universities were used in this study, it is not surprising to find that the university characteristics used offer little explanation, particularly financial indicators such as endowment and total research dollars. This is somewhat counterintuitive, but is hopeful news to universities with limited financial resources and with sights on growing a portfolio of faculty members engaged in revenue-producing activities.

Financial resources are seemingly inconsequential among research universities, which are among the best-off. There are likely other organizational influences that guide faculty behavior towards academic capitalism. Two examples come to mind. First, internal support mechanisms such as technology transfer offices provide faculty members with non-financial resources to move their research into the market (e.g., Siegel & Phan, 2005). Second, the promotion and

tenure process is highly influential on productivity (Antony & Raveling, 1999; Bess, 1998, Cotter, 1996). P&T processes—whether through policy or practice—tightly coupled with academic capitalism most certainly push faculty toward revenue- producing activities. This may become particularly relevant given the increasing numbers of non-tenure track faculty. Fewer faculty members on the tenure track may lead to less influence on the types, quantity, and quality of work performed. Scholarly work performed during pre-tenure years very well translates to higher trait levels post-tenure leading to increased potential for revenue. The implications for practice are therefore quite clear.

The implications for research are vast. Clearly this study presents preliminary, exploratory research that warrants further investigation. Because the measure of academic capitalism used is relatively simplistic and best measures higher trait levels, a more advanced measure must be created to account for a wider range of behaviors. However, findings show promise that academic capitalism can in fact be measured at the individual faculty member level and can be studied to determine a clearer picture of the types of individuals engaged in such behavior. Future research should include faculty at and organizations belonging to other institutional types. Research should also seek to understand longitudinal changes in academic capitalism. Previous waves of NSOPF data can be used for this work. Future research should also measure differences between academic disciplines. What are the differences between pure and applied, science and non-science fields? The magnitude of these differences is fundamental to understanding academic capitalism.

Policy makers must consider the impact of funding decisions, particularly in the area of research. Since women and minorities are disproportionately represented in academic disciplines, they are often at a distinct disadvantage to access funding to support their research. Faculty in

non-science fields, which have limited access to deeper pools of funding provided by organizations such as the National Science Foundation, may be less valued by their universities. This has implications for career paths, lifetime earnings, and job satisfaction.

This study does not purport to judge the importance of academic capitalism to higher education in general or to faculty work in particular. Some have argued that collaborations between industry and academia might be beneficial to the academic profession (Mendoza, 2009) while others (e.g., Campbell & Slaughter, 1999) have pointed to perceived conflicts of interest and commitment that create tension between and among faculty and administrators. This study instead diverges from the "for or against" argument to advance the idea that faculty members will be differently positioned to take advantage of opportunities to engage in academic capitalism. University and academic department leaders should be cognizant of this fact, particularly when making decisions that impact individual faculty. For example, changes in tenure criteria that reward external funding or transferring technology to the market will affect faculty members differently.

The design of this study allowed me to reach the conclusion that there is in fact variability among faculty, particularly across academic disciplines. This is a key step towards better understanding the work of faculty, particularly in a rapidly evolving global economy. In addition, political pressures continue to mount from outside the academy and push universities toward new sources of revenues for institutions and states while fortifying the competitiveness of the nation. These external influences will likely continue to increase the burden on individual faculty members to find new ways to remain competitive, not just in their careers but for their universities and disciplines as well.

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APPENDIX A: IRB Approval Letter

VirginiaTech

Office of Research Compliance
Institutional Review Board
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540/231-4991 Fax 540/231-0959
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FWA00000572(expires 1/20/2010)
IRB # is IRB00000667

DATE: January 26, 2009

MEMORANDUM

TO: Steven M. Janosik
David Kniola
Joan B. Hirt

FROM: David M. Moore

Approval date: 1/26/2009
Continuing Review Due Date:1/11/2010
Expiration Date: 1/25/2010

SUBJECT: **IRB Expedited Approval**: "Constructing an Estimate of Academic Capitalism and Explaining Faculty Differences Through Multi-Level Analysis" , IRB # 09-001

This memo is regarding the above-mentioned protocol. The proposed research is eligible for expedited review according to the specifications authorized by 45 CFR 46.110 and 21 CFR 56.110. As Chair of the Virginia Tech Institutional Review Board, I have granted approval to the study for a period of 12 months, effective January 26, 2009.

As an investigator of human subjects, your responsibilities include the following:

1. Report promptly proposed changes in previously approved human subject research activities to the IRB, including changes to your study forms, procedures and investigators, regardless of how minor. The proposed changes must not be initiated without IRB review and approval, except where necessary to eliminate apparent immediate hazards to the subjects.
2. Report promptly to the IRB any injuries or other unanticipated or adverse events involving risks or harms to human research subjects or others.
3. Report promptly to the IRB of the study's closing (i.e., data collecting and data analysis complete at Virginia Tech). If the study is to continue past the expiration date (listed above), investigators must submit a request for continuing review prior to the continuing review due date (listed above). It is the researcher's responsibility to obtain re-approval from the IRB before the study's expiration date.
4. If re-approval is not obtained (unless the study has been reported to the IRB as closed) prior to the expiration date, all activities involving human subjects and data analysis must cease immediately, except where necessary to eliminate apparent immediate hazards to the subjects.

Important:
If you are conducting **federally funded non-exempt research**, please send the applicable OSP/grant proposal to the IRB office, once available. OSP funds may not be released until the IRB has compared and found consistent the proposal and related IRB applicaton.

cc: File