**Flexibility For Survival: State Funding And Contingent Faculty Employment At Public Higher Education Institutions**

by

Joanna R. Frye

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Doctoral Committee:

Professor Michael N. Bastedo, Co-Chair
Professor Stephen L. DesJardins, Co-Chair
Associate Professor Peter R. Bahr
Assistant Professor Kevin M. Stange

## DEDICATION

To my family: Fred, Penelope, Charlotte, & Elizabeth

In loving memory of Joanne (Jodi) Black

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## ABSTRACT

Flexibility For Survival: State Funding And Contingent Faculty Employment At Public Higher Education Institutions

by

Joanna R. Frye

Co-chair: Stephen L. DesJardins

Co-chair: Michael N. Bastedo

The dynamics of state funding for public higher education in the United States are changing. Per-student state appropriations to higher education have decreased over the past few decades and have become increasingly volatile from year to year. As public higher education institutions seek ways to educate more students with fewer and less predictable resources, a strategy that has gained momentum is the hiring of faculty employed in contingent (part-time or full-time non-tenure track) positions. Although decreasing state support is often cited as a primary force driving public higher education institutions' increased hiring of contingent faculty, researchers have not systematically examined this relationship. This study addresses this gap in understanding by examining how changes and volatility in state funding have influenced faculty hiring at public institutions over the last two decades.

I estimate the relationship between state appropriations and institutions' faculty employment patterns by analyzing a panel of institution- and state-level data spanning 1994-2013. Employing a two-way fixed effects regression model, I estimate the relationship between state appropriations and five dependent variables: numbers of part-time faculty, full-time non-tenure track faculty, and tenure track faculty, and the proportions of part-time faculty and full-time non-tenure track faculty. I estimate each model for the full sample of public institutions, then separately by public institution type: research institutions, four-year non-research institutions, and community colleges.

This study provides evidence of a systematic relationship between state appropriations to higher education and public institutions' faculty employment patterns, consistent with study hypotheses informed by resource dependence theory. The findings suggest that when state appropriations decrease or become more volatile, public institutions employ greater proportions of part-time and non-tenure track faculty and fewer tenure track faculty. This study found these relationships to be stronger for public non-research institutions and community colleges than public research institutions. This study quantifies the long-term effects of declining state support for public higher education and has important implications for higher education equity. State funding cuts are often made in response to short-term state budget crises but may have long-term consequences for the quality of public higher education over time.

# CHAPTER 1

## Introduction

The dynamics of state funding for public higher education in the United States are changing. The share of public institutions' revenue provided by the state has decreased, while the share provided by tuition and other sources has increased steadily over the last two decades (Bell, 2008; Callan, 2002; Heller, 2006). These changes have occurred in the wake of persistent state economic challenges such as tax and expenditure limitations (Archibald & Feldman, 2006), and growing competition from other areas of the state budget such as health care, corrections, and K-12 education (Bell, 2008; Delaney & Doyle, 2011; Hauptman, 2001). States' tendencies to cut higher education spending in the face of fiscal pressure and competing budget priorities are well documented in the literature (e.g., Hovey, 1999; Humphreys, 2000; Kane, Orszag, & Apostolov, 2005).

Although total state appropriations to higher education have increased in nominal dollars since 1980, reaching a peak of $89 billion in 2008, these increases have not kept pace with the substantial enrollment demand experienced by public institutions during this time (State Higher Education Executive Officers [SHEEO], 2012). As a result, per-student state appropriations have decreased by about 22 percent[1] since the early 1980s, with the steepest declines occurring during the last decade (SHEEO, 2012). At the same time, state appropriations decisions have become increasingly volatile, characterized by a

[1] Revenues and expenditures are reported in constant dollars unless otherwise noted.

roller coaster pattern of steep changes from year to year in many states (Doyle & Delaney, 2010). Public institutions have responded to declines in state resources by increasing tuition, but have generally been unable to fully offset decreases in state funding per student over this time period (Desrochers & Wellman, 2011; Oliff, Palacios, Johnson, & Leachman, 2013).

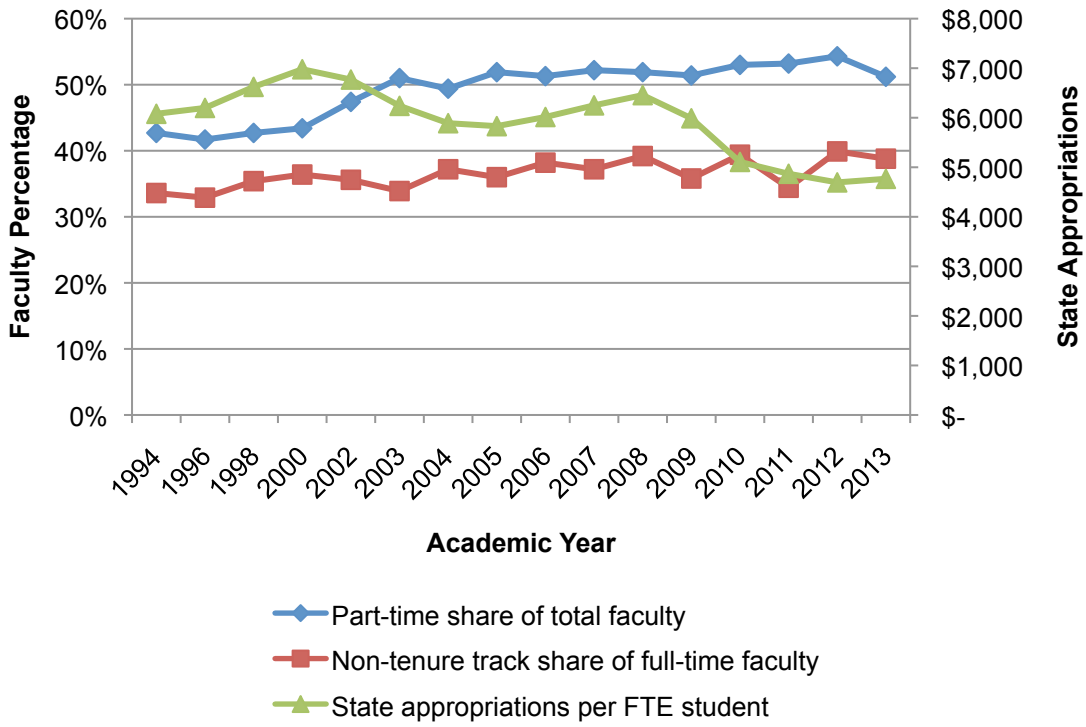
As public higher education institutions seek ways to educate more students with fewer and less predictable resources, one strategy that has gained momentum in recent decades is the hiring of faculty employed in contingent positions (Anderson, 2002; Conley, Leslie, & Zimbler, 2002). A report by the American Federation of Teachers (2009) demonstrated that between 1997 and 2007, the number of faculty employed in part-time or full-time non-tenure track positions at public institutions grew about 37 percent, while the number of faculty employed in tenure-track positions grew only 6.5 percent during this time.[2] Currently, the majority of new faculty hires at public institutions are placed into non-tenure track positions, and higher education scholars and policy experts expect this trend to continue well into the future (American Federation of Teachers, 2009; Baldwin & Chronister, 2001; Ehrenberg, 2012; Gappa & Leslie, 1993). Higher education institutions now rely on contingent faculty to teach a significant share of lower-level undergraduate and general education courses (American Federation of Teachers, 2009; Conley et al., 2002; Schuster & Finkelstein, 2006).

Decreasing state support is often cited as a primary force driving public higher education institutions' increased hiring of contingent faculty (e.g., Baldwin & Chronister,

[2] Throughout this dissertation, full-time faculty who are tenured or eligible to earn tenure will be described as "tenure track faculty." Full-time faculty who are not eligible to earn tenure are referred to as "non-tenure track faculty." Part-time and non-tenure track faculty typically hold appointments with titles such as adjunct, lecturer, or instructor. Both part-time and non-tenure track faculty are also described in this dissertation as "contingent faculty."

2001; Gappa & Leslie, 1993; Schuster & Finkelstein, 2006; Slaughter & Leslie, 1997). Trend analyses suggest that as state appropriations for public higher education have decreased, the use of contingent faculty has increased (e.g., Desrochers & Wellman, 2011), yet researchers have not systematically examined this relationship. Figure 1.1 illustrates changes in the average proportions of part-time and non-tenure track faculty at public institutions between 1994 and 2013, alongside changes in the average amount of state appropriations per student received during the time period. The trend lines for contingent faculty and state appropriations have clearly moved in the opposite direction over time, but further empirical analysis is needed to identify a causal connection between state funding and contingent faculty employment at public institutions.

**Figure 1.1 Changes in faculty composition and state appropriations at public institutions, 1994-2013**



Past studies examining faculty employment patterns have relied on economic theory to explain the determinants of contingent faculty hiring (Ehrenberg & Zhang, 2004; Liu & Zhang, 2007; Zhang & Liu, 2010). These studies have focused on the lower salary costs of contingent faculty relative to their tenure track peers as the primary reason for institutions' increased demand for contingent faculty. However, researchers have generally not considered the importance of public institutions' changing revenue patterns and how these changes may influence institutions' decisions to alter their faculty compositions. Furthermore, past studies have largely ignored public two-year institutions, which employ the majority of contingent faculty and educate a significant share of undergraduate students in the United States. As a result, our understanding of how the changing dynamics of public higher education finance may be affecting academic employment patterns at public institutions, particularly community colleges, is incomplete.

## Purpose and Research Questions

This dissertation will estimate the impact of state appropriations on the employment of contingent faculty at public institutions. Although increasing numbers of contingent faculty can be found at all types of higher education institutions (Rhoades & Frye, 2015; Desrochers & Kirshstein, 2014), this dissertation is specifically focused on public institutions and the dramatic changes that have occurred in public higher education finance over the last two decades. By applying a conceptual framework drawing from organizational theory, this study will examine how public institutions manage and strategically adapt to changes and volatility in their financial environments. Specifically,

the proposed study seeks to contribute to the higher education finance and policy literature by addressing the following main questions:

**RQ1.** How have faculty employment patterns changed over time at public higher education institutions? Do changes in faculty employment patterns over time differ by institution type?

**RQ2.** What is the relationship between state funding and faculty employment patterns at public institutions? Do public institutions respond to declines in state funding by altering their faculty compositions?

**RQ3.** Do public institutions with different missions and resource capacities (i.e., community colleges and flagship research universities) respond differently to declines in state appropriations in terms of their faculty employment strategies?

**RQ4.** How does volatility in state appropriations to higher education influence public institutions' faculty employment behavior?

**RQ5.** Do public institutions with different missions and resource capacities respond differently to volatility and uncertainty in state funding for higher education?

By answering these questions, this dissertation will improve our understanding of how the ongoing privatization[3] of public higher education is affecting institutional behavior and decision-making. Higher education leaders and policy researchers have referred to declining state support as a "crisis" facing public higher education (Jenny & Arbak, 2004; National Education Association, 2004), but few empirical studies have attempted to systematically identify how changes in state funding have affected policies

[3] Privatization generally refers to the combination of decreasing state investment and increasing market forces influencing public higher education institutions (Eckel & Morphew, 2009).

and practices at public institutions. Cuts to state funding for higher education are often made in response to short-term state budget crises, but over time, these cuts may have long-term consequences for the quality of public higher education. This study attempts to quantify the long-term effects of declining state support resulting from states' higher education budget cuts and failure to increase funding in pace with rising student enrollment. This study also pays particular attention to role of volatility in state support, and how this funding instability and uncertainty may shape institutional behavior.

## The Growing Use of Contingent Faculty

The dramatic increase in the number of contingent faculty employed by higher education institutions over the last several decades represents a major restructuring of the traditional academic workforce (Shuster & Finkelstein, 2006). The tenure system has provided the dominant model of faculty employment in the United States since the early twentieth century (Baldwin & Chronister, 2001; Park, Sine, & Tolbert, 2011). The concept of tenure was developed to provide faculty with continuously guaranteed employment in order to protect their freedom in teaching and research, and to attract talented individuals to the academic profession (American Association of University Professors [AAUP], 1940, 2009). While tenure remains a cornerstone of academic employment at many institutions, the viability of the traditional tenure system has been called into question by higher education leaders and stakeholders as more faculty are being hired off the tenure track. The widespread growth of contingent faculty in higher education has been characterized as "an unambiguous signal of a revolution in academic appointments" (Schuster & Finkelstein, 2006, p. 192).

Like many sectors of the U.S. economy, higher education institutions have confronted a turbulent environment characterized by increased market competition, technological advances, changing consumer demographics, and financial constraints (Baldwin & Chronister, 2001; Cappelli et al., 1997; Schuster & Finkelstein, 2006). Similar to corporations and non-profit firms, higher education institutions have felt pressure to restructure their employment in order to respond to these rapid changes (Baldwin & Chronister, 2001; Cappelli et al., 1997; Kanter, 1989). The traditional tenure system, with its emphasis on long-term employment and stability, may fail to provide institutions with the flexibility needed to adapt to sudden changes in their environments and the growing market-driven specialization of faculty roles (Cross & Goldenberg, 2009). A "just-in-time professoriate" comprised of contingent faculty has proven to be an attractive alternative for institutions seeking a more flexible employment structure (Barker, 1998, p. 197).

Institutions' increased reliance on part-time and full-time non-tenure track faculty has been met with criticism by some scholars and policymakers. A number of studies have found evidence suggesting a negative relationship between the use of contingent faculty and student outcomes such as persistence (Jaeger & Eagan, 2011; Jaeger & Hinz, 2008), transfer (Eagan & Jaeger, 2009), and degree completion (Ehrenberg & Zhang, 2005; Jaeger & Eagan, 2009). Concern regarding the employment conditions and treatment of contingent faculty is also widespread inside and outside of the academic community (Baldwin & Chronister, 2001; Benjamin, 2002; Gappa & Leslie, 1993; Hickman, 1998; U.S. House of Representatives Committee on Education and the Workforce, 2013). Given the growing concern about the impact of institutions' increased

reliance on contingent faculty on educational quality, understanding how changes in state postsecondary funding may alter public institutions' academic employment is of great importance to higher education leaders and policy makers.

## A Brief History of State Support for Public Higher Education

In order to explain why changes in state funding might influence institutions' behavior, it is necessary to understand the history and rationale underlying state support for public higher education. One of the defining economic characteristics of higher education is the ability of institutions to subsidize the cost of their "product" by charging students less than what it actually costs to produce their educations (Winston, 1999). A tradition of state support (and to some extent private support) for higher education is what allows this "sustainable excess of production cost over price" to occur at public institutions (Winston, 1999, p. 17).

State financial support for higher education dates back to the colonial era during which the states allocated land and other authorizations to religiously chartered private institutions (Heller, 2002). Although state chartered institutions began to appear as early as the late 18th century, historians of higher education have generally credited the Morrill Act of 1862 for expanding state support for higher education and providing the foundation for the system of direct appropriations to public institutions that exists today (Goldin & Katz, 1999; Thelin, 2004). The federal Morrill Act allocated large tracts of undeveloped Western land to the states to be sold and their proceeds used to build state supported "land grant" universities (Thelin, 2004). Through the implementation of the Morrill Act, the federal government effectively "delegated primary responsibility for the

organization, support, and maintenance of public higher education to the states" (Hines & Hartmark, 1980, p. 12).

The federal government still provides financial support to public higher education in the form of research grants and student financial aid, but the state holds primary responsibility for funding public higher education institutions and shaping the direction of higher education within the state (Layzell & Lyddon, 1990). State governments exert influence over their public higher education institutions in many ways, but the budgetary process is the primary policy lever available to the states (Hines & Hartmark, 1980; Layzell & Lyddon, 1990). More than 90 percent of financial support provided by the state is allocated in the form of direct appropriations[4] (Hauptman, 2001; Toutkoushian & Shafiq, 2010), which are intended to support the general operating expenses of public institutions (SHEEO, 2015). Public institutions rely heavily on appropriations from the state, which represent one-third of their revenues on average, although this proportion is much larger at many regional four-year institutions and community colleges (Desrochers & Wellman, 2011; Hauptman, 2001).

**Rationale for State Support**

Historically, public higher education institutions were distinguished by their commitment to providing valuable goods and services to the citizens and industries in their surrounding communities (Goldin & Katz, 1999). Recognizing this value, states increased their financial investment in public higher education dramatically during the early half of the 20th century, more than doubling the average share of the state budget

[4] Other forms of state support for public higher education include student financial aid, capital outlays, and targeted funding through grants and contracts, but appropriations remain the primary vehicle for state support (Toutkoushian & Shafiq, 2010).

allocated to higher education between 1902 and 1940. Despite pressures from other areas of state spending (i.e., Medicaid, corrections, and transportation), higher education currently remains a significant item in most state budgets, comprising an average of 12 percent of total state spending in 2008 (Bell, 2008).

The role of public higher education as a provider of social and individual benefits continues to provide the underlying rationale for state subsidies to higher education today. In return for state support, public higher education institutions are expected to serve the public interests of the state by educating its citizens, encouraging civic engagement, and providing opportunities for social mobility (Kallison & Cohen, 2010; Lingenfelter, 2004; Newman, Couturier, & Scurry, 2004). Through state subsidies, public higher education institutions are able to maintain relatively low levels of tuition in order to increase educational access and equity for state residents (DesJardins, 2002; Hauptman, 2001; Mumper, 2003). However, as greater public attention is placed on the individual benefits of higher education, scholars have worried that a decreasing recognition of higher education as public good will continue to undercut state financial support for higher education (Kezar, 2004).

**Higher Education as a Balance Wheel**

The contemporary landscape of state higher education funding is characterized by both decreasing amounts of state financial support and increasing unpredictability and volatility in state appropriations from year to year. Higher education finance experts have observed that fluctuations in state appropriations to higher education are due to states' tendencies to treat higher education as a balance wheel for state budgets (Bell, 2008; Delaney & Doyle, 2011; Hovey, 1999). The balance wheel concept suggests that state

appropriations to higher education rise disproportionately to other areas of state spending when state finances are strong, and decrease disproportionately when state finances are weak. Volatility in state spending for higher education has become much more pronounced since the 1980s and is now a defining feature of state higher education finance (Doyle & Delaney, 2010).

Several important factors influence the selection of higher education as a balance wheel in state budgets. First, unlike many other programs competing for state funding (e.g., Medicaid and corrections), public higher education institutions are able to generate revenue through tuition and fees to help offset cuts in state funding. Second, higher education institutions are perceived by legislators to have more flexibility than other state programs in adjusting their spending levels by altering employee pay structures, course offerings, class sizes, and the like (Hovey, 1999). When state economic conditions are good, higher education may benefit from larger increases than other programs because it is often viewed as a wise state investment (Doyle & Delaney, 2010). As volatility and unpredictability become the norm in state higher education funding, public institutions must find ways to adapt to these financial realities.

## Significance of the Study

State funding for higher education continues to be one of the most pressing policy issues currently facing public institutions (American Association of State Colleges and Universities [AASCU], 2015). Higher education leaders and advocates have decried the declines in state investment in public higher education over the last two decades, but have presented little empirical evidence of the long-term impact of decreasing state funding on public institutions. Past research suggests public institutions have attempted to raise

alternative sources of revenue and alter their expenditure patterns in order to compensate for losses in state funding. However, few studies have examined how public institutions' changing revenue streams have affected their academic employment strategies. Faculty represent both the core of the academic mission and the largest expenditure category at higher education institutions. While descriptive evidence suggests public institutions have increased their reliance on contingent faculty in response to reductions in state appropriations, further empirical research is needed to investigate this relationship.

This study attempts to fill this gap in our understanding by systematically examining how changes and volatility in state funding have affected faculty hiring at public institutions. The rise in contingent faculty has become salient to public higher education leaders and policymakers as criticism over contingent faculty working conditions and potential negative effects on student learning have increased both inside and outside of the academy (e.g., U.S. House of Representatives Committee on Education and the Workforce, 2013). By examining the issue of contingent faculty employment, this study contributes to higher education leaders' and policymakers' understanding of the long-term, and perhaps unintended, consequences of persistent declines and uncertainty in state support for public institutions. Higher education leaders and policy analysts generally agree that cuts in state funding are unlikely to be fully reversed in the future (Bell, 2008). Similarly, trends toward the increased use of contingent faculty are expected to continue (Kezar, 2012). This dissertation aims to increase higher education leaders' and state policymakers' awareness of the link between changes in public higher education finance and faculty employment practices. In doing so, this study may prompt more discussion about the use of contingent faculty and a greater emphasis on intentional

planning and investment in contingent employees, conditions that experts believe are critical to the future success of the academic workforce (Baldwin & Chronister, 2001; Gappa & Leslie, 1993; Kezar, 2012).

By examining differences in the effects of state funding on public research institutions, non-research institutions, and community colleges, this dissertation also highlights potential inequities in states' higher education finance policies. The theoretical framework guiding this study suggests public non-research institutions and community colleges will be more vulnerable to declines in state funding because they have less capacity for resource diversification. Although systematic research comparing the teaching effectiveness of tenure track and non-tenure track faculty is scarce, preliminary evidence suggests the increased use of contingent faculty may have negative effects on student outcomes such as persistence and graduation (e.g., Jacoby, 2006; Jaeger & Eagan, 2011). If public non-research institutions and community colleges are more likely to hire non-tenure track faculty in response to changes in state funding, this should raise concern for policymakers and higher education leaders interested in higher education equity, particularly for traditionally underserved student populations. This dissertation investigates whether the effects of state funding on contingent faculty are distributed unevenly by institution type, hopefully drawing policymakers' attention to the implications for public higher education quality and equity.

This study makes important contributions to the literature on higher education finance and policy through the use of panel data estimation techniques. Past studies of the determinants of faculty employment are limited by their reliance on cross-sectional regression techniques that do not fully account for potential bias due to omitted variables.

Because the unobserved factors that influence state appropriations to higher education may also be correlated with a number of important institutional outcomes of interest, more rigorous estimation techniques are necessary to investigate these relationships.

This study also develops a fresh theoretical view of the relationship between public institutions' revenue streams and their faculty employment strategies. Past studies have relied on principles of labor demand to explain faculty hiring, but I apply a resource-based theory of organizations to explain how institutions' pursuit of power, control, and autonomy will influence their academic employment patterns in response to resource shifts and instability. Organizational theory broadens our understanding of institutional behavior and provides mechanisms that help explain how changes in resources will influence public institutions' faculty employment strategies. As public institutions continue to adapt to shifting financial dynamics, this dissertation provides a unique and timely analysis of an important policy issue that will hopefully guide future policy discussions and research.

## Organization of the Dissertation

I organize this dissertation into five chapters. In Chapter One, I discussed the purpose and significance of this study, and provided a brief overview of the growing use of contingent faculty and the historical context and rationale for state support of public higher education. I also presented the main research questions guiding the analysis of the relationship between state funding and contingent faculty employment.

In Chapter Two, I present a review of the literature informed by two questions: how do higher education institutions respond to changing resources, and why do institutions employ contingent faculty? Guided by resource dependence theory, I

integrate the theoretical and empirical perspectives on institutional responses to changes in resources, literature on contingent employment outside of higher education, and studies examining the determinants of contingent faculty hiring. Chapter Two concludes with the conceptual framework and hypotheses guiding this dissertation.

Chapter Three provides a detailed explanation of the study methodology. I describe the analytic strategy for estimating the relationship between state appropriations and contingent faculty employment at public institutions, an overview of the data, sample, and variables used in the analysis, and a discussion of study limitations.

The study results are presented in Chapter Four. I first present the findings from the descriptive investigation of faculty trends over time, then the main fixed effects regression models estimating various faculty outcomes. I then present the results of the volatility extension models, focusing on both the descriptive results and fixed effects analyses.

In Chapter Five, I summarize my key findings and discuss their implications for higher education theory, policy, and practice. I also identify additional questions raised by this study and suggest directions for future research.

# CHAPTER 2

## Literature Review

My review of the literature is guided by two primary questions: how do higher education institutions respond to changing resources, and why do institutions employ contingent faculty? I begin with a discussion of theoretical and empirical perspectives on institutional responses to changes in resources. I then review the literature related to contingent employment outside of higher education and bridge these findings with the existing set of studies examining the determinants of contingent faculty hiring. I conclude this chapter with a discussion of the conceptual framework and hypotheses guiding this dissertation.

## Institutional Responses to Changing Resources

In seeking to explain the relationship between state appropriations and contingent faculty employment in public higher education, I review past studies that have examined how institutions respond to changes in resources and situate these findings within a resource dependence theory of organizations. A robust body of literature exists that explains changes in state funding to public higher education institutions over time (e.g., Humphreys, 2000; Kane et al., 2005; McLendon, Hearn, & Mokher, 2009; Toutkoushian & Hollis, 1998), but comparatively few studies have examined how public institutions respond to these changes in state support. Resource dependence theory has become an attractive theoretical lens through which to view public institutions' responses to changing revenue streams (e.g., Jaquette & Curs, 2015; Slaughter & Leslie, 1997).

**Resource Dependence Theory**

Resource dependence theory provides insight into the relationship between revenue sources and institutional behavior by defining colleges and universities as organizations that depend upon their external environments for resources, and ultimately, their survival (Bastedo & Bowman, 2011; Gumport & Pusser, 1997; Pfeffer & Salancik, 1978; Slaughter & Leslie, 1997). Organizations cannot survive without interacting with their environments to acquire and manage resources such as revenue, labor, services, and supplies. Resource dependence theory is part of the open-systems approach to understanding organizations, which emphasizes interdependence between organizations and their environments (Scott & Davis, 2007). From a resource dependence perspective, an organization's survival depends primarily on its ability to respond to external demands and expectations (Oliver, 1991; Pfeffer & Salancik, 1978).

When an organization's supply of resources is plentiful and stable, dependence is not a problem for the organization (Pfeffer & Salancik, 1978). However, as the external environment changes in ways that decrease resource stability, the organization's dependence on the resource becomes problematic and may create constraints on the organization's actions. Organizations seek to actively manage and control their resource dependencies in order to increase organizational power and autonomy (Pfeffer & Salancik, 1978; Oliver, 1991). As an organization faces demands from an external resource provider, it may choose to comply with external pressures or develop strategies for managing or avoiding external influence and dependence. Because compliance may lead to organizational vulnerability and place constraints on the organization's ability to adapt to future demands, organizations are likely to minimize their external influences

and dependencies, particularly when external demands conflict with the organization's interests (Pfeffer & Salancik, 1978).

Resource dependence theory offers a number of strategies available to higher education institutions to manage their external dependencies, such as diversifying their revenue, suppliers, or institutional activities. In addition to diffusing external constraints through diversification, institutions can absorb constraints through activities such as mergers or acquisitions, or co-opt external constraints by developing strategic alliances with resource providers (Wry, Cobb, & Aldrich, 2013). In the literature examining how public higher education institutions respond to declines in state appropriations, primary attention is placed on the diffusion of external influences through the diversification of institutional revenue and activities.

**State Appropriations and Institutional Behavior**

Past studies in higher education have generally focused on two institutional responses to reductions in state appropriations: seeking alternative revenue sources and altering activities and expenditures. Several studies have estimated the relationship between state appropriations and tuition, determining that public four-year institutions increase their in-state tuition rates when state appropriations decrease (Koshal & Koshal, 2000; Lowry, 2001; Rizzo & Ehrenberg, 2004). The negative relationship between state appropriations and tuition at public institutions has been documented extensively in a number of descriptive reports (e.g., Kirshstein & Hurlburt, 2012).

Recognizing that state politics and policies may constrain public institutions' ability to raise their in-state tuition rates, researchers have also considered the relationship between state funding and the enrollment of non-resident students, who

typically pay substantially higher tuition rates than resident students. Analyzing a panel of institutional data spanning 2003-2013, Jaquette and Curs (2015) found that public research institutions increased their enrollment of non-resident students in response to declines in state revenues. Findings related to the diversification of institutional revenues support the theoretical argument that public institutions seek alternative revenues to improve organizational stability when state appropriations decline.

In a detailed analysis of changing trends in revenues and institutional behaviors at public research universities, Slaughter and Leslie (1997) determined that research institutions responded to diminishing state appropriations by raising tuition and increasing their share of revenue from research grants and contracts, private gifts, and sales and services in the decade between 1980 and 1990. Drawing directly from resource dependence theory, Slaughter and Leslie (1997) argued that shifts in institutional revenue sources have destabilized public universities, causing them to seek alternative resource providers that each bring an additional set of demands and interests to the institution. The authors stated,

> The end result of these changes has been reduced university effort in the area of primary state (and student) interest: instruction and increased effort particularly in the area stipulated in contractual agreements, research. The shift away from instruction may have negative direct consequences not only for students, but it also contributes to increased university alienation from the general public, thereby reinforcing secular tendencies to reduce state general support even more, which in turn further destabilizes the universities and ultimately renders them more dependent upon and answerable to contracting and granting organizations. (p. 100)

In attempting to reduce the organizational turbulence prompted by reduced state support, Slaughter and Leslie (1997; 2001) argued that public institutions increasingly engage in academic capitalism, a term that describes market-like behaviors such as

competition for research grants, university-industry partnerships, tuition, and other revenue-generating activities. Increasing revenue from private giving is another strategy available to public institutions, but a study by Cheslock and Gianneschi (2008) found that private donations have generally been unable to counteract losses in state appropriations and are disproportionately concentrated at the most selective public institutions. Consistent with findings by Jaquette & Curs (2015), public non-research institutions may be limited in their ability to engage alternative resource providers through academic capitalism.

In addition to generating alternative sources of revenue, institutions have altered their activities and expenditure behavior in response to reductions in state appropriations. Resource dependence theory describes organizations as engaged in interdependent relationships in which resource providers place demands upon the organization in exchange for resources (Pfeffer & Salancik, 1978). Consistent with the academic capitalism perspective, institutions will necessarily alter their activities in response to decreases in state appropriations in order to manage their dependence on new revenue sources (Slaughter & Leslie, 1997).

Studies examining the relationship between institutional revenue and expenditure categories have consistently determined a positive relationship between revenue from state appropriations and instructional spending at public institutions. McPherson, Shapiro, and Winston (1989) examined the relationship between revenues and expenditures at four-year institutions between 1978 and 1985 and found descriptive evidence that public institutions experienced a “cost-squeeze” due to slow growth in government funding that resulted in lower levels of instructional expenditures during the time period. McPherson

and Shapiro (1991) extended their analysis using an econometric model and found state appropriations to be positively related to per-student instructional expenditures at public two- and four-year institutions. Furthermore, revenue from state appropriations was the strongest predictor of instructional expenditures at public two-year colleges, while revenue from tuition was the strongest predictor at public four-year institutions.

Hasbrouck (1997) examined revenues and expenditures at public four-year institutions to determine whether changes in revenue sources influenced institutions' spending priorities. She found governmental appropriations (a variable that aggregated appropriations from federal, state, and local sources) to be a strong predictor of per-student instructional expenditures, and also determined that institutions receiving more appropriations spent a larger share of their budget on instruction. Hasbrouck's findings support her hypothesis that an institution's revenue sources will influence its resource allocation, consistent with a resource dependence perspective that emphasizes the external control of organizations.

In a more recent study, Leslie, Slaughter, Taylor, and Zhang (2012) examined revenues and expenditures for a sample of public and private research-extensive universities. Similar to Hasbrouck's (1997) study, the researchers determined these institutions generally used resources to support the intended goals of their resource providers. For example, revenues from tuition and state appropriations were strongly related to instructional spending, while revenues from grants and contracts were strongly associated with research expenditures. As public institutions continue to generate revenue from a variety of sources, they may experience conflicts between institutional goals and the goals of their resource providers. As Pfeffer and Salancik (1978) observed,

> Organizations could not survive if they were not responsive to the demands from their environments. But, we have noted that demands often conflict and that response to the demands of one group constrains the organization in its future actions, including responding to the demands of others. This suggests that organizations cannot survive by responding completely to every environmental demand. (p. 43)

From a resource dependence perspective, revenue providers can and do shape institutional spending behavior, but institutions must continually negotiate these dependencies and the often conflicting interests that accompany them. For example, in order to meet both the demands for undergraduate instruction and research activity, institutions may choose to hire contingent faculty to take on teaching responsibilities (often at a lower cost), freeing up tenure track faculty to concentrate more effort on research. In the following section, I describe empirical and theoretical findings related to the determinants of contingent faculty hiring.

## Determinants of Contingent Faculty Employment

Drawing from resource dependence theory, the hiring of contingent faculty can be framed as an adaptive response to changes in state funding at public higher education institutions. Pfeffer and Salancik (1978) outlined a number of ways in which an organization may respond to changes in the environment, including adapting "its structure, its information system, its pattern of management and human relations, its technology, its product, its values and norms, or its definition of the environment" (p. 107). Because state appropriations decisions are often made in response to the states' fiscal conditions (Doyle & Delaney, 2009), institutions have little control over their allocation. Institutions thus may be more successful in engaging in restructuring behaviors (in terms of revenue, personnel, and activities) to lessen their dependency on

the state, rather than increasing their state appropriations. Previous studies suggest that institutions alter their administrative structures (e.g., positions and offices) to more effectively manage their resource dependencies (Gumport & Pusser, 1995; Tolbert, 1985). Perspectives from the literature on contingent employment outside of higher education provide additional insight into how resource dependencies may also influence faculty structures at public institutions.

**Contingent Employment Literature**

Much of the literature related to related to contingent employment focuses on the transformation of employment structures in the U.S. from internal labor markets to increasingly externalized forms of employment (Cappelli et al., 1997; Pfeffer & Baron, 1988). Barker (1998) described a "restructuring of the American workplace" beginning in the 1970s and 1980s characterized by reorganization, downsizing, and an expansion of contingent employment (p. 197). Faced with increasing pressure from global competitors, U.S. firms sought to reorganize their labor forces to reduce costs and improve flexibility (Cappelli et al., 1997). As a result, contemporary employment relations have transitioned away from a hierarchically controlled system rooted in strong administrative control, worker loyalty, and long-term employment (Barker & Christensen, 1998). In its place, a more complex model of variable administrative control has taken hold to accommodate more flexible forms of employment such as temporary workers, agency hires, and self-contractors.

While internal labor markets focused on employment security through low turnover, internal promotion, and seniority, dual labor markets emerged that divided employees into two distinct groups – core and peripheral workers (Bidwell, Briscoe,

Fernandez-Mateo, & Sterling, 2013; Kalleberg, 2009). In the dual labor market model, core workers are buffered by peripheral, less permanent employees who serve to absorb fluctuations in supply and demand. Scholars have argued that precarious and uncertain employment is no longer concentrated in a secondary job market but that precarious work has spread to all areas of employment, including professional and managerial job functions (Kalleberg, 2009). Informed by resource dependence theory, Pfeffer & Baron (1988) suggested that organizations have increased the use of contingent employees to manage environmental uncertainties and interdependencies:

> If we are correct in claiming that organizations face increasing uncertainty in labor and product markets, and that they often lack the ability to control these sources of uncertainty directly, then it makes sense that we would observe an increase of adaptive strategies that aid organizations in reducing or avoiding their dependence on skilled permanent workers. (p. 277)

Research on the determinants of "non-standard"[5] employment outside of higher education supports the externalization of employment as an adaptive organizational strategy for managing changes in the environment. Studies have found improving a firm's flexibility to be a primary reason for increasing the hiring of contingent workers (Davis-Blake & Uzzi, 1993; Houseman, 2001; Kalleberg, Reynolds, & Marsden, 2003; Pfeffer & Baron, 1988). Contingent employees improve organizational flexibility and control by reducing employment costs and allowing for increases and reductions in staffing due to variable labor needs. Harrison and Kelley (1993) described three types of organizational flexibility that may be achieved by restructuring employment. Functional flexibility allows organizations to redefine tasks and redeploy resources in response to

[5] Non-standard employment includes work that is part-time, temporary, fixed-term, or by contract (Kalleberg et al., 2003).

demand. Financial flexibility can be achieved by introducing wage competition among workers, such as hiring part-time workers at lower wages. Numerical flexibility allows an organization to quickly adjust the size of its workforce, often through the employment of contingent workers.

The forms of flexibility described above may improve an organization's ability to respond to its environment and manage its dependence on external resources. For example, in a study of 2,076 firms, Davis-Blake and Uzzi (1993) determined that employers increased their use of temporary workers and independent contractors in order to lower employment costs and improve organizational control and autonomy. When firms experienced greater variability in their employment needs, they were more likely to employ contingent workers in order to increase the organization's ability to respond to external changes. Similarly, when firms experienced a greater need for employment stability (e.g., for highly complex or firm-specific jobs), they hired fewer contingent workers. Applying a resource dependence perspective, Davis-Blake and Uzzi (1993) concluded that organizations seek to organize their employment structures as a strategy for managing external dependencies.

**Empirical Studies of Contingent Faculty Employment**

Research on the determinants of contingent employment offers two primary rationales for the use of contingent faculty in public higher education: to lower employment costs and to increase organizational flexibility. Both of these goals are consistent with a resource dependence theory of organizations in which institutions are continually seeking to manage dependencies and increase their power, autonomy, and survival. In the following section, I review the relatively small body of literature related

to the determinants of contingent faculty employment, focusing on the two broad themes of finances and flexibility.

**Financial Factors.**

Studies examining the growth of part-time and full-time non-tenure track faculty have consistently identified financial concerns as a main influence on faculty employment at public and private institutions, particularly the rising cost of academic labor (Baldwin & Chronister, 2001; Gappa & Leslie, 1992). Faculty have become more expensive to employ, yet due to the labor-intensive nature of academic work, institutions have not seen a corresponding increase in their productivity over time (Baldwin & Chronister, 2001; Cross & Goldenberg, 2009; Schuster & Finkelstein, 2006). Past studies have shown that increases in average tenure track faculty salaries are associated with increased employment of full- and part-time non-tenure track faculty at four-year institutions (Ehrenberg & Klaff, 2003; Ehrenberg & Zhang, 2004; Liu & Zhang, 2007; Zhang & Liu, 2010). These findings indicate that, all else equal, institutions may choose to substitute less-expensive contingent faculty when the cost of employing tenure track faculty increases.

The use of contingent faculty provides considerable short-term labor savings to postsecondary institutions. Monks (1997) found non-tenure track and part-time faculty were paid an average of 26 to 64 percent less than traditional tenure track faculty using data from the 1999 National Study of Postsecondary Faculty. Contingent faculty are often compensated per course or credit hour taught, at rates significantly below those of their tenure track peers, and may or may not be eligible for health benefits (Baldwin & Chronister, 2001; Benjamin, 2002; Cross & Goldenberg, 2009; Monks, 2007; Thedwall,

2008). The use of contingent faculty thus allows institutions to generate a greater number of student credit hours for fewer salary dollars than would be required for a tenure track faculty member (Mortimer, Bagshaw, & Masland, 1985). Because contingent faculty are hired primarily to teach, they typically carry higher teaching loads than tenure track faculty, leading to additional cost savings (Baldwin & Chronister, 2001; Cross & Goldenberg, 2009).

Despite the evident short-term labor savings, some scholars have questioned whether higher education leaders have overstated the long-term savings provided by hiring contingent faculty. Baldwin and Chronister (2001) found that simple comparisons of teaching loads between tenure track and non-tenure track faculty inflate cost-saving estimates since they do not account for the many other responsibilities held by tenure track faculty such as advising, research, and service. Gappa and Leslie (1993) described the use of part-time faculty as false economy in which increases in part-time faculty lead to hidden institutional costs such as heavier administrative burdens on remaining tenure track faculty and high turnover expenses from hiring, orienting, and supervising new part-timers. These findings suggest that decisions to increase the use of contingent faculty may be based on short-term financial stress than attention to long-term institutional needs or dependencies.

Consistent with a resource dependence perspective, scholars have specifically examined the relationship between institutional revenue and contingent faculty employment. In their analysis of interview data from 18 institutions, Gappa and Leslie (1993) determined financial resources to be the most important force affecting the employment of part-time faculty, particularly at public institutions. The authors identified

eroding state investment in higher education and the unpredictability of state budgeting as major causes of financial uncertainty for public higher education institutions. State appropriations to higher education have become increasingly volatile and unpredictable from year to year, challenging public institutions' ability to engage in long-term planning (Delaney & Doyle, 2011). Because state appropriations are often finalized shortly before the start of the fall term, institutions may turn to contingent faculty to meet last-minute changes in state funding or student enrollment (Gappa & Leslie, 1993).

In the only previous study to quantitatively examine the effects of state appropriations on faculty employment, Cheslock and Callie (2015) estimated the determinants of tenure track faculty employment and salaries at a sample of public and private business schools between 1999 and 2006. The authors determined that state funding was positively related to faculty salaries and numbers of tenure track faculty at public business schools. Although Cheslock and Callie's (2015) study was limited to business school faculty and did not consider the employment of full-time non-tenure track and part-time faculty, their findings suggest an important relationship between state appropriations and faculty employment.

Researchers have most often explored the impact of total institutional revenue on contingent faculty hiring, determining that increases in total per-student revenue are associated with increased hiring of both tenure track and non-tenure track faculty (Ehrenberg & Klaff, 2003; Ehrenberg & Zhang, 2004; Zhang & Liu, 2010). Liu and Zhang (2007) more closely examined the importance of revenues by focusing specifically on the share of institutional revenue received from tuition and fees. Using institutional data from the 2006 academic year, they found four-year institutions that received a higher

proportion of their revenue from tuition and fees had higher levels of part-time faculty. Liu and Zhang's (2007) findings suggest that the source of institutional revenue, not just the amount of total revenue, may be an important predictor of contingent faculty employment at public institutions.

**Flexibility.**

The pursuit of institutional flexibility is another important rationale for contingent faculty hiring. Flexibility is related in many ways to the financial factors discussed in the previous section, but flexibility goes beyond cost-savings to emphasize an institution's desire to increase its organizational power and autonomy. Creating a more flexible workforce improves an organization's ability to manage and adapt to changes in the external environment, which may be particularly important for higher education institutions that have historically relied on a tenure-based model of employment. As Pfeffer and Baron (1988) observed,

> Organizations require flexibility not only in terms of numbers of employees, but also in terms of the skills those employees possess…This flexibility is important, of course, only if there are difficulties in adapting the permanent workforce to changing conditions of market demand. (p. 273)

Related to the concept of dual labor markets, the use of contingent faculty may actually allow the institution to protect its long-term tenure-track workforce (Pfeffer & Baron, 1988). For example, Gappa and Leslie (1993) found evidence that institutions employed part-time faculty as a "buffer to protect the salaries, work load, and tenure of full-time faculty" (p. 92). Changes in the nature of academic labor suggest that tenure track faculty at doctoral and research institutions have shifted some of their efforts away from teaching in favor of increased research and scholarship (Slaughter & Leslie, 1997).

As a result, institutions may choose to hire part-time and full-time non-tenure track faculty to more flexibly meet the demand for undergraduate teaching. Contingent faculty often teach high-enrollment lower-division undergraduate courses, allowing tenure track faculty to focus on upper-level and graduate teaching and other scholarly responsibilities (Baldwin & Chronister, 2001; Schuster & Finkelstein, 2006; Thedwall, 2008).

The ability to adapt to future increases and decreases in student demand is another goal underlying institutions' pursuit of greater flexibility. Contingent employees improve organizational flexibility by allowing for adjustments in staffing due to variable labor needs (Kalleberg et al., 2003; Davis-Blake & Uzzi, 1993). Public institutions, particularly community colleges, have experienced substantial growth in enrollment over the last two decades (Desrochers & Wellman, 2011). Gappa and Leslie (1993) determined that institutions tend to substitute part-time faculty for tenure track faculty as student enrollments increase. For community colleges and other open-access institutions, limiting student enrollment is not politically or practically feasible. When enrollment increases are not met by corresponding increases in state funding, budget realities may force institutions to hire more contingent faculty to help meet increased demand for courses (Gappa & Leslie, 1993). Because the number of tenure track positions available is strictly limited at many institutions, it is often more feasible to hire contingent faculty to meet student demand than seek the authorization of new tenure track faculty lines (Cross & Goldenberg, 2009; Pfeffer & Baron, 1988).

The use of contingent faculty may also improve an institution's flexibility in the timing and structure of its course offerings. Institutions with large part-time enrollments may prefer to hire more part-time faculty to teach courses at times that are more

convenient for part-time students, such as evenings and weekends. Since tenure-track faculty may be reluctant to take on flexibly scheduled courses, institutions may turn to contingent instructors to help meet the enrollment needs of part-time students (Baldwin & Chronister, 2001; Thedwall, 2008; Zhang & Liu, 2010). Studies have found four-year institutions with higher shares of part-time students have higher levels of part-time faculty, and lower levels of tenure track and full-time non-tenure track faculty (Liu & Zhang, 2007; Zhang & Liu, 2010). As higher education institution continue to serve an increasingly diverse population of students, part-time and non-tenure track faculty may provide opportunities for greater organizational control and flexibility to adapt to changing student demands.

## Limitations of Past Literature

This study seeks to improve the existing literature by addressing a number of limitations. First, although several quantitative studies have attempted to identify the determinants of contingent faculty hiring, they have generally not considered the impact of state appropriations on public institutions' faculty employment patterns. Past studies have often included total institutional revenue as an explanatory variable, but this approach masks important changes that have occurred in the composition of public higher education finance over the last few decades. Empirical and theoretical evidence suggest that revenue received from particular sources (such as state appropriations) may differentially affect an institution's behavior.

Second, past studies have relied on cross-sections or short panels of data to examine faculty hiring, and have not fully accounted for time varying or invariant institution- and state-level characteristics that could influence faculty employment

patterns. For example, the cross-sectional analyses conducted by Liu and Zhang (2007) and Zhang and Liu (2010) were not able to control for unobservable institution-specific characteristics such as institutional culture, leadership, and faculty relations, all of which could influence an institution's faculty employment practices and lead to biased statistical estimates. Employing a longer panel of data allows for the use of fixed-effects modeling techniques that control for institution- and time-specific trends, as well as the inclusion of time-varying characteristics such as economic conditions and institutional demographics.

Third, existing quantitative studies have focused exclusively on four-year institutions, thus ignoring the determinants of contingent faculty employment at community colleges. Community colleges have recently experienced greater increases in student enrollment than any other type of institution; enrollment at two-year institutions increased nearly 50 percent between 2000 and 2010 (Kirshstein & Hurlburt, 2012). As a result, while most public institutions saw modest increases in their per-student instructional expenditures during this time, community colleges were forced to cut their per-student instructional expenditures by nearly eleven percent (Hurlburt & Kirshtein, 2012). As community colleges continue to be asked to educate the most students with the least amount of resources, it is important to examine how decreases in state funding have influenced their faculty employment patterns.

Finally, many past studies examining the effects of state appropriations on institutional behavior have focused on expenditures as the dependent variable(s). Expenditures provide information about the level and share of resources allocated to institutional activities such as instruction or research. However, these expenditure categories are highly aggregated and offer little insight into changes in institutional

policies and practices over time. For example, instructional expenditures describe the amount of money spent on instruction but no information about the composition of the faculty. Recent research suggests shifts toward greater proportions of non-tenure track faculty may have significant impacts on higher education institutions, faculty, and students. Analyzing faculty employment patterns offers a direct and meaningful evaluation of how institutions respond to changes in state appropriations.

## Conceptual Framework

I draw upon the characteristics of resource dependence theory to argue that changes in important external resources will alter public higher education institutions' faculty employment strategies. Higher education institutions, like all organizations, desire a stable and predictable flow of resources to ensure their ongoing survival (Pfeffer & Salancik, 1978). When resources are in flux, particularly financial resources, organizational turbulence and uncertainty may occur and institutions become vulnerable (Slaughter & Leslie, 1997). Declining state appropriations have proven to be a destabilizing force in public higher education, prompting changes in institutions' revenue and expenditure activities (Jaquette & Curs, 2015; Leslie et al., 2012; Slaughter & Leslie, 1997). When faced with a shifting resource environment, higher education institutions must find ways to actively manage their resource dependencies to ensure organizational autonomy and stability.

Past studies examining the determinants of contingent faculty hiring have relied on economic theory to explain institutions' increased use of non-tenure track faculty, emphasizing cost-savings and improved efficiency as the motivations driving institutions' behavior (Ehrenberg & Zhang, 2004; Zhang & Liu, 2010). These studies have applied

principles of labor demand to model institutions' demand for tenure track and non-tenure track faculty as a function of price (faculty salaries) and income (institutional revenue). Resource dependence theory complicates this labor demand function by drawing particular attention to the sources of institutional revenue and describing how the characteristics or preferences of resource providers serve to facilitate or constrain organizational behavior. A resource dependent view of organizations does not necessarily contradict an economic view of organizations, but expands upon economic principles to describe how institutions' preferences and behaviors are shaped by their desire to manage external dependencies and ensure organizational stability (Pfeffer & Salancik, 1978; Oliver, 1991). Examined through the lens of resource dependence, institutions increase their use of contingent faculty not only to maximize economic efficiency, but also to better manage environmental uncertainties caused by volatility and shifts in their resource providers.

When revenues from state appropriations decline or become unpredictable, higher education institutions will seek adaptive responses that ensure organizational stability. Historically, state appropriations were allocated to public institution through block grants designed to support general educational expenses, providing public institutions with a considerable amount of operational stability and control (Slaughter & Leslie, 1997). State budgeting for higher education has become increasingly volatile over time, subjecting public institutions to growing uncertainty regarding their revenue streams and limiting their ability to make long-term planning decisions (Delaney & Doyle, 2011). Hiring more part-time and full-time non-tenure track faculty increases an institution's flexibility to adjust its labor force in response to revenue availability, and may also reduce the

institution's short-term labor costs. Because labor is the largest cost facing higher education institutions, it is an attractive target for institutions experiencing financial distress (Slaughter & Leslie, 1997). Furthermore, as state appropriations fluctuate and decline, public institutions rely on tuition to help cover the loss in revenue. Tuition is a variable source of revenue that depends heavily on student enrollment. As an institution derives more of its revenue from variable and volatile sources, it will likely seek greater flexibility in its employment structure.

However, the effects of declining or volatile state appropriations on public institutions' academic employment patterns may be mediated by institutional mission and resource capacity. Public higher education institutions vary in their dependence on state appropriations according to three criteria: resource importance, resource control, and resource concentration (Pfeffer & Salancik, 1978). Resource importance can be measured along two interrelated dimensions: the *magnitude* of the resource in proportion to the organization's total resources, and the *criticality* of the resource, or the extent to which the organization could survive in its absence. Resource control measures the organization's discretion over the allocation and use of an important resource, while resource concentration refers to the extent to which the organization has access to the resource from multiple sources or suppliers. While most public institutions have little control over how state resources are allocated to them through the state legislative process, institutions are likely to vary considerably along the other two dimensions, resource importance and resource concentration, which may differentially influence their responses to changes in the external environment.

All public higher education institutions receive a portion of their operating expenses from state and/or local appropriations, but the proportion of public institutions' budgets derived from state sources varies dramatically depending on institution type. On average, public research institutions receive about 21 percent of their total budget from the state, while non-research four-year institutions and community colleges rely on state and local sources for about a third and half of their operating budgets, respectively (Kirshtein & Hurlburt, 2012). Because state funding is an arguably more important resource to non-research four-year institutions and community colleges, these institutions are more vulnerable to changes in state appropriations and may be more likely to alter their academic employment patterns to maintain organizational stability.

Public higher education institutions also vary in both the amounts and sources of alternative revenue available to them. While virtually all public institutions have raised tuition in response to shrinking state appropriations, few public institutions enjoy the excess enrollment demand that allows them to raise their prices substantially without experiencing enrollment declines (Winston, 1999). Price increases at non-selective two- and four-year institutions threaten to undermine these institutions' underlying mission to create access for underserved populations, who are the most sensitive to college pricing (Heller, 1997; Perna & Titus, 2004). In the absence of the ability to raise tuition substantially, institutions may increase their use of contingent faculty as an alternative to raising additional revenue (Slaughter & Leslie, 1997).

Similarly, revenues from private giving and endowments are concentrated almost exclusively at public research universities (Cheslock & Gianneschi, 2008; Rothschild, 1999). Research institutions also receive more than half of the federal grants,

appropriations, and contracts (excluding Pell grants) awarded to public institutions (Desrochers & Wellman, 2011). Clearly, public institutions are not equal in their ability to diversify their revenue streams in order to compensate for changes or volatility in state appropriations. Differences in both the importance of state funding and the availability of alternative revenue sources may influence an institution's use of contingent faculty as a strategy for managing its resource dependencies.

In their detailed description of strategies and behaviors organizations may employ to manage their dependence on external resources and improve their chances of survival, Pfeffer and Salancik (1978) did not explicitly discuss the restructuring of labor. However, the authors described a related strategy: the process of executive succession, the selection and removal of organization leaders with the objective of alignment between the organization and its environment. In their discussion of executive succession, Pfeffer and Salancik (1978) stressed the importance of identifying *how* organizations are influenced by their environments: "To say that organizations are externally controlled or constrained, however, does not specify how. If we are to understand organizational actions, the processes by which environmental factors affect organizational actions must be specified" (p. 225). Informed by the literature on the rise of contingent employment and the restructuring of work in the U.S., I argue that the employment of contingent faculty represents an important mechanism through which changes in the environment have influenced public higher education institutions. In examining the relationship between state appropriations and contingent faculty employment, I aim to test the utility of resource dependence theory in explaining how public institutions have responded to dramatic changes in their financial resources.

## Hypotheses

The conceptual framework outlined above informs the following hypotheses related to the research questions guiding this study:

**H1**: When revenue from state appropriations decreases, public institutions will attempt to mitigate environmental constraints by hiring more part-time and full-time non-tenure track faculty, and fewer tenure-track faculty.

**H2**: When revenue from state appropriations decreases, public institutions will seek to increase the flexibility of their workforce by employing greater proportions of part-time and full-time non-tenure track faculty.

**H3**: The relationship between state funding and faculty employment (levels and shares) will be stronger at public four-year non-research institutions and community colleges than public research institutions.

**H4**: When revenue from state appropriations becomes more volatile, public institutions will respond to increasing environmental uncertainty by hiring more part-time and full-time non-tenure track faculty, and fewer tenure-track faculty.

**H5**: When revenue from state appropriations becomes more volatile, public institutions will seek to increase organizational flexibility by employing greater proportions of part-time and full-time non-tenure track faculty

**H6**: The relationship between state funding volatility and faculty employment will be stronger at four-year non-research institutions and community colleges than public research institutions.

## Summary of the Literature and Conceptual Framework

The literature related to higher education institutions' responses to changes in resources can be understood through the lens of resource dependence theory. Past studies demonstrate that institutions respond to changes in resources by attempting to generate additional sources of revenue and by altering institutional expenditures and activities. Perspectives from the literature on contingent employment outside of higher education provide a rationale for the use of contingent faculty and support the framing of contingent faculty hiring as an adaptive response to environmental uncertainty. This study aims to improve upon past inquires into the determinants of contingent faculty hiring that have applied economic frameworks, emphasizing efficiency as the motivations driving institutions' behavior. I apply principles from resource dependence theory and a more nuanced understanding of organizational behavior by focusing on institutions' pursuit of organizational power, autonomy, and stability. Resource dependence theory explains how declines and volatility in state appropriations might affect an institution's faculty employment, and why institutions may respond differently depending on their mission and resource capacities. In the next section, I describe my methodological approach to testing the hypotheses guiding this study.

# CHAPTER 3

## Methodology

I begin this chapter by describing the analytic strategy for estimating the relationship between state appropriations and contingent faculty employment at public institutions. I then describe the data and sample, and provide an overview of the variables used in the analysis. I conclude with a discussion of the limitations of this study.

## Analytic Strategy

To estimate the true causal effect of state funding on institutions' faculty employment behavior, state appropriations would ideally be randomly distributed to public institutions. Random assignment would provide the exogenous source of variation in state appropriations necessary to obtain unbiased estimates of its effect on faculty composition. However, it is not possible to experimentally assign state appropriations to public institutions, so a quasi-experimental approach may be used to approximate the conditions of random assignment in non-experimental data (Angrist & Pischke, 2009).

The primary goal of quasi-experimental methods is to control for unobserved or omitted factors that may confound the relationship between the treatment and outcome of interest. In the context of panel data, in which the same individuals (or institutions) are observed at multiple points in time, a researcher can focus on the change *within* the individual over time to essentially treat each individual as its own control group (Allison, 2009). Panel data allow the researcher to control for all observable and unobservable individual characteristics that are assumed to be stable (e.g., fixed) over time. Controlling

for individual-specific fixed effects effectively mitigates the threat of bias from unobserved time-invariant heterogeneity. However, individual fixed effects do not account for unobserved variables that change over time, so these variables must be identified and controlled for in the regression model (Allison, 2009). Because fixed effects regression models may be subject to bias from unobserved time varying factors, researchers should exercise caution when interpreting these estimates as causal effects (Angrist & Pischke, 2009).

**Fixed Effects Model**

In order to estimate the relationship between state appropriations and institutions' faculty employment patterns, I employ a two-way fixed effects regression model. By estimating an individual-specific fixed effects model, I control for both observable institution-specific characteristics such as location, as well as unobserved differences between institutions that are unable to be accounted for in a basic linear regression model, such as organizational culture and faculty relations. These kinds of factors may influence institutions' faculty hiring practices and failure to account for them would likely result in biased estimates of the effects of state funding on faculty employment patterns. In addition to individual-specific effects, which are assumed to be stable over time, the addition of time-specific effects controls for unobserved factors that may affect all institutions similarly in a time period (such as macroeconomic conditions).

Equation (1) specifies a general model of faculty employment where $Y_{it}$ is the number of faculty (either part-time, full-time non-tenure track, or tenure track) at institution $i$ at time $t$, $State_{it}$ represents the amount of state appropriations per FTE student received, $W_{it}$ represents the institutional revenue variables of interest, $X_{it}$ represents a set

of time-varying institution- and state-level covariates, $\alpha_i$ is an institution-level fixed effect, $\gamma_t$ is a year-level fixed effect, and finally, $\varepsilon_{it}$ is the error term:

$$Y_{it} = \mu_0 + \beta State_{it} + \delta W_{it} + \theta X_{it} + \alpha_i + \gamma_t + \varepsilon_{it} \quad (1)$$

The main coefficient of interest in Equation (1) is $\beta$, which represents the change in the levels of part-time, full-time non-tenure track, or tenure track faculty in response to changes in state funding. Because fixed effects models transform the independent and dependent variables to measure variation within units over time, they are not able to provide estimates for time-invariant variables such as institution type. The theoretical framework for this study predicts that institutions will respond differently to changes in state funding based on their institutional mission and resource capacities. To test for differences in the influence of state funding on faculty employment strategies, I estimate each faculty model separately for public research institutions, public comprehensive institutions, and community colleges. Robust standard errors clustered at the institution level are estimated for all regression models.

A combination of theoretical and empirical considerations were used to determine the inclusion of lagged independent variables in the regression models. The IPEDS Fall Staff survey (from which the faculty dependent variables are collected) is collected in the fall of each academic year, while state appropriation allocations are generally determined in the summer prior to the academic year. For example, the 2012-2013 Fall Staff survey is collected in the fall of 2012, and state appropriations affecting the 2012-2013 academic year are determined in the summer of 2012. Given the short timeline between when appropriations are allocated and when the Fall Staff survey is collected, institutions are

unlikely to be able to adjust their fall tenure track faculty counts in response to state appropriations because the approval and hiring processes for tenure track faculty can take months or years to complete (Cross & Goldenberg, 2009). For the models estimating the number of tenure track faculty, I lag the key dependent variables and institution- and state-level covariates by one year ($t - 1$). In contrast, the theoretical argument for increases in part-time and full-time non-tenure track faculty is based upon institutional flexibility to respond to quick changes in their environments. For the models estimating the numbers and shares of part-time and full-time non-tenure track faculty, I choose not to lag state appropriations or institution- and state-level covariates. Sensitivity analyses of the preferred models versus various lag periods are reported in Appendix Tables A.1-A.5.

The fixed effects strategy eliminates some potential for bias in $\beta$ by controlling for unobserved time-invariant differences between public institutions that may be correlated with their faculty employment outcomes. The fixed effects model allows this limited form of endogeneity by permitting the regressors to be correlated with the time-invariant component of the error in Equation (1) (Cameron & Trivedi, 2010). However, the fixed effects model is not able to control for unobserved institution-specific factors that vary over time. For example, year-to-year changes in student enrollment may influence an institution's faculty composition. To address these concerns, I control for a set of institution- and state-level time-varying covariates in all models.

**Volatility Extension**

This dissertation also seeks to understand how volatility in state appropriations influences faculty employment at public institutions. To address RQ4, and RQ5, I conducted additional analyses to estimate the relationship between state appropriations

volatility and faculty employment behavior. Equation (2) specifies a model of faculty employment where $Y_{it}$ is the number of faculty (either part-time, full-time non-tenure track, or tenure track) at institution $i$ at time $t$, $Volatility_{it-1}$ represents the amount of volatility in per-FTE student state appropriations in the time period preceding year $t$, lagged one year ($t - 1$), $W_{it}$ represents the institutional revenue variables of interest, $X_{it}$ represents a set of time-varying institution- and state-level covariates, $\alpha_i$ is an institution-level fixed effect, $\gamma_t$ is a year-level fixed effect, and finally, $\varepsilon_{it}$ is the error term:

$$Y_{it} = \mu_0 + \beta Volatility_{it-1} + \delta W_{it} + \theta X_{it} + \alpha_i + \gamma_t + \varepsilon_{it} \quad (2)$$

To create a measure of volatility and unpredictability in state appropriations to public higher education institutions, I operationalize volatility as the variance in year-to-year fluctuation in per FTE student state appropriations over a given time period. For each institution, I constructed a measure of volatility in per-FTE student state appropriations over two time periods (T1=1994-2001; T2=2002-2011). For each time period, I began by removing the linear trend in state appropriations per FTE student in order to focus on the short-term fluctuations in state appropriations independent of the overall downward trend. I de-trended the state appropriations variable following conventional econometric procedures by regressing the log of state appropriations per FTE student on time (year) for each institution and obtaining the residuals of this regression (Wooldridge, 2009). I then created a variable containing the standard deviation of the residuals to calculate the variance of the yearly fluctuations in per FTE state appropriations over each time period. Larger values of this variable indicate a greater amount of variation in year-to-year changes in per-student state appropriations

(volatility), while smaller values indicate less volatility in per-student state appropriations during the time period.

The measure of state appropriations volatility is added to the fixed effects panel model described in Equation (2). As described in Equation (2), the volatility measure is lagged one year, meaning volatility in per-FTE student state appropriations between 1994 and 2001 is predicting each of the faculty outcomes in 2002. Because the volatility variable appears in only two years of the panel (2002 and 2012), the fixed effects regression models are estimated using these two time points.

## Data

The primary source of institution-level data is the Integrated Postsecondary Education Data System (IPEDS) surveys administered annually by the National Center for Education Statistics (NCES). The publicly available IPEDS data contain information about institutional characteristics, student enrollment and completion, staffing, finances, and more. IPEDS data have been collected by NCES since 1987; similar data were previously collected through the Higher Education General Information Surveys (HEGIS) system from 1966-1986 (Fuller, 2011).

Data were downloaded from the IPEDS Data Center in separate files for each year for each survey subcomponent (e.g., Finance). The data panel was created by appending years of data for each subcomponent, then merging subcomponents together following the IPEDS data processing procedures recommended by Jaquette and Parra (2014). In order to account for the unique reporting structure of IPEDS, careful attention must be paid to differences in how data are reported for multi-campus institutions and multi-institution higher education systems. Branch campuses may choose to report their own

IPEDS data, or their data may be aggregated and reported through the main campus, which is referred to as part-child reporting (Jaquette & Parra, 2014). Similarly, institutions that are part of a higher education system may report their own data, or may report through a system office.

Because system institutions and branch campuses may report data differently for each survey component (e.g., they report Fall Enrollments at the campus level but Finance at the main campus level), data for these institutions may need to be collapsed to the parent level to ensure a consistent unit of analysis across survey components and over time. The parent-child collapsing procedures recommended by Jaquette & Parra (2014) address these challenges and allow for the construction of data panels that are appropriate for longitudinal institution-level analyses. Recent studies have used similarly constructed data panels to analyze institutional behaviors such as mission drift (Jaquette, 2013) and enrollment of non-resident students (Jaquette & Curs, 2015).

To help answer my first question (RQ1), which is focused on describing changes in faculty employment patterns at public institutions over time, I also analyze additional data from three waves of the National Study of Postsecondary Faculty (NSOPF), administered by NCES in 1993, 1999, and 2004. The NSOPF contains both individual- and institution-level data for a stratified sample of public and private degree-granting institutions. Many of the faculty employment variables available in IPEDS define "faculty" as instructional staff whose primary responsibility includes teaching, or teaching combined with research and public service. The NSOPF data contain faculty measures that are disaggregated by primary responsibility, allowing researchers to

determine how many faculty have instruction-only or research-only positions.[6] Since part of the growth in contingent faculty hiring is due to increases in non-tenure track research faculty positions, the NSOPF data provide a more detailed view of changing faculty employment patterns between 1993 and 2004.[7]

## Analytic Period and Sample

The analytic period for this study is a twenty-year panel spanning 1994 and 2013, and was determined by the availability of the dependent variables and independent variables of interest. For example, IPEDS data on faculty tenure status were not available prior to the 1993-1994 academic year. Because I am estimating the relationship between state higher education appropriations and faculty employment patterns, my analytic sample is limited to public higher education institutions. The reauthorization of the Higher Education Act in 1992 made the completion of IPEDS survey components mandatory for all postsecondary institutions receiving federal funding for Title IV student financial aid programs (Fuller, 2011). I initially included all public two- and four-year institutions that reported IPEDS data and received state appropriations during the analysis period (N=1,456). Public institutions in Colorado were excluded from the analysis (N=27) because they stopped receiving state appropriations under the Colorado Opportunity Fund voucher program in 2005 (Hillman, Tandberg, & Gross, 2014). Institutions that had missing data in all years of the analysis period were dropped from the sample (N=68), resulting in a final sample of 1,361 institutions.

[6] The sample of the first wave of NSOPF in 1988 was limited to faculty whose principal activity was instruction, so this wave is not included in the current analysis.
[7] 2004 is the last available and final wave of the NSOPF survey.

I disaggregated the full sample of public institutions into the following subsamples for analysis using the 2005 Carnegie Basic Classification: public research institutions[8] (N=160), public four-year non-research institutions[9] (N=334); and public two-year community colleges[10] (N=867).

## Variables

All dependent and independent variables (excluding proportions) were transformed by taking the natural logarithm to correct the data for skewness and excess kurtosis caused by differences in institutional size and spending (Cameron & Trivedi, 2010). Another benefit of the log transformation is that it allows for the interpretation of the beta coefficient as an elasticity (e.g., a percentage change in the dependent variable is associated with a percentage change in the independent variable). All revenue variables were adjusted to constant dollars using the 2012 Consumer Price Index. Table A.6 contains a list of all variables, variable definitions, and sources.

Missing institution-year observations were imputed for all covariates, excluding the independent variables of interest (state appropriations per FTE student and state appropriations share of total institutional revenue). Missing data were imputed for the covariates by averaging the leading (year + 1) and lagging (year – 1) observations within each institution panel. As a result, data missing for two or more institution-year observations in a row, or at the beginning or end of the analysis period, were not imputed. Approximately 30 percent of observations in the analysis sample (N=8,277) contained at least one imputed value. Missing institution-year observations for the dependent variables

[8] Includes "Research Universities (very high research activity)"; "Research Universities (high research activity)"; and "Doctoral/Research Universities"
[9] Includes all "Master's Colleges and Universities"
[10] Includes all "Associates--Public" institutions

were not imputed. Table 3.1 describes the number of observations with imputed values by variable. Missing data for two variables (percent of non-resident freshmen and average full-time faculty salary outlays) accounted for 97 percent of all imputations. The explanations for missing data are described in the following sections. Sensitivity analyses were conducted without the imputed data and selected models are reported in Tables A.7-A.11.

**Table 3.1 Number of observations with imputed data, by variable**

| Variable | No. of observations with imputed values |
|---|---|
| Net tuition and fees revenue | 63 |
| Share of degrees awarded in natural science & engineering | 166 |
| Share of non resident students | 6941 |
| Number of part-time students | 1 |
| Average full-time faculty salary outlay | 1106 |
| Total | 8277 |

**Dependent Variables**

Past studies of the determinants of contingent faculty employment have defined their dependent variables in terms of faculty levels (the number of each faculty type employed by the institution), faculty shares (the relative proportion of each faculty type), or both. To conduct the most comprehensive analysis of changes in faculty employment patterns, I examine both groups of dependent variables in my empirical analysis: faculty levels and faculty shares. I define faculty levels as the numbers of part-time faculty, full-time non-tenure track faculty, and full-time tenured or tenure track faculty employed at each institution in each year of the panel. Previous studies examining the determinants of contingent faculty hiring have either excluded part-time faculty from their analyses

(Ehrenberg & Zhang, 2004) or divided faculty into two categories, part-time and full-time (combining full-time non-tenure track and tenure track faculty together) (Liu & Zhang, 2007). Excluding or combining faculty types is unsatisfactory for a number of reasons. First, part-time faculty represent the fastest growing segment of the academic workforce, particularly at public institutions (AFT, 2009). Excluding part-time faculty undermines efforts to understand how institutions have changed their faculty employment strategies in response to changes in state funding. Second, substantial differences in employment conditions and job security exist between these three types of faculty (Anderson, 2002; Baldwin & Chronister, 2001; Ehrenberg, 2006). For example, full-time tenure track and non-tenure track differ dramatically in terms of their teaching loads, scholarly responsibilities, and employment contracts (Ehrenberg, 2006). To fully explain changes in faculty employment patterns at public institutions over time, this study follows the approach of Zhang and Liu (2010) to analyze all three major categories of faculty individually.

While faculty levels provide the most detailed measure of change for each type of faculty, it is also worthwhile to explore how the relative composition of faculty has changed over time in response to changes in state funding. To investigate changes in the relative proportions of each type of faculty, I will analyze two measures of faculty shares: the share of all faculty who are employed part-time, and the share of full-time faculty who are non-tenure track. The first variable will examine institutions' shift from a full-time to part-time faculty workforce, while the second variable will examine whether institutions move away from the tenure system in favor of full-time non-tenure track faculty as state funding decreases. This analysis of faculty shares will complement the

analysis of faculty levels by illustrating changes in the relative importance of part-time and non-tenure track faculty as institutions respond to their changing resource environments.

**Explanatory Variables**

The primary explanatory variable of interest for RQ2 and RQ3 is the amount of institutional revenue received through state appropriations per full-time equivalent (FTE) student. This measure includes the dollar amount of unrestricted state funding received through legislative appropriations divided by the number of total FTE students in each year. Additionally, I conduct a secondary analysis using an alternative measure of state funding: the share of total institutional revenue received through state appropriations. This variable is constructed by dividing total state appropriations by total institutional revenue.

As described in Equations (1) and (2), I control for a number of additional time-varying institution-level covariates to account for influences on faculty employment patterns as identified by past theoretical and empirical literature. I control for several categories of institutional revenue (scaled per FTE student) including net tuition and fees, federal appropriations, grants, and contracts (excluding Pell grants), and other revenue.[11] While state appropriations per FTE student is the key revenue variable of interest, revenue from tuition and federal sources may also have an important influence on institutions' faculty compositions. For example, Liu and Zhang (2007) found four-year institutions that received a greater share of funding from tuition and fees employed higher levels of part-time faculty. Increases in federal revenue, comprised primarily of research

[11] Includes revenue from private, local, and "other" sources (excluding auxiliary and hospital revenue, as these categories are generally self-supporting.)

contracts and grants, may lead to higher levels of contingent faculty through mechanisms related to academic capitalism. Because higher levels of contract and grant revenue is associated with higher levels of research activity, institutions may turn to part-time and non-tenure track faculty to meet instructional needs as tenure track faculty shift their attention to research (Slaughter & Leslie, 1997; Leslie et al., 2012).

Past studies have found full-time faculty salaries to be positively related to the number of part-time and non-tenure track faculty at four-year institutions (Ehrenberg & Zhang, 2004; Zhang & Liu, 2010). Institutions appear to substitute contingent faculty when the cost of employing tenure track faculty increases. I control for the average full-time faculty salary outlay to account for this relationship.

Recognizing that increases in faculty levels are likely a function of increases in institution size, I also control for changes in total FTE student enrollment. Past research has determined a strongly significant relationship between faculty levels and FTE student enrollment at four-year institutions (Zhang & Liu, 2010). This relationship is intuitive: when student enrollment increases, an institution must increase its instructional capacity to supply additional courses and sections to meet student demand. However, state appropriations have generally not kept up with the large increases in student enrollment at public institutions over the last two decades. Under these conditions, institutions will likely turn to contingent faculty to accommodate increases in enrollment without making long-term employment commitments (Davis-Blake & Uzzi, 1993; Kalleberg et al., 2003).

Informed by prior research, I also control for characteristics of student enrollment such as the number of part-time students and the share of non-resident students enrolled. Institutions with higher levels of part-time students have been found to employ higher

numbers of part-time faculty, possibly in order to better meet the demand for flexibly scheduled courses (Liu & Zhang, 2007; Zhang & Liu, 2010). Non-resident students pay higher tuition rates and have stronger academic backgrounds than resident students at public institutions (Jaquette & Curs, 2015; Rizzo & Ehrenberg, 2004; Volkwein & Grunig, 2005). Institutions that wish to attract non-resident students may hire more tenure track faculty, since they conduct research and enhance institutional prestige (Zhang & Liu, 2010). In order to adapt to decreases in state appropriations, institutions may choose to increase their enrollment of non-resident students, thereby generating additional tuition revenue rather than reduce instructional costs through the use of contingent faculty.

I also control for the percentage of degrees awarded in engineering and natural science. Contingent faculty are more likely to be found in professional programs such as business and law, vocational programs, and the humanities, and less likely to be employed in engineering and the natural sciences (Benjamin, 2002; Conley et al., 2002; Kezar & Maxey, 2012). Due to a lower supply of doctorates in science and engineering, the pool of contingent labor may be smaller in these fields (Zhang & Liu, 2010). When institutions serve a greater number of students in science and engineering, they may be less likely to turn to contingent faculty as a strategy for managing their resource dependencies.

At the state level, I control for state economic conditions as measured by the state unemployment rate and total state tax revenues. A state's economic health could influence both the amount of state appropriations available to public higher education institutions and the market for academic labor, so it is important to control for potential bias related to these variables.

## Limitations

This study has several important limitations. First, I attempt to estimate the causal effect of state appropriations on faculty composition by employing a two-way individual- and time-specific fixed effects model. While I attempt to control for many time-varying covariates identified as important in previous studies, other important factors such political or demographic shifts are more difficult to observe and their exclusion may confound the relationship between state appropriations and faculty employment. Because it is likely impossible to fully control for all sources of potential bias in this relationship, identifying an arguably unrelated (exogenous) source of variation in state appropriations may be preferable when attempting to estimate the causal effect of state funding.[12]

Second, the outcome variables of interest, faculty levels and faculty shares, are measured only at the institution level. IPEDS unfortunately does not contain department-level indicators of faculty by type. Descriptive analyses suggest substantial differences exist between disciplines in the hiring of contingent faculty (Cross & Goldenberg, 2009). For example, contingent faculty are more likely to be found in professional programs such as business and law, vocational programs, and the humanities, and less likely to be employed in engineering and the natural sciences (Benjamin, 2002; Conley et al., 2002; Kezar & Maxey, 2012). Although I attempt to control for these disciplinary differences by including a measure of the number of degrees awarded in engineering and natural science, this dissertation is only able to investigate institution-level trends in the hiring of

[12] A previous version of this study attempted to approximate the conditions of random assignment using instrumental variable estimation. However, the instrument (number of Medicaid recipients + number of prisoners in each state) was extremely weak, leading to unreliable estimates. I determined that the fixed effects approach was more appropriate for the current analysis, despite the increased potential for unobserved time-varying heterogeneity.

contingent faculty. Future research should examine potential within-institution differences in the determinants of faculty hiring using department-level data.

This dissertation attempts to examine faculty composition as a concrete measure of how changing state funding has influenced institutions' behavior and, perhaps, the educational experiences of students. Although I can observe the number of each type of faculty employed at each institution in each year, I cannot observe more detailed factors such as teaching workloads to determine the proportion of credit hours that are actually taught by contingent faculty. Using institutional data from the State University of New York system, Ehrenberg and Klaff (2003) determined that as the proportion of contingent faculty increased, the proportion of undergraduate credit hours taught by tenure track faculty decreased. These findings suggest that the numbers of contingent faculty employed by an institution may serve as a good indicator of who is actually teaching undergraduate students. Future studies that wish to examine the full extent of institutions' increased reliance on contingent faculty should make use of course-level data to glean information on credit hours, course levels, and other important characteristics.

Finally, this study explains how broad changes in public higher education finance have influenced faculty hiring at public institutions, but does not address the influence of specific federal, state, or institutional policies affecting academic employment behavior. This dissertation attempts to hold many of these federal, state, and local factors constant through the use of individual and year fixed effects in order to estimate the impact of state appropriations on faculty hiring. However, this analytic strategy is limited because it does not account for the influence of time-varying state or institutional policies that might mediate the relationship between state appropriations and faculty hiring, specifically

those that were enacted or discontinued during the analytic time period. An important example is the presence of collective bargaining units representing academic employees at public institutions. Recent data suggest that faculty unions have become more prevalent over the last decade at public and private institutions, particularly unions that represent contingent faculty, graduate students, and post-doctoral researchers (Berry & Savarese, 2012; Rhoades & Torres-Olave, 2015). About 36 percent of all faculty at public institutions were represented by a collective bargaining unit in 2012 (Berry & Savarese, 2012; National Center for Education Statistics, 2013). As described in Table 3.2, faculty unions were present at 349 public two-year and 101 public four-year institutions in 2012, with the frequency of faculty unionization varying considerably by state.

Collective bargaining influences many aspects of faculty employment relations such as salaries, benefits, and contract procedures, which may mediate institutions' perceived benefits of employing contingent faculty (Cross & Goldenberg, 2009; Gappa & Leslie, 1993). However, Rhoades' (1998) analysis of nearly 200 collective bargaining agreements found little evidence of contractual constraints on institutions' flexibility to hire, renew, or non-renew contingent faculty. Thus, the question of whether collective bargaining influences public institutions' hiring of contingent faculty as a strategy to increase organizational power and manage external dependencies deserves further analysis. Although obtaining institution-level data on faculty collective bargaining suitable for panel analyses would require a significant data collection effort, this is an important avenue for future research.

**Table 3.2 Number of public institutions with faculty unions by institution type and state**

| | Public 2-year | Public 4-year | | Public 2-year | Public 4-year |
|---|---|---|---|---|---|
| AK | 1 | 0 | NC | 0 | 0 |
| AL | 0 | 0 | ND | 0 | 0 |
| AR | 0 | 0 | NE | 6 | 3 |
| AZ | 0 | 0 | NH | 1 | 2 |
| CA | 73 | 2 | NJ | 19 | 4 |
| CT | 1 | 3 | NM | 2 | 1 |
| DC | 0 | 1 | NV | 1 | 0 |
| DE | 0 | 2 | NY | 32 | 2 |
| FL | 11 | 11 | OH | 15 | 8 |
| GA | 0 | 0 | OK | 0 | 0 |
| HI | 1 | 0 | OR | 15 | 4 |
| IA | 13 | 1 | PA | 14 | 4 |
| ID | 0 | 0 | RI | 1 | 2 |
| IL | 39 | 10 | SC | 0 | 0 |
| IN | 0 | 0 | SD | 2 | 1 |
| KS | 20 | 1 | TN | 0 | 0 |
| KY | 0 | 0 | TX | 0 | 0 |
| LA | 0 | 0 | UT | 0 | 0 |
| MA | 2 | 2 | VA | 0 | 0 |
| MD | 1 | 0 | VT | 0 | 2 |
| ME | 1 | 2 | WA | 30 | 4 |
| MI | 25 | 11 | WI | 16 | 7 |
| MN | 1 | 2 | WV | 0 | 0 |
| MO | 3 | 0 | WY | 0 | 0 |
| MS | 0 | 0 | | | |
| MT | 3 | 9 | Total | 195 | 57 |

Source: National Center for the Study of Collective Bargaining in Higher Education

Note: Systems with more than one institution (e.g., California State University) are only counted once. Systems with a mix of 2-year and 4-year institutions are included in the 2-year totals.

# CHAPTER 4

## Results

This chapter is organized into three sections corresponding to my research questions. The first section reports the results of the descriptive analysis of faculty employment patterns over time. I then present the results of the main fixed effects regressions estimating the relationship between state appropriations and my faculty outcomes of interest. Finally, I conclude the chapter by reporting the results of the state appropriations volatility extension.

## Descriptive Results

This section addresses my first two research questions: 1) How have faculty employment patterns changed over time at public higher education institutions? 2) Do changes in faculty employment patterns over time differ by institution type? I present descriptive findings regarding changes in the total faculty workforce at public institutions, followed by changes in faculty disaggregated by type (part-time, full-time non-tenure track, and tenure track). I conclude the descriptive findings with an analysis of changes in faculty composition by principal job activity.

### Total Faculty Workforce

Between the decades of 1994 and 2013, the average size of the total faculty workforce increased substantially across all types of public institutions, as illustrated in Table 4.1. Public non-research institutions experienced the most growth in faculty size

**Table 4.1 Faculty trends by institution type, 1994 & 2013**

| | Public Research Institutions | | Public Non-Research Institutions | | Community Colleges | |
|---|---|---|---|---|---|---|
| | **1994** | **2013** | **1994** | **2013** | **1994** | **2013** |
| | mean/sd | mean/sd | mean/sd | mean/sd | mean/sd | mean/sd |
| Number of total faculty | 1352.65 | 2060.21 | 358.10 | 558.86 | 322.07 | 492.67 |
| | 936.05 | 1469.85 | 267.15 | 418.72 | 382.78 | 599.55 |
| Number of total faculty per 1000 FTE students | 77.50 | 87.83 | 67.86 | 76.81 | 102.96 | 96.10 |
| | 24.80 | 42.17 | 26.63 | 22.77 | 59.08 | 35.89 |
| Number of part-time faculty | 274.50 | 536.95 | 112.62 | 249.16 | 209.02 | 342.11 |
| | 284.30 | 456.16 | 143.49 | 271.74 | 295.92 | 454.68 |
| Number of part-time faculty per 1000 FTE students | 16.10 | 24.07 | 21.44 | 32.87 | 64.87 | 63.56 |
| | 13.80 | 20.43 | 25.36 | 23.20 | 55.46 | 33.96 |
| Share of part-time faculty | 0.20 | 0.27 | 0.26 | 0.40 | 0.54 | 0.63 |
| | 0.13 | 0.13 | 0.21 | 0.17 | 0.26 | 0.16 |
| Number of full-time non-tenure track faculty | 244.81 | 361.90 | 32.69 | 64.55 | 43.83 | 59.96 |
| | 276.42 | 453.70 | 38.18 | 62.41 | 71.24 | 102.25 |
| Number of full-time non-tenure track faculty per 1000 FTE students | 13.43 | 15.10 | 6.80 | 9.75 | 19.14 | 18.08 |
| | 10.81 | 13.11 | 7.85 | 7.10 | 22.98 | 21.15 |
| Number of tenure track faculty | 833.34 | 846.18 | 213.50 | 227.20 | 69.50 | 75.07 |
| | 552.35 | 516.11 | 156.98 | 161.06 | 113.32 | 121.66 |
| Number of tenure track faculty per 1000 FTE students | 47.97 | 37.88 | 39.75 | 33.91 | 19.04 | 15.30 |
| | 13.17 | 11.79 | 12.62 | 10.06 | 18.11 | 15.24 |
| Share of tenure track faculty | 0.80 | 0.74 | 0.85 | 0.78 | 0.56 | 0.52 |
| | 0.11 | 0.12 | 0.16 | 0.15 | 0.46 | 0.46 |
| Total FTE students | 17052.30 | 22537.53 | 5455.90 | 7194.10 | 3287.36 | 4931.30 |
| | 9367.15 | 12217.83 | 3915.04 | 5619.38 | 4207.78 | 6284.50 |

during the time period, increasing about 56 percent from 358 to 559 total faculty on average. Public research institutions, which generally employ the largest number of faculty, increased their total faculty by about half, from 1,353 to 2,060 on average. Community colleges also increased their total faculty by about 53 percent, from 322 to 493 total faculty on average.

While experiencing growth in the size of their total faculty workforce, public institutions varied in their ability to maintain the size of their total faculty relative to their full-time equivalent (FTE) student enrollment. Between 1994 and 2013, community colleges saw their FTE student enrollment increase by about 50 percent, while public non-research and research institutions each experienced increases of about 32 percent. Despite demonstrating a 53 percent increase in average total faculty, community colleges actually decreased their total faculty per FTE student by nearly seven percent on average over the time period due to the dramatic increases in student enrollment. Public research institutions and non-research institutions increased their total faculty per FTE student by about 13 percent during the time period.

## Faculty Workforce by Type

### Part-time faculty.

At public non-research institutions and community colleges, most of the gains in total faculty between 1994 and 2013 occurred through the expansion of part-time faculty hiring. At public non-research institutions, 68 percent of the increase in average total faculty during the time period was attributed to part-time faculty. Public non-research institutions increased the size of their part-time faculty by a dramatic 121.2 percent on average, compared to an increase of just 26.2 percent in full-time faculty during the time

period. After adjusting for increases in student enrollment, public non-research institutions increased their average number of part-time faculty per FTE student by 53.3 percent. In 2013, part-time faculty comprised 39.8 percent of total faculty on average at public non-research institutions; approximately a third more than the average share of part-time faculty in 1994 (26.4 percent).

At community colleges, 78 percent of total faculty gains between 1994 and 2013 were due to increases in part-time faculty. Community colleges more than doubled the size of their part-time faculty workforce, increasing an average of 63.7 percent over the time period, compared to an increase of 33 percent in full-time faculty. However, on a per FTE student basis, community colleges actually decreased the average size of their part time faculty by about 2 percent. By 2013, part-time faculty outnumbered full-time faculty at community colleges, representing 63.4 percent of total faculty on average, an increase of about 17 percent in their share of faculty since 1994 (54.3 percent).

In contrast, public research institutions attributed a smaller share of their increase in total faculty over the time period to part-time faculty, approximately 37 percent on average. Still, public research institutions experienced a sizable increase in their part-time faculty workforce, increasing 95.6 percent between 1994 and 2013, compared to an increase in full-time faculty of 41.3 percent during the same period. The average number of part-time faculty per FTE student increased by nearly half at public research institutions. Public research institutions increased their share of part-time faculty by about 37 percent since 1994, from 19.5 percent to 26.8 percent of total faculty on average in 2013. Although public research institutions employ larger absolute numbers of part-time faculty than public non-research institutions and community colleges on average, part-

timers still represent a relatively small fraction of total faculty at public research institutions.

**Full-time tenure track and non-tenure track faculty.**

Between 1994 and 2013, the majority of public institutions' gains in total full-time faculty occurred off the tenure track. At public research institutions, approximately 90 percent of the increase in average total full-time faculty was due to the expansion of full-time non-tenure track faculty. Public research institutions increased the size of their non-tenure track faculty by approximately a third on average, while increasing their tenure track faculty by just 1.52 percent between 1994 and 2013. Accounting for changes in student enrollment, public research institutions increased their average number of full-time non-tenure track faculty per FTE student by 12.4 percent over the time period, while actually decreasing their average number of tenure track faculty per FTE student by nearly 27 percent. By 2013, about 74 percent of full-time faculty were tenure track at public research institutions on average, a decrease from about 80 percent in 1994.

At public non-research institutions, about 70 percent of the increase in total full-time faculty between 1994 and 2013 occurred off the tenure track. Public non-research institutions experienced the largest percentage gain of all public institutions in average total and per FTE student non-tenure track faculty, increasing by 49.4 percent and 43.4 percent, respectively. In contrast, public non-research institutions expanded the average size of their total tenure track faculty by just 6 percent during the time period, and decreased their average tenure track faculty per FTE student by 17.2 percent. In 2013, about 78 percent of full-time faculty were tenure track at public non-research institutions on average, a decline from 85 percent in 1994.

Although community colleges experienced increases in the average size of their full-time non-tenure track and tenure track faculty of about 26.9 percent and 7.41 percent respectively, these gains disappeared after accounting for changes in student enrollment during the time period. Between 1994 and 2013, the average number of non-tenure track faculty per FTE student decreased by 5.5 percent, while the average number of tenure track faculty per FTE decreased by nearly 25 percent. Tenure track faculty accounted for 52 percent of all full-time faculty at community colleges in 2013, decreasing from 55.7 percent in 1994.

**Faculty by Principal Job Activity**

Although many contingent faculty, particularly part-time faculty, are hired primarily to teach, the literature suggests that institutions also hire contingent faculty to perform a wider variety of responsibilities, such as research and administration (Baldwin & Chronister, 2001). For example, research institutions may hire full-time non-tenure track "research faculty" whose jobs are typically devoted exclusively to research activities, often sponsored or contracted research projects. I present data from the National Study of Postsecondary Faculty (NSOPF) to supplement institution-level data on faculty by type to provide a more detailed description of the primary job activities for which institutions are hiring contingent faculty and how these have changed over time. Using data from three waves of the NSOPF survey,[13] Table 4.2 describes trends in principal job activities reported by part-time, full-time non-tenure track, and tenure track faculty between 1993 and 2004. Across all types of public institutions, part-time faculty

[13] The first wave of NSOPF in 1988 included only faculty whose principal activity was instruction, so this wave is not included in the current analysis.

**Table 4.2 Principal job activity by faculty type & institution type; 1993-2004**

| | Public Research Institutions | | | Public Non-Research Institutions | | | Community Colleges | | |
|---|---|---|---|---|---|---|---|---|---|
| | **1993** | **1999** | **2004** | **1993** | **1999** | **2004** | **1993** | **1999** | **2004** |
| Part-time Faculty | | | | | | | | | |
| Teaching | 74.7 | 73.1 | 72.4 | 89.2 | 92.2 | 91.8 | 92.9 | 93.8 | 92.4 |
| Research | 8.3 | 5.8 | 9.0 | 2.3 | 1.0 | 0.7 | 0.4 | 0.0 | 0.0 |
| Administration | 2.9 | 2.7 | 1.9 | 0.7 | 1.7 | 0.7 | 1.2 | 1.5 | 0.6 |
| Other | 14.1 | 18.4 | 16.7 | 7.9 | 5.0 | 6.8 | 5.5 | 4.8 | 6.9 |
| | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |
| Non-tenure Track Faculty | | | | | | | | | |
| Teaching | 53.8 | 53.6 | 48.9 | 82.5 | 82.4 | 81.6 | 86.6 | 87.1 | 86.7 |
| Research | 22.8 | 23.0 | 29.1 | 2.2 | 1.6 | 2.6 | 0.4 | 0.2 | 0.1 |
| Administration | 11.7 | 12.2 | 11.2 | 10.7 | 10.5 | 10.6 | 7.8 | 6.5 | 5.8 |
| Other | 11.7 | 11.2 | 10.9 | 4.7 | 5.6 | 5.2 | 5.1 | 6.2 | 7.4 |
| | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |
| Tenure Track Faculty | | | | | | | | | |
| Teaching | 37.1 | 37.1 | 33.9 | 69.8 | 63.5 | 63.5 | 63.8 | 79.4 | 76.8 |
| Research | 25.9 | 19.6 | 27.0 | 2.9 | 2.7 | 2.1 | 0.3 | 0.6 | 0.1 |
| Administration | 14.1 | 15.3 | 11.8 | 15.2 | 22.3 | 14.2 | 24.3 | 13.9 | 12.2 |
| Other | 23.0 | 28.1 | 27.3 | 12.1 | 11.5 | 20.1 | 11.6 | 6.1 | 11.0 |
| | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |

Source: National Study of Postsecondary Faculty (NSOPF): 1993, 1999, 2004 waves

are clearly hired primarily to teach, with the proportion part-time faculty reporting teaching as their principal activity remaining fairly steady over the survey period. However, part-time faculty reported research or "other"[14] as their principal activity more frequently at public research institutions than other public institutions.

Full-time non-tenure track faculty most commonly reported teaching or administration as their principal activity at community colleges. In the 2004 NSOPF survey, a higher proportion of full-time non-tenure track faculty indicated teaching and

[14] "Other" may include technical activities, clinical service, community service, artist-in-residence, etc.

fewer reported administration as their primary activity than in earlier waves of the survey. At public non-research institutions, full-time non-tenure track faculty less frequently reported teaching as their principal activity between 1993 and 2004, while an increased proportion reported "other" as their principal activity over the survey period. At public research institutions, full-time non-tenure track faculty were more evenly split between teaching, research, and "other," with a smaller proportion indicating administration as their principal activity than at other public institutions. By 2004, only a third of full-time non-tenure track faculty reported teaching as their principal activity at public research institutions, while the proportion indicating research or "other" increased from earlier waves of the survey.

The majority of tenure track faculty at public non-research institutions and community colleges reported teaching as their principal activity, with the proportions remaining steady over the three survey waves. At public research institutions, however, the share of tenure track faculty primarily engaged in teaching dropped between 1993 and 2004, with less than half of tenure track faculty indicating teaching as their principal activity in 2004. The share of tenure track faculty reporting research as their principal activity increased over the survey period, reaching nearly 30 percent in 2004. Across all public institutions, the proportion of tenure track faculty primarily involved in administration and "other" remained fairly steady between 1993 and 2004.

## Summary of Descriptive Results

The total faculty workforce increased substantially between 1994 and 2013 across public institutions but did not keep pace with rising student enrollment at community colleges. Part-time faculty represented the fastest growing group of faculty at public

institutions, followed by full-time non-tenure track faculty. Tenure track faculty experienced the least growth of all faculty types, increasing by only single digit percentages on average over the time period. After accounting for increases in FTE student enrollment, the number of tenure track faculty per FTE student decreased between 17 and 26 percent across public institutions.

The primary activities for which public institutions hired contingent faculty differed by institution type between 1993 and 2004. Part-time faculty were primarily devoted to teaching at all public institutions, but also reported research, administrative, and other principal activities at public research institutions. Full-time non-tenure track faculty were also more likely to report teaching as their primary activity at non-research institutions and community colleges, but were more evenly split between teaching, research, and other activities at public research institutions. The proportion of full-time non-tenure track faculty devoted to teaching decreased at public research and non-research institutions, while increasing at community colleges between the 1993 and 2004 surveys.

## Fixed Effects Regression Results

The research questions guiding the analyses in this section are 1) What is the relationship between state funding and faculty employment patterns at public institutions? Do public institutions respond to declines in state funding by altering their faculty compositions? 2) Do public institutions with different missions and resource capacities (e.g., community colleges and public research universities) respond differently to declines in state appropriations in terms of their faculty employment strategies? I present models estimating the relationship between state appropriations and levels of part-time

faculty, full-time non-tenure track faculty, and tenure track faculty. I also present additional results estimating the relationship between state funding and the shares of part-time faculty and full-time non-tenure track faculty. For all models, I focus on reporting the results of state funding and the other institutional revenue variables of interest.

**Descriptive Statistics**

Table 4.3 presents descriptive statistics for the independent variables included in the fixed effects panel models of faculty employment.[15] I present descriptive statistics for the full sample and disaggregated by institution type in the years at the beginning and end of the analytic period (1994 and 2013). In 1994, public research institutions received the highest amount of state appropriations per student, while community colleges received the least amount, less than half of the amount allocated to public research institutions. By 2013, the gap in average per FTE state appropriations decreased slightly but persisted between institution types.

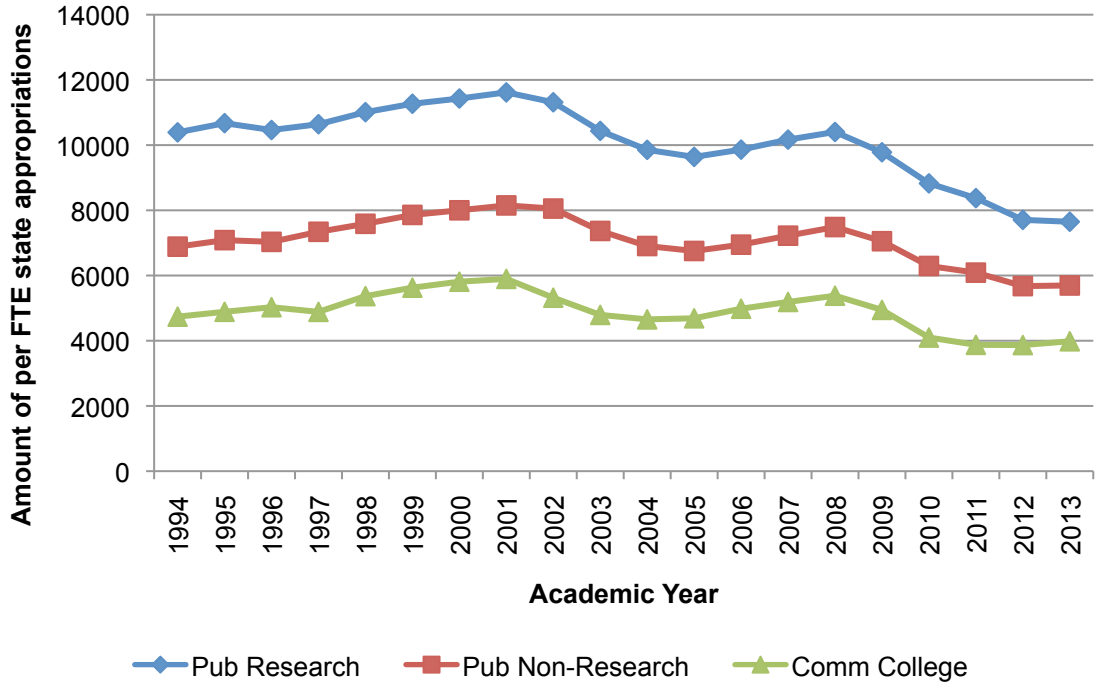
Mean state appropriations per FTE student declined between 1994 and 2013 across all public institution types. Public research universities experienced the largest percentage decrease in per student state appropriations on average (25.9 percent) while community colleges experienced the smallest percentage decrease over the time period (13.8 percent). Figure 4.1 displays mean state appropriations per FTE over time by institution type. Consistent with past research, state appropriations for higher education appear to vary according to the business cycle, increasing during periods of high economic growth, and decreasing during recessionary periods. However, the general

[15] The correlation matrix for all variables included in the fixed effects regression models is available in Table A.12.

**Table 4.3 Descriptive statistics for independent variables, 1994 & 2013**

| | Full Sample | | Public Research Institutions | | Public Non-Research Institutions | | Community Colleges | |
|---|---|---|---|---|---|---|---|---|
| | **1994** | **2013** | **1994** | **2013** | **1994** | **2013** | **1994** | **2013** |
| | mean/sd | mean/sd | mean/sd | mean/sd | mean/sd | mean/sd | mean/sd | mean/sd |
| State appropriations per FTE student | 5941.99 | 4799.09 | 10286.89 | 7613.87 | 6774.11 | 5669.92 | 4476.69 | 3856.87 |
| | 3375.07 | 3015.41 | 4112.23 | 3788.90 | 2546.64 | 2810.72 | 2288.23 | 2394.22 |
| State appropriations share of total revenue | 0.44 | 0.28 | 0.46 | 0.27 | 0.51 | 0.32 | 0.41 | 0.27 |
| | 0.14 | 0.12 | 0.09 | 0.09 | 0.10 | 0.10 | 0.16 | 0.12 |
| Net tuition & fees per FTE student | 3005.81 | 5303.08 | 5002.03 | 9920.41 | 3717.02 | 6935.47 | 2177.40 | 3670.86 |
| | 1659.28 | 3060.18 | 2016.39 | 3372.14 | 1281.05 | 2153.31 | 1025.42 | 1686.94 |
| Federal revenue per FTE student | 2044.54 | 3863.27 | 4376.17 | 6691.86 | 1674.63 | 3010.11 | 1643.47 | 3650.44 |
| | 1898.18 | 2690.98 | 3493.45 | 4930.57 | 1268.41 | 2280.59 | 932.98 | 1639.41 |
| Other revenue per FTE student | 2318.83 | 3022.51 | 3230.33 | 5410.03 | 1196.40 | 1844.95 | 2623.45 | 3037.14 |
| | 2049.57 | 3056.96 | 2280.91 | 4577.19 | 1099.73 | 1597.43 | 2117.32 | 2854.94 |
| Share of degrees awarded in natural science & engineering | 0.08 | 0.08 | 0.16 | 0.17 | 0.09 | 0.09 | 0.06 | 0.05 |
| | 0.09 | 0.08 | 0.11 | 0.11 | 0.10 | 0.08 | 0.06 | 0.06 |
| Share of non resident students | 0.10 | 0.10 | 0.18 | 0.22 | 0.14 | 0.15 | 0.05 | 0.06 |
| | 0.11 | 0.12 | 0.14 | 0.15 | 0.12 | 0.14 | 0.07 | 0.07 |
| Number of part-time students | 4150.51 | 4684.98 | 5883.60 | 5276.00 | 2397.56 | 2505.59 | 4549.83 | 5490.42 |
| | 5450.54 | 6937.72 | 4138.12 | 3383.10 | 2215.52 | 3013.42 | 6497.74 | 8336.33 |
| Total full-time equivalent (FTE) students | 6397.67 | 8092.47 | 17279.08 | 22583.47 | 5863.81 | 7395.84 | 3963.24 | 5441.65 |
| | 7061.85 | 9110.81 | 9367.41 | 12055.92 | 3957.67 | 5608.25 | 4635.15 | 6516.76 |
| Average full-time faculty salary outlay | 62634.57 | 62837.81 | 75402.03 | 81790.99 | 65366.48 | 65290.38 | 58193.49 | 57942.13 |
| | 13496.60 | 15159.88 | 10395.46 | 14199.08 | 11614.82 | 10890.72 | 12633.48 | 13549.01 |
| State unemployment rate | 6.65 | 8.64 | 6.59 | 8.64 | 6.65 | 8.32 | 6.66 | 8.78 |
| | 1.42 | 1.74 | 1.31 | 1.79 | 1.51 | 1.72 | 1.41 | 1.72 |
| Total state tax revenue (in millions) | 21230.00 | 29100.00 | 18750.00 | 25930.00 | 19760.00 | 28060.00 | 22530.00 | 30180.00 |
| | 19920.00 | 30040.00 | 18100.00 | 26930.00 | 20000.00 | 29710.00 | 20230.00 | 30750.00 |

**Figure 4.1 Mean state appropriations per FTE student by institution type, 1994-2013**




trend for per FTE state appropriations is downward, as states have generally not restored funding for higher education to pre-recession levels.

Turning to the other institutional revenue categories displayed in Table 4.3, the descriptive trends reveal that public institutions vary in their ability to generate alternative revenue to replace losses in state appropriations. For example, between 1994 and 2013, public research institutions nearly doubled the amount of revenue received from net tuition and fees per FTE student, on average. Non-research institutions increased their per FTE net tuition and fees revenue by 87 percent, while community colleges saw a 68.6 percent average increase over the time period.

**Faculty Levels**

The models described in this section estimate the relationship between state appropriations and logged levels of faculty by type, both with and without institution- and state-level controls. Unless otherwise specified, columns (1) and (2) of the results tables contain the full sample of public institutions, columns (3) and (4) contain results for public research institutions, columns (5) and (6) contain the results for public non-research institutions, and columns (7) and (8) represent the results for community colleges. In addition to the detailed results tables discussed for each dependent variable, I present a summary of findings for the key predictor of interest, per-FTE state appropriations, in Table 4.4.

**Table 4.4 The relationship between state appropriations/FTE and faculty outcomes: summary**

| | Full sample | 4-year Research | 4-year Non-Research | 2-year |
|---|---|---|---|---|
| | (1) | (2) | (3) | (4) |
| Log Part-time Faculty | 0.004 | 0.461+ | 0.134 | -0.006 |
| | (0.026) | (0.240) | (0.135) | (0.025) |
| | [-0.048,0.055] | [-0.014,0.935] | [-0.131,0.399] | [-0.055,0.042] |
| Log Non-Tenure Track Faculty | 0.097** | 0.264+ | 0.082 | 0.116** |
| | (0.037) | (0.145) | (0.098) | (0.041) |
| | [0.024,0.170] | [-0.021,0.550] | [-0.110,0.275] | [0.035,0.197] |
| Tenure Track Faculty | 0.067** | 0.145*** | 0.228*** | 0.049* |
| | (0.02) | (0.033) | (0.029) | (0.021) |
| | [0.027,0.107] | [0.080,0.210] | [0.170,0.286] | [0.008,0.090] |
| Part-time Faculty Share | -0.014* | -0.006 | -0.031+ | -0.014* |
| | (0.005) | (0.028) | (0.019) | (0.006) |
| | [-0.025,-0.003] | [-0.062,0.050] | [-0.069,0.006] | [-0.026,-0.002] |
| Non-tenure Track Faculty Share | -0.012 | 0.033 | -0.014 | -0.011 |
| | (0.008) | (0.021) | (0.013) | (0.009) |
| | [-0.027,0.003] | [-0.009,0.076] | [-0.040,0.012] | [-0.028,0.006] |

$^{+}$p<0.10, *p<0.05, **p<0.01, ***p<0.001

Robust std errors in parentheses; 95% confidence intervals in brackets

**Part-time faculty.**

Table 4.5 presents fixed effects regression results for the log number of part-time faculty as the dependent variable. The coefficient for logged state appropriations per FTE student is negative for public non-research institutions ($p<.05$) and community colleges ($p<.001$) when controlling for individual and year fixed effects only. When institution- and state level controls are added to the models, the point estimates for per-FTE state appropriations are no longer significant. These results are inconsistent with **H1** and **H3**, which predicted that state appropriations would be negatively related to part-time faculty, and that this relationship would be stronger at non-research institutions and community colleges. Interestingly, the relationship between state appropriations and the log number of part-time faculty is positive at public research institutions after including control variables ($p<.10$). This finding, which is also inconsistent with **H1**, indicates that public research institutions decrease their log number of part-time faculty by .46 percent in response to a one percent decline in state appropriations per-FTE student (95% CI [-0.014, 0.935]).[16]

After accounting for per-FTE state appropriations and controls, the other institutional revenue categories are not significantly related to the log levels of part-time faculty, with the exception of net tuition and fees revenue per FTE student at public non-research institutions ($p<.05$). This finding is consistent with the theoretical argument that institutions will hire more flexible part-time faculty to manage their dependence on highly variable sources of revenue such as tuition and fees.

[16] 95% confidence intervals are reported in the summary table for this section (Table 4.3).

**Table 4.5 The relationship between state appropriations/FTE and log levels of part-time faculty**

| | Full sample | | 4-year Research | | 4-year Non-Research | | 2-year | |
|---|---|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
| Log state appropriations/FTE | -0.105*** | 0.004 | 0.067 | 0.461+ | -0.210* | 0.134 | -0.102*** | -0.006 |
| | (0.026) | (0.026) | (0.194) | (0.240) | (0.099) | (0.135) | (0.027) | (0.025) |
| Log net tuition revenue/FTE | | 0.090* | | 0.243 | | 0.268* | | 0.036 |
| | | (0.042) | | (0.272) | | (0.122) | | (0.041) |
| Log federal revenue/FTE | | -0.042 | | 0.061 | | 0.088 | | -0.027 |
| | | (0.026) | | (0.131) | | (0.072) | | (0.030) |
| Log other revenue/FTE+ | | 0.034+ | | -0.040 | | 0.061 | | 0.019 |
| | | (0.020) | | (0.044) | | (0.050) | | (0.023) |
| Percent engin/sci degrees | | -0.168 | | -0.993 | | 0.458 | | -0.290 |
| | | (0.238) | | (0.945) | | (0.779) | | (0.256) |
| Percent non-resident students | | -0.239+ | | -0.894 | | 0.162 | | -0.202 |
| | | (0.138) | | (0.559) | | (0.377) | | (0.142) |
| Log total part-time students | | 0.027 | | 0.190 | | -0.002 | | 0.138* |
| | | (0.056) | | (0.179) | | (0.112) | | (0.065) |
| Log total FTE students | | 0.643*** | | 1.205** | | 1.081*** | | 0.539*** |
| | | (0.083) | | (0.433) | | (0.244) | | (0.085) |
| Log avg. full-time faculty salary | | 0.037 | | -0.031 | | 0.051 | | -0.018 |
| | | (0.023) | | (0.051) | | (0.034) | | (0.033) |
| State unemployment rate | | -0.004 | | 0.041 | | 0.036 | | -0.029** |
| | | (0.011) | | (0.035) | | (0.028) | | (0.011) |
| Log state tax revenue | | 0.126 | | -0.309 | | 0.279 | | 0.046 |
| | | (0.124) | | (0.312) | | (0.263) | | (0.155) |
| Independent variables lagged one year | | | | | | | | |
| Institution fixed effects | x | x | x | x | x | x | x | x |
| Year fixed effects | x | x | x | x | x | x | x | x |
| Institution- & state-level controls | | x | | x | | x | | x |
| R2 (within) | 0.152 | 0.170 | 0.180 | 0.216 | 0.190 | 0.217 | 0.130 | 0.156 |
| Observations | 15145 | 15145 | 2066 | 2066 | 3936 | 3936 | 9143 | 9143 |
| Institutions | 1357 | 1357 | 160 | 160 | 334 | 334 | 863 | 863 |
| F | 43.762 | 31.720 | 11.348 | 8.907 | 17.192 | 12.233 | 23.398 | 21.864 |

+p<0.10, *p<0.05, **p<0.01, ***p<0.001

Robust std errors in parentheses; errors clustered at institution level

Across samples, most of the institution- and state-level control variables are not statistically significant after including individual and year fixed effects. However, the log total number of FTE students proves to be a major exception: it is the strongest predictor of part-time faculty levels across all samples ($p<.01$). A one percent increase in the number of total FTE students is associated with a greater than one percent increase in the number of part-time faculty at four-year research and non-research institutions, suggesting that part-time faculty hiring is highly responsive to increases in student enrollment at these institution types. The coefficient for total FTE students is less than one at community colleges, which is consistent with the descriptive finding that community colleges have generally not been able to increase the size of their part-time faculty in pace with enrollment demand. The strong positive link between total FTE student enrollment and the number of part-time faculty is consistent with past studies of the determinants of contingent faculty hiring (Zhang & Liu, 2010).

**Full-time non-tenure track faculty.**

Table 4.6 describes the regression results for the log number of full-time non-tenure track faculty as the dependent variable. At public non-research institutions, per-FTE state appropriations is negatively related to the log level of non-tenure track faculty, but this coefficient loses statistical significance after the addition of institution- and state-level controls. State appropriations per FTE student is positively related to the level of non-tenure track faculty at community colleges ($p<.01$) and research institutions ($p<.10$) in the specifications with controls. At community colleges, a one percent increase in state per-FTE state appropriations is associated with a .12 percent increase in the number of non-tenure track faculty (95% CI [0.035, 0.197]). Public research institutions increase

**Table 4.6 The relationship between state appropriations/FTE and log levels of non-tenure track faculty**

| | Full sample | | 4-year Research | | 4-year Non-Research | | 2-year | |
|---|---|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
| Log state appropriations/FTE | -0.018 | 0.097** | 0.081 | 0.264+ | -0.270** | 0.082 | 0.006 | 0.116** |
| | (0.035) | (0.037) | (0.138) | (0.145) | (0.093) | (0.098) | (0.038) | (0.041) |
| Log net tuition revenue/FTE | | 0.066+ | | 0.051 | | -0.053 | | 0.039 |
| | | (0.036) | | (0.108) | | (0.097) | | (0.040) |
| Log federal revenue/FTE | | -0.009 | | 0.193** | | 0.075 | | 0.021 |
| | | (0.026) | | (0.072) | | (0.046) | | (0.035) |
| Log other revenue/FTE+ | | 0.003 | | -0.017 | | -0.015 | | -0.009 |
| | | (0.019) | | (0.035) | | (0.033) | | (0.026) |
| Percent engin/sci degrees | | 0.011 | | -0.060 | | -0.227 | | -0.029 |
| | | (0.232) | | (0.611) | | (0.580) | | (0.281) |
| Percent non-resident students | | -0.130 | | 0.340 | | -0.265 | | -0.140 |
| | | (0.166) | | (0.335) | | (0.226) | | (0.229) |
| Log total part-time students | | -0.066 | | 0.111 | | -0.044 | | 0.081 |
| | | (0.045) | | (0.135) | | (0.062) | | (0.069) |
| Log total FTE students | | 0.654*** | | 0.483 | | 1.174*** | | 0.622*** |
| | | (0.088) | | (0.318) | | (0.162) | | (0.110) |
| Log avg. full-time faculty salary | | 0.006 | | 0.000 | | 0.019 | | -0.109*** |
| | | (0.014) | | (0.029) | | (0.017) | | (0.032) |
| State unemployment rate | | -0.034*** | | -0.012 | | -0.015 | | -0.040* |
| | | (0.010) | | (0.016) | | (0.017) | | (0.016) |
| Log state tax revenue | | -0.168+ | | -0.501 | | -0.229+ | | -0.029 |
| | | (0.095) | | (0.304) | | (0.134) | | (0.138) |
| Independent variables lagged one year | | | | | | | | |
| Institution fixed effects | x | x | x | x | x | x | x | x |
| Year fixed effects | x | x | x | x | x | x | x | x |
| Institution- & state-level controls | | x | | x | | x | | x |
| R2 (within) | 0.077 | 0.094 | 0.239 | 0.257 | 0.229 | 0.274 | 0.025 | 0.051 |
| Observations | 13591 | 13591 | 2071 | 2071 | 4017 | 4017 | 7503 | 7503 |
| Institutions | 1325 | 1325 | 160 | 160 | 333 | 333 | 832 | 832 |
| F | 23.781 | 17.248 | 16.279 | 14.647 | 22.087 | 19.544 | 6.278 | 7.091 |

+p<0.10, *p<0.05, **p<0.01, ***p<0.001

Robust std errors in parentheses; errors clustered at institution level

their number of non-tenure track faculty by .26 percent in response to a one percent increase in state appropriations (95% CI [-0.021, 0.550]). This result is inconsistent with **H1**, which predicted a negative relationship between state funding and non-tenure track faculty at public institutions.

Similar to the other faculty models presented in this section, other institutional revenue categories are not statistically significant predictors of non-tenure track faculty levels, with the exception of federal revenue per FTE student. At public research institutions, federal revenue per FTE student (which is largely comprised of grants and contracts related to research) is positively related to the level of non-tenure track faculty ($p<.01$). When federal research funding increases, institutions may hire additional non-tenure track faculty to take on teaching responsibilities as tenure track faculty shift a greater amount of their attention toward research. This finding is consistent with the descriptive analysis of NSOPF data presented in the previous section, which demonstrated that the share of tenure track faculty reporting teaching as their principal activity declined while the share reporting research as their primary activity increased between 1993 and 2004.

Several interesting findings emerged from the control variables in the non-tenure track faculty model. Increases in total FTE student enrollment are strongly associated with increases in the number of full-time non-tenure track faculty at public non-research institutions and community colleges ($p<.001$), providing additional evidence of a close positive relationship between student enrollment and faculty hiring. At community colleges, the average full-time faculty salary outlay[17] is negatively related to the number

[17] The average full-time faculty salary outlay includes the salaries of both tenure track and non-tenure track faculty.

of full-time non-tenure tenure track faculty. Consistent with past research on the determinants of contingent faculty hiring, this finding indicates that community colleges employ fewer full-time non-tenure track faculty when the average salary outlay for full-time faculty increases.

**Tenure track faculty.**

The regression results for the log number of tenure track faculty are presented in Table 4.7. After including institution- and state-level controls, state appropriations per FTE student is positive and significant across all models ($p<.05$), indicating that increases in per FTE state appropriations are associated with increases in the level of tenure track faculty at all public institution types. A one percent increase in per-FTE state appropriations is associated with a .15 percent increase in the log number of tenure track faculty at public research institutions (95% CI [0.080, 0.210]), .23 percent at public non-research institutions (95% CI [0.170, 0.286]), and .05 percent at community colleges (95% CI [0.008, 0.090]). These findings are consistent with **H1**, which predicted that institutions will hire fewer tenure track faculty when state appropriations decrease. The coefficient for per FTE state appropriations is highest for non-research institutions, which partially supports the hypothesis that the relationship between state funding and faculty hiring will be strongest at non-research institutions and community colleges (**H3**).

Similar to the non-tenure track faculty models discussed above, federal revenue per FTE student is positively related to the level of tenure track faculty at public research

**Table 4.7 The relationship between state appropriations/FTE and log levels of tenure track faculty**

| | Full sample | | 4-year Research | | 4-year Non-Research | | 2-year | |
|---|---|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
| Log state appropriations/FTE | 0.023 | 0.067** | 0.063 | 0.145*** | 0.020 | 0.228*** | 0.020 | 0.049* |
| | (0.015) | (0.020) | (0.040) | (0.033) | (0.026) | (0.029) | (0.018) | (0.021) |
| Log net tuition revenue/FTE | | 0.017 | | 0.041 | | 0.088+ | | -0.010 |
| | | (0.020) | | (0.029) | | (0.047) | | (0.022) |
| Log federal revenue/FTE | | -0.003 | | 0.045* | | 0.012 | | 0.014 |
| | | (0.012) | | (0.019) | | (0.018) | | (0.015) |
| Log other revenue/FTE[+] | | 0.021* | | 0.036*** | | 0.011 | | 0.029+ |
| | | (0.011) | | (0.008) | | (0.010) | | (0.018) |
| Percent engin/sci degrees | | 0.099 | | -0.080 | | 0.034 | | 0.167 |
| | | (0.153) | | (0.088) | | (0.350) | | (0.205) |
| Percent non-resident students | | 0.035 | | -0.043 | | 0.007 | | 0.065 |
| | | (0.056) | | (0.064) | | (0.060) | | (0.086) |
| Log total part-time students | | -0.055* | | 0.000 | | -0.019 | | -0.079 |
| | | (0.026) | | (0.025) | | (0.020) | | (0.060) |
| Log total FTE students | | 0.460*** | | 0.575*** | | 0.658*** | | 0.464*** |
| | | (0.070) | | (0.064) | | (0.085) | | (0.105) |
| Log avg. full-time faculty salary | | 0.002 | | 0.000 | | 0.003 | | -0.023 |
| | | (0.005) | | (0.005) | | (0.005) | | (0.017) |
| State unemployment rate | | 0.004 | | 0.000 | | 0.002 | | 0.014 |
| | | (0.005) | | (0.004) | | (0.006) | | (0.009) |
| Log state tax revenue | | 0.169*** | | 0.036 | | -0.010 | | 0.338*** |
| | | (0.038) | | (0.042) | | (0.042) | | (0.083) |
| Independent variables lagged one year | x | x | x | x | x | x | x | x |
| Institution fixed effects | x | x | x | x | x | x | x | x |
| Year fixed effects | x | x | x | x | x | x | x | x |
| Institution- & state-level controls | | x | | x | | x | | x |
| R2 (within) | 0.011 | 0.066 | 0.081 | 0.225 | 0.043 | 0.175 | 0.009 | 0.057 |
| Observations | 11992 | 11992 | 2061 | 2061 | 4015 | 4015 | 5916 | 5916 |
| Institutions | 1081 | 1081 | 160 | 160 | 331 | 331 | 590 | 590 |
| F | 4.670 | 7.287 | 8.766 | 11.608 | 5.562 | 9.799 | 2.624 | 3.952 |

[+]p<0.10, *p<0.05, **p<0.01, ***p<0.001

Robust std errors in parentheses; errors clustered at institution level

institutions ($p<.05$). "Other" revenue per FTE student, which includes revenue from private, local, and other sources, is also positively related to the number of tenure track faculty at research institutions and community colleges. These findings support the argument that public institutions will respond to decreases in key institutional revenue categories by hiring fewer tenure track faculty. These findings also suggest that in addition to changes in state appropriations, shifts in other types of institutional revenue may influence the employment of tenure track faculty.

As observed in the models predicting part-time and non-tenure track faculty levels, the total number of FTE students is a strong predictor of tenure track faculty levels across all public institution types. However, the coefficients for total FTE students are generally lower in the tenure track faculty models than the part-time (Table 4.5) and non-tenure track faculty models (Table 4.6), suggesting that tenure track faculty levels may be less responsive to total student enrollment than contingent faculty levels. These findings are consistent with the descriptive results discussed above, which found that tenure track faculty levels have generally not kept pace with student enrollment at public institutions over time.

**Faculty Shares**

Tables 4.8 and 4.9 describe the fixed effects regression results estimating the relationship between state funding and the *share* of part-time faculty and full-time non-tenure track faculty, respectively. Whereas the previously described models estimate levels of each type of faculty independent of each other, the analysis of faculty shares describes changes in the proportion of part-time faculty relative to full-time faculty, and in the proportion of full-time non-tenure track faculty relative to tenure track faculty.

**Table 4.8 The relationship between state appropriations/FTE and the share of part-time faculty**

| | Full sample | | 4-year Research | | 4-year Non-Research | | 2-year | |
|---|---|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
| Log state appropriations/FTE | -0.020*** | -0.014* | -0.019 | -0.006 | -0.032* | -0.031+ | -0.019** | -0.014* |
| | (0.005) | (0.005) | (0.022) | (0.028) | (0.016) | (0.019) | (0.006) | (0.006) |
| Log net tuition revenue/FTE | | 0.005 | | 0.006 | | 0.009 | | 0.006 |
| | | (0.007) | | (0.027) | | (0.016) | | (0.008) |
| Log federal revenue/FTE | | -0.007 | | -0.019 | | -0.001 | | -0.011 |
| | | (0.005) | | (0.015) | | (0.010) | | (0.007) |
| Log other revenue/FTE+ | | -0.007 | | -0.008 | | 0.010 | | -0.012+ |
| | | (0.005) | | (0.006) | | (0.007) | | (0.006) |
| Percent engin/sci degrees | | -0.113* | | -0.115 | | 0.048 | | -0.162* |
| | | (0.058) | | (0.121) | | (0.146) | | (0.071) |
| Percent non-resident students | | -0.083** | | -0.092 | | -0.033 | | -0.093* |
| | | (0.028) | | (0.057) | | (0.056) | | (0.036) |
| Log total part-time students | | 0.021* | | 0.037* | | 0.011 | | 0.019 |
| | | (0.009) | | (0.018) | | (0.014) | | (0.014) |
| Log total FTE students | | 0.028+ | | 0.026 | | 0.058+ | | 0.015 |
| | | (0.017) | | (0.050) | | (0.032) | | (0.022) |
| Log avg. full-time faculty salary | | 0.002 | | -0.003 | | 0.003 | | 0.011 |
| | | (0.004) | | (0.006) | | (0.004) | | (0.010) |
| State unemployment rate | | -0.004* | | 0.002 | | -0.001 | | -0.008** |
| | | (0.002) | | (0.004) | | (0.004) | | (0.003) |
| Log state tax revenue | | 0.018 | | -0.021 | | 0.080+ | | -0.006 |
| | | (0.023) | | (0.032) | | (0.048) | | (0.034) |
| Independent variables lagged one year | | | | | | | | |
| Institution fixed effects | x | x | x | x | x | x | x | x |
| Year fixed effects | x | x | x | x | x | x | x | x |
| Institution- & state-level controls | | x | | x | | x | | x |
| R2 (within) | 0.119 | 0.127 | 0.098 | 0.117 | 0.182 | 0.194 | 0.113 | 0.122 |
| Observations | 15613 | 15613 | 2081 | 2081 | 4093 | 4093 | 9439 | 9439 |
| Institutions | 1359 | 1359 | 160 | 160 | 334 | 334 | 865 | 865 |
| F | 32.192 | 20.327 | 5.093 | 4.068 | 15.810 | 10.284 | 17.415 | 11.451 |

+p<0.10, *p<0.05, **p<0.01, ***p<0.001

Robust std errors in parentheses; errors clustered at institution level

**Table 4.9 The relationship between state appropriations/FTE and the share of full-time non-tenure track faculty**

| | Full sample | | 4-year Research | | 4-year Non-Research | | 2-year | |
|---|---|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
| Log state appropriations/FTE | -0.018* | -0.012 | 0.012 | 0.033 | -0.035** | -0.014 | -0.017* | -0.011 |
| | -0.007 | -0.008 | -0.023 | -0.021 | -0.013 | -0.013 | -0.008 | -0.009 |
| Log net tuition revenue/FTE | | -0.004 | | 0.009 | | -0.007 | | -0.008 |
| | | -0.008 | | -0.017 | | -0.016 | | -0.009 |
| Log federal revenue/FTE | | -0.004 | | 0.012 | | 0.01 | | -0.003 |
| | | -0.005 | | -0.011 | | -0.007 | | -0.007 |
| Log other revenue/FTE+ | | -0.005 | | -0.010+ | | 0.002 | | -0.011 |
| | | -0.005 | | -0.006 | | -0.008 | | -0.007 |
| Percent engin/sci degrees | | 0.016 | | 0.045 | | -0.05 | | 0.024 |
| | | -0.064 | | -0.12 | | -0.112 | | -0.086 |
| Percent non-resident students | | -0.002 | | 0.06 | | 0.015 | | -0.01 |
| | | -0.033 | | -0.059 | | -0.033 | | -0.046 |
| Log total part-time students | | -0.002 | | 0.026 | | 0.004 | | 0.006 |
| | | -0.01 | | -0.023 | | -0.009 | | -0.017 |
| Log total FTE students | | 0.013 | | -0.005 | | 0.059+ | | 0.009 |
| | | -0.019 | | -0.053 | | -0.031 | | -0.025 |
| Log avg. full-time faculty salary | | 0.001 | | 0 | | 0.004 | | -0.009* |
| | | -0.002 | | -0.005 | | -0.002 | | -0.005 |
| State unemployment rate | | -0.003+ | | -0.001 | | -0.001 | | -0.005+ |
| | | -0.002 | | -0.003 | | -0.003 | | -0.003 |
| Log state tax revenue | | -0.059** | | -0.097+ | | -0.024 | | -0.086* |
| | | -0.023 | | -0.058 | | -0.019 | | -0.041 |
| Independent variables lagged one year | | | | | | | | |
| Institution fixed effects | x | x | x | x | x | x | x | x |
| Year fixed effects | x | x | x | x | x | x | x | x |
| Institution- & state-level controls | | x | | x | | x | | x |
| R2 (within) | 0.022 | 0.024 | 0.208 | 0.227 | 0.112 | 0.121 | 0.01 | 0.014 |
| Observations | 15595 | 15595 | 2081 | 2081 | 4093 | 4093 | 9421 | 9421 |
| Institutions | 1359 | 1359 | 160 | 160 | 334 | 334 | 865 | 865 |
| F | 9.878 | 7.444 | 22.72 | 15.975 | 10.402 | 8.653 | 3.884 | 3.055 |

+p<0.10, *p<0.05, **p<0.01, ***p<0.001

Robust std errors in parentheses; errors clustered at institution level

**Part-time faculty share.**

After including institution- and state-level controls, state appropriations per FTE student is negatively related to the part-time share of total faculty at non-research institutions ($p<.10$) and community colleges ($p<.05$), as described in Table 4.8. This finding is consistent with the hypothesis that a decrease in state funding will lead to an increase in the share of part-time faculty (**H2**). At public non-research institutions, a one percent decrease in per FTE state appropriations is associated with a 3.1 percentage point increase in the share of part-time faculty (95% CI [-0.069, 0.006]). At community colleges, a one percent decrease in per FTE state appropriations is estimated to lead to a 1.4 percentage point increase in the share of total faculty who are part-time (95% CI [-0.026, -0.002]). Per-student state appropriations is not a significant predictor of the share of part-time faculty at public research institutions, which provides support for this study's hypothesis that the relationship between state funding and the share of part-time faculty will be strongest at non-research institutions and community colleges (**H3**).

**Non-tenure track faculty share.**

Table 4.9 describes the results of the non-tenure track faculty share models. State appropriations per FTE student is negatively related to the share of full-time faculty who are non-tenure track at public non-research institutions ($p<.01$) and community colleges ($p<.05$) in the models including fixed effects only. However, after controlling for institution- and state-level covariates, the coefficients for state appropriations are no longer significant for either institution type. Similarly, the relationship between state appropriations and non-tenure track faculty share at public research institutions is not statistically significant. These results are inconsistent with **H2**, which predicted that a

reduction in state appropriations will lead to an increase in the share of full-time faculty who are off the tenure track.

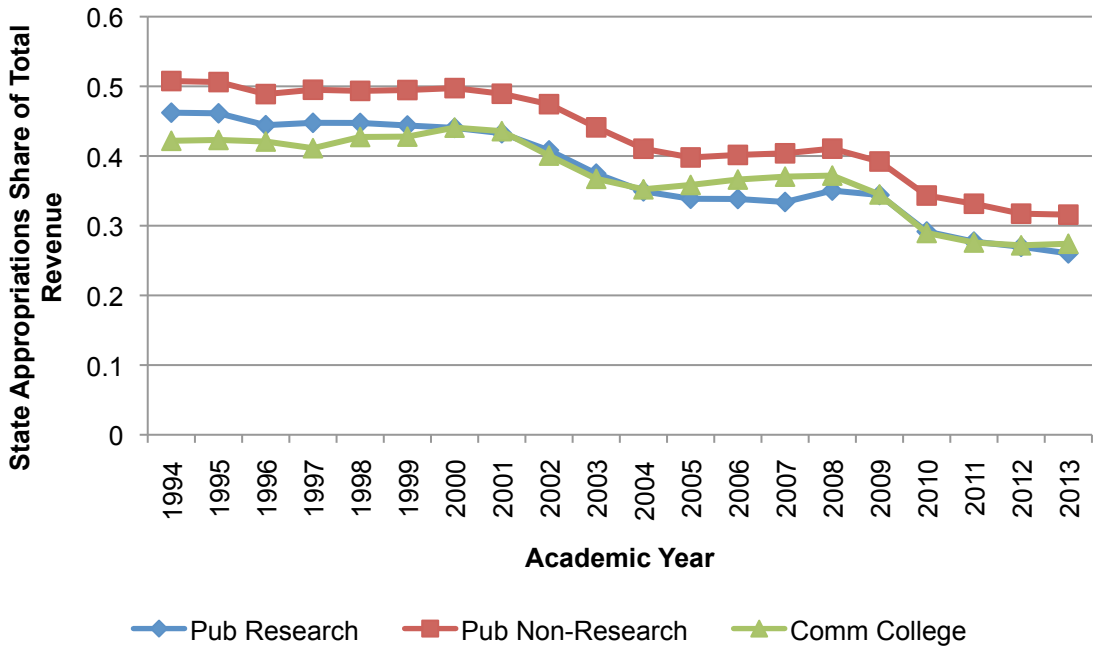
**Secondary Analysis Using State Appropriations Share of Total Revenue**

I conducted a secondary analysis of the relationship between state appropriations and faculty employment using an alternative measure of state funding: the share of total institutional revenue received through state appropriations. Figure 4.2 illustrates changes in the mean state appropriations share of total revenue over time by institution type. Similar to the trends observed in per-FTE student appropriations (Figure 4.1), the average share of institutional revenue provided by state appropriations decreased steadily from 1994 to 2013, between 19.4 and 13.8 percentage points depending on institution type.[18] Public institutions relied on state appropriations for about half of their total revenue[19] on average in 1994, but that portion decreased to a third or less by 2013. On average, public research institutions received the smallest share of total institutional revenue from state appropriations in 2013, followed by community colleges and public four-year non-research institutions.

[18] The state share of total institutional revenue for community colleges is lower than what is generally documented (e.g., Desrochers & Wellman, 2011) because these reports typically combine state AND local revenues.

[19] The total revenue variable excludes auxiliary and hospital revenues as these operations are generally self-supporting (see Table A.6 for variable definitions).

**Figure 4.2 Mean state appropriations share of total revenue by institution type, 1994-2013**




As summarized in Table 4.10, the relationships between state appropriations and faculty employment are highly robust to the alternative definition of state funding.[20] Across all faculty models, the coefficients for state appropriations per FTE and state appropriations share are identical in terms of sign but vary slightly in the precision and statistical significance of the estimates. At public research institutions and community colleges, some important relationships emerged from the secondary analysis. At public research institutions, the state appropriations share of total institutional revenue is positively related to the share full-time faculty who are non-tenure track (p.<.10). This finding, which suggests that public research institutions decrease their share of non-tenure track faculty when state appropriations decrease, is inconsistent with **H2**. At

[20] The summarized results presented in Table 4.10 include fixed effects and controls. The full results of the state appropriations share models are reported in Appendix Tables A.13 through A.17.

**Table 4.10 The relationship between state appropriations share and faculty outcomes: summary**

| | Full sample | | 4-year Research | | 4-year Non-Research | | 2-year | |
|---|---|---|---|---|---|---|---|---|
| | SA | SS | SA | SS | SA | SS | SA | SS |
| Log Part-time Faculty | 0.004 | -0.354** | 0.461+ | 1.836+ | 0.134 | 0.588 | -0.006 | -0.302* |
| | (0.026) | (0.129) | (0.240) | (0.985) | (0.135) | (0.488) | (0.025) | (0.131) |
| Log Non-Tenure Track Faculty | 0.097** | -0.002 | 0.264+ | 0.859 | 0.082 | 0.386 | 0.116** | 0.295 |
| | (0.037) | (0.170) | (0.145) | (0.593) | (0.098) | (0.367) | (0.041) | (0.201) |
| Tenure Track Faculty | 0.067** | 0.465*** | 0.145*** | 0.550*** | 0.228*** | 0.812*** | 0.049* | 0.567*** |
| | (0.020) | (0.089) | (0.033) | (0.146) | (0.029) | (0.123) | (0.021) | (0.122) |
| Part-time Faculty Share | -0.014* | -0.102*** | -0.006 | -0.029 | -0.031+ | -0.056 | -0.014* | -0.134*** |
| | (0.005) | (0.027) | (0.028) | (0.123) | (0.019) | (0.067) | (0.006) | (0.033) |
| Non-tenure Track Faculty Share | -0.012 | -0.082** | 0.033 | 0.155+ | -0.014 | -0.067 | -0.011 | -0.063+ |
| | (0.008) | (0.030) | (0.021) | (0.093) | (0.013) | (0.053) | (0.009) | (0.035) |

+p<0.10, *p<0.05, **p<0.01, ***p<0.001
Robust std errors in parentheses; errors clustered at institution level
SA = Log per-FTE state appropriations; SS = State appropriations share of total revenue

community colleges, the state appropriations share of total institutional revenue is negatively related to both the log number of part-time faculty (p<.05) and the share of full-time faculty who are non-tenure track (p<.10). These findings are consistent with the hypotheses guiding this study, which predicted that public institutions would increase their levels of part-time faculty **(H1)** and their share of non-tenure track faculty **(H2)** in response to decreases in state appropriations.

**Sensitivity Analyses**

Sensitivity analyses were conducted to test the robustness of the fixed effects regression models to imputed institution- and state-level covariates and different lag periods. All sensitivity models specify state appropriations per FTE student as the key predictor (models specifying state appropriations share are available upon request).

Tables A.1-A.5 present the results of the robustness checks of the lagged covariate specifications for each dependent variable (number of part-time faculty, number of full-time non-tenure track faculty, number of tenure track faculty, part-time faculty share, and full-time non-tenure track faculty share) for the full sample of institutions. Column (1) displays the results for no lag in institution- and state-level covariates, column (2) displays the results for a one year lag (t – 1) in covariates, and column (3) displays the results of a two year lag (t – 2) in covariates.

The point estimates for per FTE state appropriations vary slightly across models but are generally robust in terms of sign and significance. For the models predicting part-time and non-tenure track faculty levels and shares, the no lag model is the preferred specification (based on generally higher R-squared and F-statistic values), while the one year lag specification is the preferred model for predicting tenure track faculty levels (based on the same criteria). Further conceptual rationale for the preferred lag specifications is discussed in Chapter 3.

Tables A.7-A.11 present the robustness of the coefficient on per FTE state appropriations in the models with and without imputed institution-level covariates. Column (1) displays the results of the models with imputed covariates, and column (2) displays the results of the models without imputed covariates. The point estimates for per FTE state appropriations are slightly higher in the imputed models, but highly robust across specifications in terms of sign and significance. The additional observations provided by the imputed covariates appear to increase the precision of the fixed effects regression models (evidenced by the lower standard errors in the imputed models), leading to the selection of the imputed model as the preferred specification.

### Summary of Fixed Effects Regression Results

The fixed effects regression results indicated that state funding is an important predictor of faculty levels and shares, but the significance of this relationship varied somewhat across dependent variables and institution types. Results were generally consistent with the study hypotheses, which predicted a negative relationship between state funding (state appropriations per FTE and state appropriations share of total revenue) and contingent faculty (part-time and non-tenure track levels and shares). The fixed effects regression models were generally most successful at explaining variation in part-time and tenure track faculty employment.

## Volatility Extension Results

In this section I build on the previous fixed effect panel analyses by testing variables related to volatility in state appropriations. The research questions guiding this extension are 1) How does volatility in state appropriations to higher education influence public institutions' faculty employment behavior? 2) Do public institutions with different missions and resource capacities respond differently to volatility and uncertainty in state funding for higher education? I begin by presenting descriptive statistics for state appropriations volatility, then the results of fixed effects models estimating the relationship between volatility in state funding and five dependent variables related to faculty levels and shares: number of part-time faculty, number of full-time non-tenure track faculty, number of tenure track faculty, part-time faculty share, and full-time non-tenure track faculty share.

**Descriptive Statistics**

Table 4.11 displays descriptive statistics for the measure of volatility in state appropriations by institution type and time period (T1= 1994–2001; T2= 2002–2011). Mean volatility in logged per FTE state appropriations is highest for community colleges in both time periods. In T2, community colleges on average experienced nearly twice as much volatility in state appropriations as public research institutions. Public non-research institutions also experienced higher volatility than research institutions in both time periods, but the gap was not as large on average. The variance of volatility in state appropriations is greater among community colleges than other public institution types in both time periods.

**Table 4.11 Descriptive statistics for state appropriations volatility by institution type**

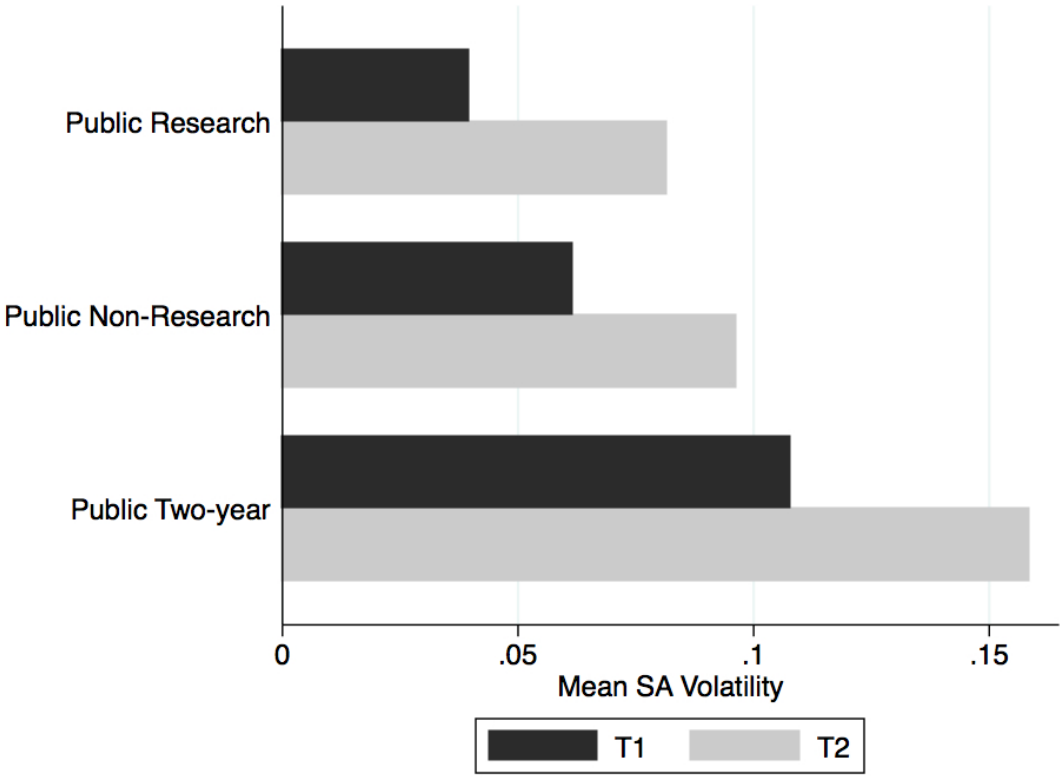
| | Full Sample | | 4-year Research | | 4-year Non-Research | | 2-year | |
|---|---|---|---|---|---|---|---|---|
| | **T1** | **T2** | **T1** | **T2** | **T1** | **T2** | **T1** | **T2** |
| mean | 0.0809 | 0.1328 | 0.0395 | 0.0818 | 0.0577 | 0.0943 | 0.0999 | 0.1599 |
| sd | 0.1037 | 0.1655 | 0.0226 | 0.0400 | 0.0978 | 0.0639 | 0.1119 | 0.2019 |

T1=1994-2001
T2=2002-2011

Mean volatility increased for all institution types between the two time periods. Figure 4.3 illustrates the average change in volatility between T1 and T2 for each institution type. Community colleges experienced the greatest increase in state appropriations volatility over the time period. Figure 4.4 and Table 4.12 display mean volatility for the full sample of public institutions by state. Mean volatility in state

appropriations increased in the majority of the 49 states included in the sample[21] between T1 and T2, but varied in the slope of the change. Seven states (IN, UT, SC, NV, OR, WV, and IL) experienced double digit increases in the magnitude of mean volatility but most states experienced increases ranging between .01 and .09. Mean volatility decreased in the second time period in eight states, including AR, CT, LA, MD, MN, MT, NE, and VT.

**Figure 4.3 Change in mean state appropriations volatility by institution type**




[21] Colorado was excluded from the analysis due to the discontinuation of state appropriations for higher education during the analytic period.

**Figure 4.4 Change in mean state appropriations volatility by state**

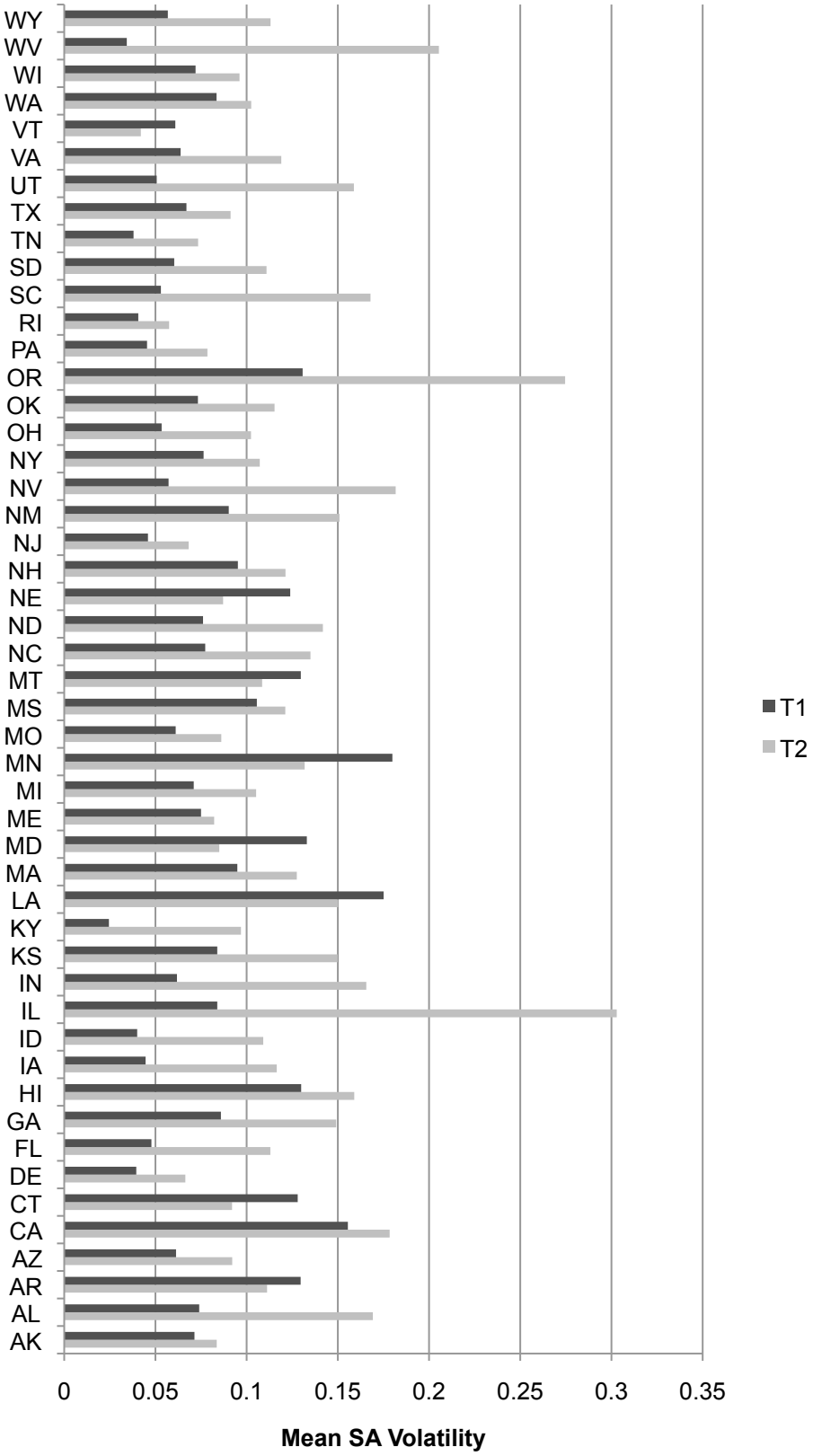


**Table 4.12 Change in mean state appropriations volatility by state**

| | T1 | T2 | Change | | T1 | T2 | Change |
|---|---|---|---|---|---|---|---|
| AK | 0.0714 | 0.0836 | 0.0121 | NC | 0.0773 | 0.1350 | 0.0577 |
| AL | 0.0740 | 0.1692 | 0.0952 | ND | 0.0761 | 0.1418 | 0.0656 |
| AR | 0.1296 | 0.1112 | -0.0184 | NE | 0.1239 | 0.0871 | -0.0368 |
| AZ | 0.0613 | 0.0921 | 0.0308 | NH | 0.0952 | 0.1213 | 0.0260 |
| CA | 0.1555 | 0.1784 | 0.0229 | NJ | 0.0459 | 0.0682 | 0.0223 |
| CT | 0.1280 | 0.0920 | -0.0360 | NM | 0.0902 | 0.1509 | 0.0608 |
| DE | 0.0395 | 0.0664 | 0.0270 | NV | 0.0572 | 0.1817 | 0.1244 |
| FL | 0.0478 | 0.1130 | 0.0651 | NY | 0.0764 | 0.1072 | 0.0308 |
| GA | 0.0859 | 0.1491 | 0.0632 | OH | 0.0534 | 0.1024 | 0.0490 |
| HI | 0.1299 | 0.1590 | 0.0292 | OK | 0.0733 | 0.1153 | 0.0420 |
| IA | 0.0446 | 0.1165 | 0.0719 | OR | 0.1307 | 0.2746 | 0.1439 |
| ID | 0.0400 | 0.1091 | 0.0691 | PA | 0.0454 | 0.0785 | 0.0330 |
| IL | 0.0839 | 0.3029 | 0.2190 | RI | 0.0406 | 0.0575 | 0.0170 |
| IN | 0.0618 | 0.1656 | 0.1038 | SC | 0.0530 | 0.1679 | 0.1149 |
| KS | 0.0839 | 0.1499 | 0.0660 | SD | 0.0603 | 0.1109 | 0.0506 |
| KY | 0.0245 | 0.0969 | 0.0725 | TN | 0.0380 | 0.0734 | 0.0354 |
| LA | 0.1751 | 0.1502 | -0.0249 | TX | 0.0670 | 0.0912 | 0.0242 |
| MA | 0.0949 | 0.1275 | 0.0325 | UT | 0.0507 | 0.1588 | 0.1081 |
| MD | 0.1330 | 0.0850 | -0.0480 | VA | 0.0638 | 0.1190 | 0.0551 |
| ME | 0.0750 | 0.0822 | 0.0072 | VT | 0.0609 | 0.0420 | -0.0190 |
| MI | 0.0710 | 0.1052 | 0.0342 | WA | 0.0835 | 0.1025 | 0.0189 |
| MN | 0.1799 | 0.1318 | -0.0481 | WI | 0.0720 | 0.0961 | 0.0241 |
| MO | 0.0611 | 0.0861 | 0.0250 | WV | 0.0343 | 0.2054 | 0.1711 |
| MS | 0.1056 | 0.1212 | 0.0156 | WY | 0.0568 | 0.1131 | 0.0564 |
| MT | 0.1297 | 0.1085 | -0.0213 | Total | 0.0872 | 0.1317 | 0.0445 |

To further explore the differences in per-student state appropriations volatility experienced by public higher education institutions, I ran a cross-sectional regression estimating the determinants of state appropriations volatility during each time period. Table 4.13 describes the results of this analysis, which regressed state appropriations volatility on several institution- and state-level characteristics including level of institution, location of institution (U.S. Census region), average yearly state tax revenue over the time period (logged), and average yearly number of state prisoners and Medicaid recipients over the time period (logged). In T1, public non-research institutions ($p<.05$) and community colleges ($p<.001$) were associated with higher levels of volatility in per-

FTE student state appropriations. In T2, only community colleges experienced significantly higher levels of volatility relative to public research institutions (p<.001).

**Table 4.13 Determinants of state appropriations volatility at T1 & T2**

| | T1 | T2 |
|---|---|---|
| Institution type (reference group: public research institutions) | | |
| Public non-research institutions | 0.024* | 0.021 |
| | (0.012) | (0.015) |
| Community colleges | 0.067*** | 0.078*** |
| | (0.010) | (0.014) |
| Census region (reference group: Northeast) | | |
| Midwest | 0.007 | 0.057*** |
| | (0.011) | (0.014) |
| South | 0.012 | 0.021 |
| | (0.010) | (0.014) |
| West | 0.040*** | 0.056*** |
| | (0.012) | (0.015) |
| Other (AK & HI) | 0.044 | 0.048 |
| | (0.034) | (0.045) |
| Log average no. of state prisoners & Medicaid recipients | -0.017 | 0.009 |
| | (0.013) | (0.016) |
| Log average state tax revenue | 0.021 | -0.007 |
| | (0.014) | (0.017) |
| Constant | -0.227 | 0.093 |
| | (0.154) | (0.202) |
| R2 | 0.057 | 0.056 |
| N | 1382 | 1379 |
| F | 10.443 | 10.222 |

+ p<0.10, * p<0.05, ** p<0.01, *** p<0.001

Robust std errors in parentheses

Census region is also an important determinant of state appropriations volatility, with public institutions located in the West region experiencing significantly higher levels of volatility in both time periods ($p<.001$). At T2, both the Midwest and West regions were associated with higher levels of state appropriations volatility ($p<.001$) (relative to the Northeast region). After controlling for level of institution and region, the state-level economic measures were not statistically significant predictors of state appropriations volatility in either time period. The regression estimates of the determinants of state appropriations volatility are consistent with the descriptive statistics presented in Table 4.11 and 4.12.

Table 4.14 displays the correlation matrix for the volatility measure and logged state appropriations per FTE. The correlation between volatility in state appropriations and the log amount of state appropriation is negative and significant ($p<.001$), indicating higher volatility is correlated with lower per FTE state appropriations. However the coefficient (-0.221) suggests volatility in state appropriations is only weakly correlated with the log amount of per FTE state appropriations.

**Table 4.14 Correlation between volatility and state appropriations/FTE**

| | Volatility in state appropriations/FTE student | Log state approps/FTE |
|---|---|---|
| Volatility in state appropriations/FTE student | 1 | |
| Log state approps/FTE | -0.221*** | 1 |

* p<0.05; ** p<.01; *** p<.001

**Faculty Levels and Shares**

The summary results displayed in Table 4.15 represent the relationship between volatility in per FTE student state appropriations and the faculty outcome variables. As described in Chapter 4, I constructed a measure of state appropriations volatility over two time periods, and then added this variable (lagged one year) to the fixed effects panel model described in Equation (2). Thus, the volatility in per student state appropriations between 1994 and 2001 is predicting faculty outcomes in 2002. Because the volatility variable appears in only two years of the panel (2002 and 2012), the fixed effects regression models are estimated using these two time points.

Columns (1) and (2) of the summarized results table contain the full sample of public institutions, columns (3) and (4) contain results for public research institutions, columns (5) and (6) display the results for public non-research institutions, and columns (7) and (8) contain the results for community colleges. The left hand column for each sample represents the results of the model including state appropriations volatility and fixed effects only, and the right hand column includes the addition of institutional revenue categories and institution- and state-level controls. The table rows contain the five dependent variables of interest related to faculty levels and shares. Full model results are presented in the Appendix (Tables A.18-A.22). I discuss the models with and without control variables below. Generally, the models including the time-varying covariates provide improved explanatory power over the fixed effects-only models and are thus the preferred specification (F-tests of the nested models are available upon request).

**Table 4.15 The relationship between state appropriations volatility and faculty outcomes: summary**

| | Full sample | | 4-year Research | | 4-year Non-Research | | 2-year | |
|---|---|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
| Log Part-time Faculty | 0.365 | 0.432+ | -0.792 | -1.232 | -0.124 | 0.123 | 0.474+ | 0.532* |
| | (0.259) | (0.233) | (1.970) | (1.806) | (0.378) | (0.388) | (0.255) | (0.226) |
| | [-0.142,0.873] | [-0.025,0.889] | [-4.683,3.098] | [-4.799,2.335] | [-0.868,0.619] | [-0.641,0.887] | [-0.026,0.975] | [0.088,0.975] |
| Log Non-Tenure Track Faculty | 0.313 | 0.141 | 0.610 | 1.038 | -0.086 | 0.356 | 0.511 | 0.209 |
| | (0.289) | (0.274) | (1.570) | (1.553) | (0.262) | (0.391) | (0.320) | (0.378) |
| | [-0.255,0.880] | [-0.397,0.680] | [-2.491,3.712] | [-2.030,4.105] | [-0.602,0.429] | [-0.412,1.125] | [-0.117,1.138] | [-0.533,0.951] |
| Tenure Track Faculty | -0.073 | -0.058 | -0.782* | -0.446 | -0.481* | -0.260+ | -0.029 | -0.010 |
| | (0.060) | (0.053) | (0.389) | (0.280) | (0.199) | (0.145) | (0.061) | (0.055) |
| | [-0.191,0.046] | [-0.161,0.045] | [-1.551,-0.013] | [-0.999,0.107] | [-0.872,-0.089] | [-0.545,0.026] | [-0.150,0.091] | [-0.117,0.097] |
| Part-time Faculty Share | 0.042 | 0.055 | -0.162 | -0.188 | 0.028 | 0.011 | 0.047 | 0.063 |
| | (0.046) | (0.042) | (0.202) | (0.177) | (0.044) | (0.049) | (0.051) | (0.046) |
| | [-0.048,0.132] | [-0.028,0.138] | [-0.562,0.238] | [-0.537,0.161] | [-0.058,0.114] | [-0.085,0.107] | [-0.054,0.148] | [-0.028,0.153] |
| Non-tenure Track Faculty Share | 0.018 | 0.022 | 0.168 | 0.158 | 0.044 | 0.080* | 0.014 | 0.019 |
| | (0.026) | (0.023) | (0.244) | (0.269) | (0.027) | (0.040) | (0.029) | (0.026) |
| | [-0.033,0.069] | [-0.023,0.068] | [-0.314,0.651] | [-0.374,0.689] | [-0.009,0.097] | [0.002,0.159] | [-0.044,0.072] | [-0.032,0.069] |

$^{+}$p<0.10, *p<0.05, **p<0.01, ***p<0.001

Robust std errors in parentheses; 95% confidence intervals in brackets

### Public Research Institutions

After accounting for the institutional revenue categories and institution- and state-level control variables, volatility in per-FTE student state appropriations is not statistically associated with any of the faculty outcomes at public research institutions. These findings are inconsistent with this study's hypotheses, which predicted that greater volatility in state appropriations would lead to increased levels and shares of contingent faculty, and decreased levels of tenure track faculty at public institutions (**H4** and **H5**). However, these findings may be partially explained by the descriptive results indicating that public research institutions have experienced less volatility in per-FTE student state appropriations than public non-research institutions and community colleges.

### Public Non-Research Institutions

At public non-research institutions, state appropriations volatility is not a significant predictor of part-time faculty employment in terms of level or share. However, important relationships emerged for both tenure track and non-tenure track faculty employment. Volatility in per-FTE student state appropriations is negatively related to the log number of tenure track faculty at public non-research institutions ($p<.10$). A one percent increase in volatility is associated with an estimated .26 percent increase in the level of tenure track faculty (95% CI [-0.545, 0.026]). State appropriations volatility is positively related to the share of full-time faculty who are non-tenure track ($p<.05$), suggesting that public non-research institutions employ a greater share of full-time faculty off the tenure track when volatility in state appropriations increases. The findings for non-research institutions are consistent with **H4** and **H5**, which predict that volatility

in state funding will lead institutions to hire fewer tenure track faculty and more non-tenure track faculty.

### Community Colleges

At community colleges, volatility in per-FTE state appropriations does not significantly predict tenure track or non-tenure track faculty employment after the inclusion of institutional revenue variables and controls. Importantly, state appropriations volatility is a significant predictor of the log number of part-time faculty, who represent the largest share of faculty at community colleges on average ($p<.05$). A one percent increase in state appropriations volatility is associated with a .53 percent increase in the number of part-time faculty at community colleges (95% CI [0.088, 0.975]). This finding is consistent with the hypotheses that greater volatility in state appropriations will prompt institutions to hire greater numbers of part-time faculty, particularly at community colleges (**H4** and **H6**).

## Sensitivity Analysis

The results of the volatility measure may be sensitive to the selection of the two time periods over which the variable was constructed. To check the robustness of the volatility variable to alternative time periods, I also constructed a measure of volatility in state appropriations over three time periods (T1=1994-1999; T2=2000-2005; T3=2006-2011) and included this variable in a similar fixed effects panel model with three corresponding time points. Tables A.23-A.27 report the results of the sensitivity model. The part-time faculty models (levels and shares) are robust to the alternative volatility measure, but the other faculty models (tenure track faculty levels and non-tenure track faculty levels and shares) are less robust in the sign and significance of the volatility

coefficient. These findings indicate that the relationship between state appropriations volatility and these faculty outcomes may be sensitive to the time periods over which the volatility variable is measured.

**Summary of Volatility Extension Results**

The results of the volatility extension indicate that per FTE student state appropriations became increasingly volatile between the periods 1994-2001 and 2002-2011 at public institutions. Average volatility increased between the time periods for all public institution types, but the increase was largest for community colleges. Volatility in state appropriations is significantly associated with the level of institution and region. Volatility in state appropriations is a significant predictor of the number of part-time faculty at community colleges, after controlling for institutional revenues and other time-varying controls. At public non-research institutions, volatility is positively related to the share of non-tenure track faculty and negatively related to the log number of tenure track faculty. Of the estimates that were statistically significant, the findings were generally consistent with the hypothesized relationship between state funding and faculty employment.

# CHAPTER 5

## Discussion, Implications, and Conclusion

This dissertation examined changes in the composition of faculty at public institutions, and the influence of declining and volatile state appropriations on the rising employment of contingent faculty. As illustrated in Figure 4.1, the average amount of state appropriations received per FTE student declined substantially at all public institution types between 1994 and 2013. Similarly, the average share of total institutional revenue provided by state appropriations also declined during this time period (Figure 4.2). The rising use of contingent faculty has been frequently attributed to this decreasing state support for higher education (e.g., Baldwin & Chronister, 2001; Gappa & Leslie, 1993; Schuster & Finkelstein, 2006; Slaughter & Leslie, 1997) but prior to this study, this relationship has not been systematically examined in the literature.

Despite the growing importance of contingent faculty in meeting the academic mission of public institutions and the increasing visibility of this population on campus, relatively little is known about the factors leading to their employment. This dissertation addresses this gap in the literature, determining that changes in public institutions' revenue streams have contributed significantly to their increased use of part-time and full-time non-tenure track faculty. In this chapter I discuss the key findings of this dissertation, followed by the implications of this study for theory, higher education policy and practice, and future research.

## Discussion of Key Findings

### Changes in Faculty Employment Patterns at Public Institutions

Consistent with previous reports on trends in academic staffing (e.g., AFT, 2009; Curtis & Thornton, 2013; Desrochers & Kirshtein, 2014), this dissertation documents substantial changes in faculty composition at public higher education institutions that have occurred over the last twenty years. The findings of this study confirm that public institutions are increasingly turning toward contingent faculty to meet their demand for academic labor. Between 1994 and 2013, the average number of total faculty increased substantially at all public institution types. Most of this growth in total faculty employment was attributed to contingent faculty, who represented the fastest growing faculty population at public institutions, particularly at four-year non-research institutions and community colleges. In contrast, the average number of tenure track faculty grew only modestly at public institutions over the twenty-year time period. As a result, contingent faculty comprise a growing share of total faculty at public institutions, although the proportion varies by institution type. This study found that on average, the majority of faculty at community colleges and public non-research institutions were employed in contingent positions in 2013. The proportion of contingent faculty at public research institutions increased over the time period but still remained less than half in 2013.

Additional differences emerged between institution types after accounting for changes in full-time equivalent (FTE) student enrollment over the time period. While the average number of total faculty generally kept pace with student enrollment at research and non-research institutions, community colleges experienced a marked decline in the

average number of total faculty per FTE student. In fact, community colleges experienced declines in the average number of all faculty types per FTE student over the time period, indicating that community colleges have generally been unable to keep up with student enrollment in terms of their faculty hiring. Community colleges have not only shifted their faculty compositions toward a predominately contingent workforce, but have also decreased the size of their faculty relative to student enrollment.

Public research and non-research institutions also experienced declines in the average number of tenure track faculty per FTE student but were able to compensate for these declines by adding additional non-tenure track and part-time faculty. Still, public research and non-research institutions employed fewer part-time and non-tenure track faculty per FTE student on average than community colleges over the time period. It is important to note that one reason why public research and non-research institutions employ fewer contingent faculty per FTE student may be the availability of graduate student instructors. Although this study does not examine the use of graduate teaching assistants, previous reports suggest that graduate students comprise a non-trivial share of instructional staff, particularly at research institutions (AFT, 2009; Curtis & Thornton, 2013). Public research institutions (and to a lesser extent, four-year non-research institutions) have access to an alternative source of instructional labor that likely permits them to employ fewer part-time and non-tenure track faculty than community colleges.

In this study I also examined data from three waves of the National Study of Postsecondary Faculty (NSOPF) to investigate changes in job activities by faculty type at public institutions between 1993 and 2004. This analysis provides insight into institutions' rationale for employing part-time, full-time non-tenure track, and tenure

track faculty. The findings confirm that, at community colleges and public non-research institutions, contingent faculty are employed primarily to meet the demand for instruction. Research institutions also employ part-time faculty primarily to teach but increasingly employ non-tenure track faculty for duties other than instruction. Over the time period, non-tenure track faculty were less likely to report teaching and more likely to report research as their primary activity at public research institutions.

Changes documented in the principal job activities of tenure track faculty may be related to public research institutions' use of contingent faculty. Between 1993 and 2004, tenure track faculty were less likely to report teaching and more likely to report research as their principal activity. These findings are consistent with research documenting the rise of "academic capitalism" behaviors at public research institutions (Slaughter & Leslie, 1997) whereby tenure track faculty increase their time spent in revenue- and prestige-generating activities (such as research) and decrease their time spent teaching undergraduates. As tenure track faculty have shifted their professional priorities toward research, public research institutions appear to have increased their employment of contingent faculty (particularly part-timers) to meet the demand for instruction.

Overall, the descriptive findings provide evidence of a major shift in faculty employment at public higher education institutions over the last two decades. Perhaps more importantly, a closer examination of faculty patterns by institution type reveals considerable differences in faculty employment patterns at public research institutions, non-research institutions, and community colleges. These differences in employment patterns are accompanied by disparities in the financial resources available to each public institution, including state appropriations (Kirshstein & Hurlburt, 2012). The descriptive

findings underscore the importance of testing for heterogeneity in the relationship between state appropriations and faculty employment across public institution types. In the next section, I discuss the results of the fixed effects regression and volatility extension analyses.

### The Relationship Between State Appropriations and Faculty Employment

The results of this dissertation confirm that changes in state appropriations, both in terms of per FTE student and share of total institutional revenue, are associated with changes in faculty employment patterns at public higher education institutions. With some exceptions, the results generally support the main hypotheses of this study: reductions in state appropriations lead to the increased employment of contingent faculty and decreased employment of tenure track faculty at public institutions. As declining state appropriations have destabilized public institutions' revenue streams, institutions have attempted to adapt by increasing the flexibility of their academic workforce. The results of the fixed effects regression models are summarized in Table 5.1. The statistically significant relationships between state appropriations and faculty employment exist after controlling for institution- and time-specific fixed effects and a set of time varying institution- and state-level covariates.

**Table 5.1 The relationship between state appropriations and faculty outcomes: summary of main findings**

| | Full sample | | 4-year Research | | 4-year Non-Research | | 2-year | |
|---|---|---|---|---|---|---|---|---|
| Dependent Variable | SA | SS | SA | SS | SA | SS | SA | SS |
| Log number of part-time faculty | | – | + | + | | | | – |
| Log number of non-tenure track faculty | + | | + | | | | + | |
| Log number of tenure track faculty | + | + | + | + | + | + | + | + |
| Share of part-time faculty | – | – | | | – | | – | – |
| Share of non-tenure track faculty | | – | | + | | | | – |

Note: p<.10
SA = Log per-FTE state appropriations
SS = State appropriations share of total revenue

Beginning with the results of the full sample models, this study determined that when revenues from state appropriations decrease, public institutions increase their employment of part-time faculty, both in the number of part-time faculty employed and the proportion of total faculty who are part-time. Consistent with the conceptual framework guiding this dissertation, part-time faculty, who are arguably the most flexible type of faculty to employ, become an increasingly important source of academic labor to public institutions when reductions in state appropriations create environmental uncertainty.

At first glance, the relationship between state appropriations and full-time non-tenure track faculty seems contradictory: state appropriations are positively related to the number of non-tenure track faculty, but negatively related to the share of full-time faculty who are non-tenure track. I discuss the possible explanations for these findings when the

results are disaggregated by institution type below. Consistent with this study's hypotheses, decreases in state appropriations are strongly associated with decreases in the number of tenure track faculty. These findings suggest declining state investment in public higher education has influenced the shift away from tenure track faculty at these institutions.

Of particular interest to this dissertation, the results confirm differences in the relationship between state appropriations and faculty employment by institution type. These findings are consistent with the descriptive results discussed in the current study and recent national reports documenting important differences in the use of contingent faculty among public institutions (e.g., Curtis, 2014). I discuss the results for public non-research institutions and community colleges, followed by public research institutions.

**Public Non-Research Institutions and Community Colleges**

Based on institutional characteristics and informed by the conceptual framework guiding this study, I hypothesized that public four-year non-research institutions and community colleges would be most vulnerable to changes in state appropriations and thus more likely than public research institutions to respond by increasing their use of contingent faculty. The results of this study partially support this hypothesis. Both non-research institutions and community colleges appear to increase their share of part-time faculty when revenue from state appropriations decrease. However, only community colleges appear to adjust their employment of non-tenure track faculty in response to changes in state appropriations. Contrary to this study's hypotheses, community colleges actually decrease their numbers of full-time non-tenure track faculty when state appropriations decrease. Because community colleges consistently operate with the

smallest amount of financial resources per student they may shift away from employing full-time faculty (even non-tenure track faculty) when state appropriations decline. This explanation is supported by the finding that nearly two-thirds of faculty at community colleges are now part-time. Although community colleges employ fewer numbers of non-tenure track faculty in response to decreasing state appropriations, the descriptive results suggest that non-tenure track faculty still comprise an increasing share of total full-time faculty at these institutions when state appropriations decline.

The results also confirm that both non-research institutions and community colleges decrease their numbers of tenure track faculty as state appropriations decrease (although the coefficients were not significantly different from public research institutions). This finding provides evidence that the employment of tenure track faculty at these institutions is systematically related to state appropriations received, both in terms of per FTE student amounts and share of total institutional revenue. Non-research institutions and community colleges appear to reduce their reliance on tenure track faculty in response to shifting resources.

**Research Institutions**

Important similarities and differences in the relationship between state appropriations and faculty employment emerged between public research institutions and non-research institutions/community colleges. Like the other types of public institutions, research institutions appear to decrease their numbers of tenure track faculty in response to declining state appropriations. Interestingly, public research institutions also appear to decrease their numbers of part-time faculty and non-tenure track faculty when state appropriations decrease. This finding is counterintuitive based on the conceptual

framework and hypotheses guiding this study. However, it may be at least partially explained by public research institutions' availability of a key alternative source of academic labor: graduate student teaching assistants. Public research institutions may prefer to respond to resource shifts by relying more on graduate teaching assistants than contingent faculty, although further inquiry is necessary to examine this relationship.

**State Appropriations Volatility and Faculty Employment**

Recognizing the volatile nature of state appropriations to public higher education institutions over the last few decades, this dissertation examined trends in per-student state appropriations volatility and the relationship between volatility and faculty employment. The results demonstrate increasing volatility in per-student state appropriations for all public institution types, but community colleges experienced the largest increase in state funding volatility over time. These findings are consistent with previous studies that have identified increasing volatility in states' spending on higher education (Delaney & Doyle, 2011).

The results of the state appropriations volatility extension models are summarized in Table 5.2. After controlling for the amount of per-student state appropriations received (in addition to other time-varying covariates), the results provide limited evidence of a systematic relationship between volatility and faculty employment at public institutions. Generally speaking, public institutions appear to be more responsive to the amount of state appropriations received each year than volatility in the amount of state appropriations received over the previous few years in terms of their faculty employment patterns.

**Table 5.2 The relationship between state appropriations volatility and faculty outcomes: summary of main findings**

| Dependent Variable | Full sample | 4-year Research | 4-year Non-Research | 2-year |
|---|---|---|---|---|
| Log number of part-time faculty | | | | + |
| Log number of non-tenure track faculty | | | | |
| Log number of tenure track faculty | | | – | |
| Share of part-time faculty | | | | |
| Share of non-tenure track faculty | | | + | |

Note: p<.10

Still, several important findings emerged from the volatility extension. No statistically significant relationships appeared between volatility and faculty employment at public research institutions (after controlling for time-varying institution- and state-level factors), providing some support for the hypothesis that the influence of volatility would be stronger for public non-research institutions and community colleges. Non-research institutions appear to reduce the number of tenure track faculty employed and increase their share of full-time faculty who are non-tenure track when per-FTE state appropriations become more unpredictable. Community colleges increase the number of part-time faculty employed as volatility in per-FTE state appropriations increases. Together, these findings provide evidence that public non-research institutions and community colleges increase their use of contingent faculty to cope with the environmental uncertainties caused by volatility in state appropriations, an important source of revenue for these institutions. When public institutions' revenue streams

become less stable, they appear to respond by decreasing their reliance on traditional faculty positions that emphasize long-term, stable employment.

## Implications

The results of this dissertation have important implications for higher education. In the following section I discuss the implications of this study's findings for theory, higher education policy and practice, and future research.

### Theory

The conceptual framework for this study is rooted in resource dependence theory and guided by the literature on contingent employment outside of higher education. This study makes important contributions to our understanding of resource dependence theory and how organizations alter their behavior in attempt to manage resource dependencies. In their foundational book outlining the key principles of resource dependence theory, Pfeffer & Salancik (1978) identified a number of strategies used by organizations to reduce external dependence and influence, including mergers, interlocking board directorates, and executive succession. However, Pfeffer & Salancik (1978) did not specifically address the restructuring of employment as an adaptive strategy, and few subsequent studies have applied resource dependence theory to the study of contingent employment (Davis-Blake & Uzzi, 1993; Pfeffer & Baron, 1988). Similarly, although several studies have examined higher education institutions' responses to external dependencies (Bastedo & Bowman, 2011; Jaquette & Curs, 2015; Slaughter & Leslie, 1997; Tolbert, 1985), none have considered the use of contingent faculty as a strategic response.

This dissertation builds upon past studies to demonstrate the utility of resource dependence theory in explaining public institutions' increased use of contingent faculty. Most importantly, this dissertation identifies faculty employment as an important mechanism through which the environment influences higher education institutions. To assert that organizations are influenced by their environments does little to improve our understanding of how this occurs (Pfeffer & Salancik, 1978). Rather, identifying the mechanism, or arrow that connects X (the environment) to Y (the organization), is necessary to advance our conceptual and empirical understanding of cause and effect (Bastedo, 2012). The findings of this study suggest that the use of contingent faculty at public institutions is an adaptive response to environmental uncertainty caused by shifts in resource providers and revenue streams. This dissertation extends resource dependence theory by demonstrating how environmental turbulence (operationalized as reductions and volatility in state appropriations) can affect employment behavior beyond the replacement of executives identified by Pfeffer & Salancik (1978).

The findings of this dissertation also confirm that labor demand theory, the predominant conceptual approach guiding previous studies of the determinants of contingent faculty, does not fully account for important relationships between resources and institutional behavior. The labor demand functions employed in past studies have predicted faculty employment using total institutional resources, but have not considered how the composition of institutions' revenue sources (and their associated resource providers) may affect institutions' faculty employment strategies. Resource dependence theory, which emphasizes the interaction and interdependence between organizations and their environments, expands upon economic principles such as efficiency and rationality

to highlight institutions' pursuit of power and autonomy (Davis & Cobb, 2010). Indeed, findings from the literature on contingent employment outside of higher education argue that while economic efficiency is important, organizational flexibility is the main reason why firms hire contingent employees. Focusing on organizations' desires to increase organizational power (in addition to increasing economic efficiency) provides valuable theoretical insight into public institutions' academic employment behavior.

This dissertation also has implications for the conceptual and empirical literature on academic capitalism. Coupled with perspectives from academic capitalism, the rise of contingent faculty can be interpreted as part of a broader restructuring of higher education, defined by Slaughter and Leslie (2001) as "substantive organizational changes" resulting from increases in market-like behavior by institutions (p. 155). Interpreted through the lens of academic capitalism, the increasing use of contingent faculty at public research institutions may be a by-product of institutions' expansion of revenue- and prestige-generating research activities. As public research institutions have increased their engagement in revenue-generating strategies to compensate for losses in state funding, they have likely turned to contingent faculty to carry the burden of undergraduate teaching.

This study applied resource dependence theory to specifically examine the relationship between state funding and faculty employment, but future studies may wish to test other theoretical perspectives such as neo-institutionalism to investigate whether increases in the use of contingent faculty are related to the increasing legitimacy of this practice in higher education (DiMaggio & Powell, 1983). Academic tenure can be described as an organizational institution; it is normative, symbolic, and widespread

across higher education (Park et al., 2011). The increasing employment of faculty outside of the tenure system may represent institutions' efforts to decouple from the institution of tenure (Meyer & Rowan, 1977; Park, et al., 2011). Increases in the hiring of part-time and non-tenure track faculty have been gradual over time, but the cumulative impact is a significant shift away from tenure as the predominant faculty employment structure in higher education. To what extent does the rising use of contingent faculty represent the deinstitutionalization of tenure (Tolbert, 1998)? Are differences in the use of contingent faculty by institution type due to differences in the prevailing norms and values guiding these institutions? The findings of this dissertation suggest there may be a number of fruitful directions for future inquiry guided by additional organizational theories.

**Higher Education Policy and Practice**

Together with previous literature examining faculty employment, this dissertation confirms that fundamental changes have occurred in the academic workforce at public higher education institutions. Most importantly for higher education policy and practice, the results of this study indicate that the rising use of contingent faculty at public institutions is partially due to declining and volatile state appropriations to higher education. Both the increasing employment of contingent faculty and the influence of state appropriations on faculty employment have important implications for higher education policy and practice.

First, this study identifies important consequences of decreasing state support for higher education, defined by some scholars as the de facto privatization of public higher education (Eckel & Morphew, 2009). Although cuts in state higher education funding have received growing public and scholarly attention, few studies have documented how

changes in state higher education finance have affected policies and practices at public institutions. State higher education budget decisions are often made in response to short-term state budget conditions, but this study demonstrates that cuts in state appropriations can have long-term consequences for public higher education through the restructuring of academic employment. Similar to previous research documenting increases in non-resident student enrollment in response to declining state appropriations (Jaquette & Curs, 2015), this study suggests that reductions in state funding for higher education could influence institutional behavior in ways that may or may not be aligned with policy makers' interests.

The results of this study demonstrate that changes in state higher education funding may have a differential impact on public institutions by type. When faced with state fiscal pressures, policy makers often choose to cut higher education appropriations under the assumption that public institutions can compensate for these cuts by raising tuition or increasing revenue from other sources (Bell, 2008). However, these strategies are only practically available to the most elite public institutions (Cheslock & Gianneschi, 2008; Jaquette & Curs, 2015; Slaughter & Leslie, 1997). Open-access institutions, including many public four-year non-research institutions and community colleges, are less able to generate alternative revenues and are most vulnerable to cuts in state funding. Consequently, public non-research institutions and community colleges are most likely to increase their employment of contingent faculty in response to declines and volatility in state appropriations.

Public institutions' increased use of contingent faculty, as evidenced in this dissertation, may be beneficial in several ways. In addition to the obvious short-term

savings on labor costs, contingent faculty provide institutions with increased flexibility to respond to changes in their environment by allowing for adjustments in staffing due to variable labor needs (Kalleberg et al., 2003; Davis-Blake & Uzzi, 1993). Institutions can hire or reassign contingent faculty in response to enrollment or program changes on a semester-to-semester basis without making long-term employment commitments (Baldwin & Chronister, 2001; Cross & Goldenberg, 2009; Gappa & Leslie, 1993; Thedwall, 2008). Contingent faculty also allow institutions to test out new curricular offerings and academic programs until enrollment and finances are stable. As public institutions struggle with organizational uncertainties caused by shrinking and unpredictable state appropriations, hiring contingent faculty enable institutions to meet instructional needs while preserving their ability to adapt to changes in the environment.

Despite the potential institutional benefits of employing contingent faculty, clear negative consequences have also emerged from the literature. As public institutions seek to manage their dependence on state appropriations by shifting away from the tenure system in favor of a more flexible workforce, they may develop new dependencies on contingent faculty that are problematic for the institution. Scholars have questioned whether higher education leaders have overstated the cost savings provided by hiring contingent faculty. Simple comparisons of teaching loads between tenure track and non-tenure track faculty inflate cost-saving estimates since they do not account for the many other responsibilities held by tenure track faculty such as advising, research, and service (Baldwin and Chronister, 2001). The employment of part-time faculty may represent "false economies" in which increases in part-time faculty lead to hidden institutional costs such as heavier administrative burdens on remaining tenure track faculty and high

turnover expenses from hiring, orienting, and supervising new part-timers (Gappa and Leslie, 1993, p. 102). As the proportion of tenure track faculty decreases, tenure track faculty may experience higher workloads and declining influence over institutional affairs (Schuster & Finklestein, 2006). These arguments suggest that cost-benefit calculations based solely on salaries paid to contingent and tenure-track faculty may not fully account for the economics of academic employment.

Institutions' increased reliance on contingent faculty has also raised concerns about their treatment and working conditions, which tend to be subpar in comparison to tenure track faculty (Kezar, 2013). Contingent faculty differ substantially from tenure track faculty in both the terms and conditions of their employment, leading to the creation of two tiers of faculty on campus (Baldwin & Chronister, 2001; Benjamin, 2002; Kezar, 2012; Schuster & Finkelstein, 2006). Contingent faculty often face low pay, job insecurity, lack of opportunity for advancement, and little access to resources such as offices and computers, contributing to perceptions of their marginalization and exploitation (Gappa & Leslie, 1993; Thompson, 2003). Significant gender differences also persist in contingent faculty appointments, with women twice as likely as men to be employed in non-tenure track positions (Schuster & Finkelstein, 2006). Recognizing that a divisive and inequitable faculty system could have deeply harmful effects on campus communities, higher education scholars have called for a critical transformation of institutional policies and practices affecting contingent faculty (Baldwin & Chronister, 2001; Gappa & Leslie, 1993; Kezar, 2012; 2013).

Scholars have found that poor institutional working conditions may harm student learning outcomes, and have expressed concern regarding the educational consequences

of institutions' increased use of contingent faculty (Ehrenberg & Zhang, 2005; Kezar, 2013). Due to job insecurity and high turnover, contingent faculty may be less able to engage in mentoring and advising relationships that increase student success (Baldwin & Chronister, 2001; Thompson, 2003). Although only a few studies have attempted to examine the teaching practices of non-tenure track faculty, the findings suggest the presence of key differences between contingent and tenure track faculty. For example, part-time faculty have been found to interact with students outside of class less frequently than full-time faculty, and spend less time preparing for class (Umbach, 2007).

A growing body of research has quantitatively examined the impact of contingent faculty on student outcomes. Ehrenberg and Zhang (2005) found increases in part-time and full-time non-tenure track faculty to have a negative influence on five- and six-year graduation rates at four-year institutions, with the strongest effects occurring at public institutions. Jacoby (2006) and Jaeger and Eagan (2009) found a similarly negative relationship between increases in part-time faculty and students' likelihood of completing a degree at two-year institutions. Researchers have also examined the influence of contingent faculty on student persistence (Jaeger & Eagan, 2011; Jaeger & Hinz, 2008) and transfer to four-year institutions (Eagan & Jaeger, 2009), generally determining a negative relationship between exposure to contingent faculty and these outcomes. However, Bettinger and Long (2010) found exposure to adjunct faculty had a positive influence on students' academic interests as measured by enrollment in subsequent subject courses. Figlio, Shapiro, and Soter (2013) also determined that non-tenure track faculty induced students to take subsequent courses in the same subject and to perform better in these courses at a selective research institution. The findings regarding the

effects of contingent faculty on student learning and success are mixed, but suggest that institutions should consider the potential unintended consequences of increasing the employment of contingent faculty.

The findings of this dissertation also raise important questions about higher education equity. Public non-research institutions and community colleges are most reliant on part-time and non-tenure track faculty and are also responsible for educating greater proportions of low-income and less-academically prepared students (The Century Foundation, 2013). Given the growing concern regarding the working conditions and instructional quality of contingent faculty, the disproportion exposure of low-income and traditionally underrepresented students to contingent faculty should be deeply concerning to higher education policy makers and institutional leaders with regard to educational equity. The U.S. higher education system is highly stratified by socioeconomic status, with low-income students remaining clustered at less-selective institutions (Bastedo & Jaquette, 2011). These institutions, particularly community colleges, are intended to improve access to higher education in hopes of improving social mobility. To the extent that the quality of education at community colleges is lessened by their reliance on contingent faculty, policy makers should consider how reductions in state funding to the least-resourced institutions may serve to reproduce social inequalities.

**Future Research**

This dissertation examined changes in faculty employment at public institutions over the last two decades and demonstrated evidence of a relationship between state appropriations and increased employment of contingent faculty during this time period. The results of this study inspire a number of directions for future research. First, future

studies should investigate differences in faculty employment patterns at public institutions by department. The present study observed faculty employment at the institution level only, obscuring potentially important differences at the department level. National data suggest substantial differences exist between disciplines in the hiring of contingent faculty. For example, contingent faculty are more often employed in professional programs such as business and law, vocational programs, and the humanities, and less frequently employed in engineering and the natural sciences (Benjamin, 2002; Conley et al., 2002; Kezar & Maxey, 2012). Future studies could examine within-institution differences in the use of contingent faculty using department-level data at a smaller number of public institutions.

Second, while this dissertation sought to specifically examine the influence of state appropriations on faculty employment patterns, future research should consider other environmental factors that may mediate public institutions' response to shifts in resources. Policy and legal environments at the state and federal levels may enable or constrain an institution's ability to increase organizational flexibility through the employment of contingent faculty. State policies determine whether non-tenure track faculty, whom are often deemed "temporary" employees by their institutions, are eligible to participate in state-sponsored retirement and health benefit plans (Gappa & Leslie, 1993). State labor policies also determine the eligibility of non-tenure track faculty to organize and participate in collective bargaining, which may influence institutions' labor relations and employment strategies (Cross & Goldenberg, 2009; Gappa & Leslie, 1993). At the federal level, laws such as the Affordable Care Act of 2012, which places new mandates on employer-offered health insurance, may also influence institutions' use of

contingent faculty (Flaherty & Lederman, 2013). Further inquiry is needed to illuminate how state and federal policies might make the employment of contingent faculty a more or less attractive strategy to public institutions seeking to improve organizational power and control.

Future research should pay particular attention to the role of collective bargaining in shaping public institutions' employment behavior. This dissertation identified two primary rationales for employing contingent faculty from the literature on contingent employment: to improve organizational flexibility and to lower labor costs. Collective bargaining agreements, which influence aspects of employment such as salaries, benefits, hiring, and layoffs, may serve to increase or decrease the perceived benefits of employing contingent faculty. If public higher education institutions employ contingent faculty as a strategy for managing their dependence on volatile external resources such as state appropriations, the presence of a strong collective bargaining agreement may negate this strategy and create new dependencies for the organization to manage. The creation of a longitudinal institution-level database containing information on collective bargaining agreements would require significant effort, but reports published by the National Center for Collective Bargaining in Higher Education could provide a good starting point.

The results of this study confirm that major changes have occurred in the composition of faculty at public institutions. In light of these findings, more research is needed to understand the impact of this shift on the experiences of students and faculty. The findings of existing quantitative studies examining the relationship between exposure to contingent faculty and student outcomes such as persistence and transfer have been mixed, indicating that further research is needed to clarify this relationship. Additionally,

the mechanisms through which contingent faculty may differentially affect student learning are understudied. Very few existing studies have examined the teaching practices of part-time and non-tenure track faculty, but their findings suggest there may be important differences in teaching practices between contingent and tenure track faculty. For example, part-time faculty have been found to be less likely than full-time faculty to engage in high-quality, learning-centered instructional methods such as encouraging active and collaborative learning (Baldwin & Wawrzynski, 2011; Umbach, 2007). Further inquiry is necessary to examine whether institutions' efforts to improve their organizational autonomy and flexibility through the use of contingent faculty are actually serving to undermine their educational mission.

Future research should also examine the relationship between state appropriations and changes in non-faculty positions at public institutions. Recent reports have documented substantial growth in the number of non-faculty, non-executive professional positions at postsecondary institutions, both in absolute numbers and as a share of total institutional employees (Desrochers & Kirshstein, 2014; Rhoades & Frye, 2015). Described in the higher education literature as "managerial professionals" (Rhoades, 1998), these types of professional employees are not executives or senior-level administrators but serve to enhance institutions' managerial capacity by influencing domains that were traditionally controlled by faculty (e.g., academic advising and instructional design) (Rhoades, 2011). Similar to the documented shift toward a more contingent academic workforce, the principles of academic capitalism suggest that institutions have restructured other areas of employment in order to increase organizational power and control (Rhoades, 2011). To what extent have major changes in

resource providers, specifically the decreasing contributions from the state, influenced this employment restructuring at public institutions? Have public institutions sought to decrease their dependence on tenure track faculty in response to environmental uncertainty in ways beyond simply hiring contingent faculty? Further examination of these questions is necessary to gain a more complete understanding of how public institutions have adapted to fundamental changes in their resource environments.

## Conclusion

State funding for higher education has declined persistently over the past several decades and continues to be one of the most important policy issues facing public higher education institutions today. Declines in state appropriations to higher education have been well documented in the scholarly literature and popular media, and higher education leaders and policy analysts have continuously advocated for increased state investment to preserve quality and access at public institutions. However, few studies have empirically examined the consequences of declines and volatility in state appropriations to public higher education, resulting in a serious gap in our understanding of how persistent reductions in state funding have affected public institutions over time.

In this dissertation, I demonstrate how changes in state appropriations have influenced faculty employment, a core function of public higher education institutions. This study found that changes in the composition of faculty over the past two decades are systematically related to changes in state appropriations to higher education. As state funding for higher education has declined and become more volatile, public institutions have increased their employment of contingent faculty and decreased their employment of tenure track faculty, cumulating in major shifts in the composition of the academic

workforce. The employment of contingent faculty represents an important mechanism through which the environment influences institutional behavior.

The use of contingent faculty appears to be a strategic response to environmental turbulence caused by changes in public institutions' revenue streams, but this finding raises important questions about the unintended consequences of this strategy. Critics inside and outside of the academy have expressed concern regarding contingent faculty working conditions and potential negative effects on student learning (Benjamin, 2002; U.S. House of Representatives Committee on Education and the Workforce, 2013). This dissertation aims to increase higher education leaders' and state policymakers' awareness of how reduced state investment in public higher education has influenced faculty employment patterns. The findings of this study will hopefully prompt discussion about the use of contingent faculty and the need for more intentional planning and investment in contingent employees, conditions that many experts believe are critical to the future success of the academic workforce in higher education (Baldwin & Chronister, 2001; Gappa & Leslie, 1993; Kezar, 2012).

## APPENDIX

**Table A.1 Lag sensitivity check: relationship between state appropriations/FTE and log level of part-time faculty**

| | No lag | 1 year lag | 2 year lag |
|---|---|---|---|
| Log state approps/FTE | 0.0037 | 0.0083 | 0.0054 |
| | (0.0261) | (0.0242) | (0.0265) |
| Log net tuition revenue/FTE | 0.0898* | 0.0562 | 0.0883* |
| | (0.0421) | (0.0478) | (0.0428) |
| Log federal revenue/FTE | -0.0422 | -0.0113 | -0.0403 |
| | (0.0263) | (0.0234) | (0.0263) |
| Log other revenue/FTE[+] | 0.0344+ | 0.0340+ | 0.0354+ |
| | (0.0197) | (0.0194) | (0.0197) |
| Percent engin/sci degrees | -0.1683 | -0.1053 | -0.2303 |
| | (0.2377) | (0.2682) | (0.2681) |
| Percent non-resident students | -0.2392+ | -0.1067 | -0.1275 |
| | (0.1379) | (0.1027) | (0.1177) |
| Log total part-time students | 0.0272 | 0.0676 | 0.0337 |
| | (0.0563) | (0.0509) | (0.0553) |
| Log total FTE students | 0.6434*** | 0.5119*** | 0.4458*** |
| | (0.0834) | (0.0809) | (0.0803) |
| Log avg. full-time faculty salary | 0.0374 | 0.0644** | 0.0646** |
| | (0.0233) | (0.0233) | (0.0229) |
| State unemployment rate | -0.0044 | -0.0003 | 0.0111 |
| | (0.0110) | (0.0111) | (0.0109) |
| Log state tax revenue | 0.1258 | 0.0142 | 0.2306+ |
| | (0.1241) | (0.1078) | (0.1269) |
| Institution fixed effects | x | x | x |
| Year fixed effects | x | x | x |
| R2 (within) | 0.170 | 0.157 | 0.159 |
| Observations | 15145 | 14846 | 14720 |
| Institutions | 1357 | 1351 | 1348 |
| F | 31.720 | 29.575 | 27.297 |

[+]p<0.10, *p<0.05, **p<0.01, ***p<0.001
Robust std errors in parentheses; errors clustered at institution level
[+]Includes revenue from private, local, and "other" sources (excluding auxiliary and hospital revenue)

Results presented for full sample; preferred model is outlined

**Table A.2 Lag sensitivity check: relationship between state appropriations/FTE and log level of non-tenure track faculty**

| | No lag | 1 year lag | 2 year lag |
|---|---|---|---|
| Log state approps/FTE | 0.0970** | 0.1224** | 0.0290 |
| | (0.0371) | (0.0411) | (0.0464) |
| Log net tuition revenue/FTE | 0.0660+ | 0.0713* | 0.0284 |
| | (0.0355) | (0.0348) | (0.0384) |
| Log federal revenue/FTE | -0.0085 | 0.0346 | 0.0203 |
| | (0.0261) | (0.0261) | (0.0253) |
| Log other revenue/FTE[+] | 0.0032 | 0.0768*** | 0.0282 |
| | (0.0189) | (0.0203) | (0.0191) |
| Percent engin/sci degrees | 0.0114 | -0.1230 | -0.0137 |
| | (0.2320) | (0.2435) | (0.2295) |
| Percent non-resident students | -0.1305 | -0.1437 | -0.1803 |
| | (0.1661) | (0.1736) | (0.1705) |
| Log total part-time students | -0.0660 | -0.1349** | -0.0790+ |
| | (0.0447) | (0.0457) | (0.0428) |
| Log total FTE students | 0.6543*** | 0.7719*** | 0.5325*** |
| | (0.0880) | (0.0944) | (0.0876) |
| Log avg. full-time faculty salary | 0.0056 | 0.0298 | 0.0319* |
| | (0.0139) | (0.0186) | (0.0139) |
| State unemployment rate | -0.0339*** | -0.0259** | -0.0302** |
| | (0.0101) | (0.0098) | (0.0094) |
| Log state tax revenue | -0.1677+ | -0.1360 | -0.1272 |
| | (0.0950) | (0.0897) | (0.0897) |
| Institution fixed effects | x | x | x |
| Year fixed effects | x | x | x |
| R2 (within) | 0.094 | 0.079 | 0.079 |
| Observations | 13591 | 13614 | 13520 |
| Institutions | 1325 | 1321 | 1317 |
| F | 17.248 | 15.813 | 16.458 |

[+]p<0.10, *p<0.05, **p<0.01, ***p<0.001
Robust std errors in parentheses; errors clustered at institution level
[+]Includes revenue from private, local, and "other" sources (excluding auxiliary and hospital revenue)

Results presented for full sample; preferred model is outlined

**Table A.3 Lag sensitivity check: relationship between state appropriations/FTE and log level of tenure track faculty**

| | No lag | 1 year lag | 2 year lag |
|---|---|---|---|
| Log state approps/FTE | 0.0717*** | 0.0669** | 0.0513** |
| | (0.0184) | (0.0203) | (0.0192) |
| Log net tuition revenue/FTE | -0.0037 | 0.0172 | 0.0331+ |
| | (0.0169) | (0.0196) | (0.0172) |
| Log federal revenue/FTE | -0.0180 | -0.0031 | 0.0048 |
| | (0.0122) | (0.0116) | (0.0110) |
| Log other revenue/FTE[+] | 0.0562*** | 0.0214* | 0.0409** |
| | (0.0134) | (0.0108) | (0.0126) |
| Percent engin/sci degrees | 0.0522 | 0.0987 | 0.0592 |
| | (0.1377) | (0.1527) | (0.1396) |
| Percent non-resident students | 0.1022 | 0.0352 | 0.0220 |
| | (0.0687) | (0.0562) | (0.0459) |
| Log total part-time students | -0.0575 | -0.0546* | -0.0597* |
| | (0.0366) | (0.0264) | (0.0273) |
| Log total FTE students | 0.4694*** | 0.4604*** | 0.4088*** |
| | (0.0737) | (0.0700) | (0.0542) |
| Log avg. full-time faculty salary | -0.0036 | 0.0017 | 0.0002 |
| | (0.0072) | (0.0050) | (0.0064) |
| State unemployment rate | 0.0066 | 0.0042 | -0.0003 |
| | (0.0045) | (0.0047) | (0.0042) |
| Log state tax revenue | 0.1474*** | 0.1687*** | 0.1443*** |
| | (0.0380) | (0.0377) | (0.0362) |
| Institution fixed effects | x | x | x |
| Year fixed effects | x | x | x |
| R2 (within) | 0.060 | 0.066 | 0.054 |
| Observations | 12081 | 11992 | 11911 |
| Institutions | 1092 | 1081 | 1074 |
| F | 7.266 | 7.287 | 6.259 |

[+]p<0.10, *p<0.05, **p<0.01, ***p<0.001
Robust std errors in parentheses; errors clustered at institution level
[+]Includes revenue from private, local, and "other" sources (excluding auxiliary and hospital revenue)

Results presented for full sample; preferred model is outlined

**Table A.4 Lag sensitivity check: relationship between state appropriations/FTE and the share of part-time faculty**

| | No lag | 1 year lag | 2 year lag |
|---|---|---|---|
| Log state approps/FTE | -0.0140* | -0.0171** | -0.0099+ |
| | (0.0055) | (0.0057) | (0.0058) |
| Log net tuition revenue/FTE | 0.0052 | 0.0042 | 0.0078 |
| | (0.0070) | (0.0088) | (0.0081) |
| Log federal revenue/FTE | -0.0074 | -0.0079+ | -0.0112* |
| | (0.0052) | (0.0046) | (0.0048) |
| Log other revenue/FTE[+] | -0.0067 | -0.0062 | -0.0104* |
| | (0.0045) | (0.0044) | (0.0044) |
| Percent engin/sci degrees | -0.1132* | -0.0958 | -0.0946+ |
| | (0.0575) | (0.0587) | (0.0547) |
| Percent non-resident students | -0.0831** | -0.0435* | -0.0336 |
| | (0.0281) | (0.0212) | (0.0261) |
| Log total part-time students | 0.0208* | 0.0276** | 0.0241** |
| | (0.0091) | (0.0087) | (0.0093) |
| Log total FTE students | 0.0285+ | 0.0019 | -0.0078 |
| | (0.0166) | (0.0162) | (0.0157) |
| Log avg. full-time faculty salary | 0.0024 | 0.0028 | 0.0070+ |
| | (0.0037) | (0.0037) | (0.0039) |
| State unemployment rate | -0.0045* | -0.0024 | 0.0007 |
| | (0.0018) | (0.0019) | (0.0019) |
| Log state tax revenue | 0.0179 | 0.0071 | 0.0541* |
| | (0.0225) | (0.0233) | (0.0275) |
| Institution fixed effects | x | x | x |
| Year fixed effects | x | x | x |
| R2 (within) | 0.127 | 0.117 | 0.121 |
| Observations | 15613 | 15242 | 15104 |
| Institutions | 1359 | 1352 | 1349 |
| F | 20.327 | 18.645 | 18.290 |

[+]p<0.10, *p<0.05, **p<0.01, ***p<0.001
Robust std errors in parentheses; errors clustered at institution level
[+]Includes revenue from private, local, and "other" sources (excluding auxiliary and hospital revenue)

Results presented for full sample; preferred model is outlined

**Table A.5 Lag sensitivity check: relationship between state appropriations/FTE and the share of full-time non-tenure track faculty**

| | No lag | 1 year lag | 2 year lag |
|---|---|---|---|
| Log state approps/FTE | -0.0122 | -0.0059 | -0.0105 |
| | (0.0077) | (0.0079) | (0.0069) |
| Log net tuition revenue/FTE | -0.0037 | -0.0111 | -0.0081 |
| | (0.0079) | (0.0095) | (0.0091) |
| Log federal revenue/FTE | -0.0043 | -0.0002 | -0.0007 |
| | (0.0050) | (0.0046) | (0.0044) |
| Log other revenue/FTE$^{+}$ | -0.0052 | 0.0075 | -0.0016 |
| | (0.0049) | (0.0051) | (0.0047) |
| Percent engin/sci degrees | 0.0159 | -0.0336 | 0.0013 |
| | (0.0638) | (0.0638) | (0.0599) |
| Percent non-resident students | -0.0016 | 0.0186 | 0.0150 |
| | (0.0326) | (0.0279) | (0.0272) |
| Log total part-time students | -0.0015 | -0.0182+ | -0.0022 |
| | (0.0097) | (0.0102) | (0.0091) |
| Log total FTE students | 0.0128 | 0.0373+ | 0.0161 |
| | (0.0186) | (0.0217) | (0.0197) |
| Log avg. full-time faculty salary | 0.0011 | 0.0034 | 0.0040+ |
| | (0.0021) | (0.0032) | (0.0021) |
| State unemployment rate | -0.0034+ | -0.0047* | -0.0043* |
| | (0.0019) | (0.0019) | (0.0019) |
| Log state tax revenue | -0.0593** | -0.0567* | -0.0491* |
| | (0.0226) | (0.0225) | (0.0223) |
| Institution fixed effects | x | x | x |
| Year fixed effects | x | x | x |
| R2 (within) | 0.024 | 0.024 | 0.027 |
| Observations | 15595 | 15561 | 15425 |
| Institutions | 1359 | 1353 | 1353 |
| F | 7.444 | 6.836 | 6.999 |

$^{+}$p<0.10, *p<0.05, **p<0.01, ***p<0.001

Robust std errors in parentheses; errors clustered at institution level

$^{+}$Includes revenue from private, local, and "other" sources (excluding auxiliary and hospital revenue)

Results presented for full sample; preferred model is outlined

**Table A.6 Variable descriptions and sources**

| Variable | Description | Source |
|---|---|---|
| Number of part-time faculty | Number of instructional staff employed in less than full-time positions. Instructional staff are defined by IPEDS as persons whose initial assignments are made for the purpose of conducting instruction (or instruction combined with research or public service) as a principal activity. They may hold academic rank titles of professor, associate professor, assistant professor, instructor, lecturer or the equivalent. Graduate, instruction, and research assistants are not included in this category. | IPEDS Fall Staff Survey |
| Number of full-time non-tenure track faculty | Number of instructional staff employed in full-time, NON-tenure track positions. | IPEDS Fall Staff Survey |
| Number of tenure track faculty | Number of instructional staff employed in full-time tenured or tenure-track positions. | IPEDS Fall Staff Survey |
| Share of part-time faculty | Percent of total faculty that are part-time | |
| Share of full-time non-tenure track faculty | Percent of total full-time faculty that are non-tenure track | |
| State appropriations revenue | Revenues received by the institution through acts of a state legislative body (except grants and contracts and capital appropriations). Funds reported in this category are for meeting current operating expenses, not for specific projects or programs. | IPEDS Finance Survey |
| Net tuition and fees revenue | Total revenue received from tuition and fees (excluding institutional student aid applied to tuition and fees). Note: This variable is only available after 2002 – prior to 2002, IPEDS collected only gross tuition and fees revenue, not excluding tuition "discounts" provided by institutional aid. I may have to use this gross tuition revenue variable instead. | IPEDS Finance Survey |

| | | |
|---|---|---|
| Federal revenue | Revenues from federal legislative appropriations, federal governmental agencies that are for training programs, research, or public service activities for which expenditures are reimbursable under the terms of a government grant or contract. Pell Grants are excluded if they were reported as federal grants. | IPEDS Finance Survey |
| Other revenue | Derived by calculating the sum of local government revenue (includes appropriations by a governmental entity below the state level, including education district taxes, and grants and contracts from local government agencies that are for training programs and similar activities for which amounts are received or expenditures are reimbursable under the terms of a local government grant or contract); state contracts and grants (revenues from state government agencies that are for training programs and similar activities for which amounts are received or expenditures are reimbursable under the terms of a state government grant or contract); private revenue (private gifts received from private donors or from private contracts for specific goods or services related to educational or institutional purposes, investment gains and losses, and endowment income from trusts, institutional endowments, and similar funds); independent operations (generally includes revenues associated with major federally funded research and development centers); and other revenue (miscellaneous revenues not included elsewhere). | IPEDS Finance Survey |
| State appropriations share of total institutional revenue | Percent of total institutional revenue received through state appropriations (state appropriations / state appropriations + net tuition and fees + federal revenue + other revenue). Excludes auxiliary and hospital revenue because these categories are generally self-supporting. | |
| Total FTE enrollment | Total full-time equivalent student enrollment. The full-time equivalent of an institution's part-time enrollment is estimated by multiplying part-time enrollment by factors that vary by control and level of institution and level of student; the estimated full-time equivalent of part-time enrollment is then added to the total full-time enrollment of the institution. | IPEDS Fall Enrollment Survey |

| | | |
|---|---|---|
| Number of students enrolled part-time | Number of total undergraduate and graduate students who are enrolled less than full-time. | IPEDS Fall Enrollment Survey |
| Share of non-resident freshman | Percent of total freshman who are non-resident based on place of origin | IPEDS Fall Enrollment Survey |
| Share of degrees awarded in engineering and natural sciences | Percent of total degrees granted that are awarded in engineering and natural sciences. Degree programs are identified in IPEDS using the Classification of Instructional Programs (CIP) taxonomy. | IPEDS Completions Survey |
| Average full-time faculty salary outlay | Projected total salary outlays for full-time instructional faculty divided by total number of full-time instructional faculty (equated to 9-month contracts) | IPEDS Salary Survey |
| State unemployment rate | Percent of state residents unemployed each year. | U.S. Bureau of Labor Statistics, Local Area Unemployment Data |
| State tax revenue | Total tax revenue collected by state each year | U.S. Census Bureau |
| Definitions for IPEDS variables retrieved from the IPEDS Data Glossary at http://nces.ed.gov/ipeds/glossary/ and IPEDS documentation files at http://nces.ed.gov/ipeds/datacenter/ | | |

**Table A.7 Imputation sensitivity check: relationship between state appropriations/FTE and log level of part-time faculty**

| | Imputed (1) | Non-Imputed (2) |
|---|---|---|
| **Log state approps/FTE** | 0.0037 | 0.0019 |
| | (0.0261) | (0.026) |
| Log net tuition revenue/FTE | 0.0898* | -0.0021 |
| | (0.0421) | (0.0314) |
| Log federal revenue/FTE | -0.0422 | -0.0673** |
| | (0.0263) | (0.0244) |
| Log other revenue/FTE[+] | 0.0344+ | 0.0346+ |
| | (0.0197) | (0.0201) |
| Percent engin/sci degrees | -0.1683 | 0.0258 |
| | (0.2377) | (0.2166) |
| Percent non-resident students | -0.2392+ | -0.0168 |
| | (0.1379) | (0.1547) |
| Log total part-time students | 0.0272 | 0.1455** |
| | (0.0563) | (0.049) |
| Log total FTE students | 0.6434*** | 0.4475*** |
| | (0.0834) | (0.089) |
| Log avg. full-time faculty salary | 0.0374 | 0.0152 |
| | (0.0233) | (0.0254) |
| State unemployment rate | -0.0044 | -0.0042 |
| | (0.0110) | (0.0107) |
| Log state tax revenue | 0.1258 | -0.1612 |
| | (0.1241) | (0.1093) |
| Independent variables lagged one year | | |
| Institution fixed effects | x | x |
| Year fixed effects | x | x |
| R2 (within) | 0.170 | 0.113 |
| Observations | 15145 | 9471 |
| Institutions | 1357 | 1312 |
| F | 31.720 | 19.396 |

[+]p<0.10, *p<0.05, **p<0.01, ***p<0.001

Robust std errors in parenthes; errors clustered at institution level

[+]Includes revenue from private, local, and "other" sources (excluding auxiliary and hospital revenue)

Results presented for full sample; preferred model is outlined

**Table A.8 Imputation sensitivity check: relationship between state appropriations/FTE and log level of non-tenure track faculty**

| | Imputed (1) | Non-Imputed (2) |
|---|---|---|
| **Log state approps/FTE** | 0.0970** | 0.0822* |
| | (0.0371) | (0.0383) |
| Log net tuition revenue/FTE | -0.0339*** | 0.0856+ |
| | (0.0101) | (0.0470) |
| Log federal revenue/FTE | -0.1677+ | -0.0170 |
| | (0.0950) | (0.0314) |
| Log other revenue/FTE[+] | 0.0660+ | 0.0072 |
| | (0.0355) | (0.0166) |
| Percent engin/sci degrees | -0.0085 | -0.1173 |
| | (0.0261) | (0.2582) |
| Percent non-resident students | 0.0032 | 0.1045 |
| | (0.0189) | (0.1767) |
| Log total part-time students | 0.0114 | -0.0028 |
| | (0.2320) | (0.0476) |
| Log total FTE students | -0.1305 | 0.6054*** |
| | (0.1661) | (0.0891) |
| Log avg. full-time faculty salary | -0.0660 | -0.0343 |
| | (0.0447) | (0.0236) |
| State unemployment rate | 0.6543*** | -0.0143 |
| | (0.0880) | (0.0102) |
| Log state tax revenue | 0.0056 | -0.3399** |
| | (0.0139) | (0.1085) |
| Independent variables lagged one year | | |
| Institution fixed effects | x | x |
| Year fixed effects | x | x |
| R2 (within) | 0.094 | 0.056 |
| Observations | 13591 | 8444 |
| Institutions | 1325 | 1251 |
| F | 17.248 | 10.742 |

[+]p<0.10, *p<0.05, **p<0.01, ***p<0.001

Robust std errors in parenthes; errors clustered at institution level

[+]Includes revenue from private, local, and "other" sources (excluding auxiliary and hospital revenue)

Results presented for full sample; preferred model is outlined

**Table A.9 Imputation sensitivity check: relationship between state appropriations/FTE and log level of non-tenure track faculty**

| | Imputed (1) | Non-Imputed (2) |
|---|---|---|
| **Log state approps/FTE** | 0.0717*** | 0.0224* |
| | (0.0184) | (0.0113) |
| Log net tuition revenue/FTE | 0.0066 | -0.0056 |
| | (0.0045) | (0.0126) |
| Log federal revenue/FTE | 0.1474*** | -0.0024 |
| | (0.0380) | (0.0111) |
| Log other revenue/FTE[+] | -0.0037 | -0.0071 |
| | (0.0169) | (0.0104) |
| Percent engin/sci degrees | -0.0180 | 0.1940 |
| | (0.0122) | (0.1482) |
| Percent non-resident students | 0.0562*** | -0.0057 |
| | (0.0134) | (0.0596) |
| Log total part-time students | 0.0522 | -0.0305 |
| | (0.1377) | (0.0229) |
| Log total FTE students | 0.1022 | 0.2500*** |
| | (0.0687) | (0.0694) |
| Log avg. full-time faculty salary | -0.0575 | 0.0149+ |
| | (0.0366) | (0.0087) |
| State unemployment rate | 0.4694*** | -0.0041 |
| | (0.0737) | (0.0042) |
| Log state tax revenue | -0.0036 | 0.1130*** |
| | (0.0072) | (0.0298) |
| Independent variables lagged one year | x | x |
| Institution fixed effects | x | x |
| Year fixed effects | x | x |
| R2 (within) | 0.060 | 0.026 |
| Observations | 12081 | 7625 |
| Institutions | 1092 | 1029 |
| F | 7.266 | 6.154 |

[+]p<0.10, *p<0.05, **p<0.01, ***p<0.001

Robust std errors in parenthes; errors clustered at institution level

[+]Includes revenue from private, local, and "other" sources (excluding auxiliary and hospital revenue)

Results presented for full sample; preferred model is outlined

**Table A.10 Imputation sensitivity check: relationship between state appropriations/FTE and the share of part-time faculty**

| | Imputed (1) | Non-Imputed (2) |
|---|---|---|
| **Log state approps/FTE** | -0.0140* | -0.0116** |
| | (0.0055) | (0.0044) |
| Log net tuition revenue/FTE | -0.0045* | -0.0013 |
| | (0.0018) | (0.0060) |
| Log federal revenue/FTE | 0.0179 | -0.0059 |
| | (0.0225) | (0.0052) |
| Log other revenue/FTE[+] | 0.0052 | 0.0026 |
| | (0.0070) | (0.0052) |
| Percent engin/sci degrees | -0.0074 | -0.0014 |
| | (0.0052) | (0.0450) |
| Percent non-resident students | -0.0067 | -0.0398 |
| | (0.0045) | (0.0267) |
| Log total part-time students | -0.1132* | 0.0299*** |
| | (0.0575) | (0.0087) |
| Log total FTE students | -0.0831** | 0.0189 |
| | (0.0281) | (0.0159) |
| Log avg. full-time faculty salary | 0.0208* | 0.0032 |
| | (0.0091) | (0.0049) |
| State unemployment rate | 0.0285+ | -0.0014 |
| | (0.0166) | (0.0018) |
| Log state tax revenue | 0.0024 | -0.0090 |
| | (0.0037) | (0.0191) |
| Independent variables lagged one year | | |
| Institution fixed effects | x | x |
| Year fixed effects | x | x |
| R2 (within) | 0.127 | 0.071 |
| Observations | 15613 | 9592 |
| Institutions | 1359 | 1316 |
| F | 20.327 | 10.535 |

[+]p<0.10, *p<0.05, **p<0.01, ***p<0.001

Robust std errors in parenthes; errors clustered at institution level

[+]Includes revenue from private, local, and "other" sources (excluding auxiliary and hospital revenue)

Results presented for full sample; preferred model is outlined

**Table A.11 Imputation sensitivity check: relationship between state appropriations/FTE and the share of full-time non-tenure track faculty**

| | Imputed (1) | Non-Imputed (2) |
|---|---|---|
| **Log state approps/FTE** | -0.0122 | 0.0037 |
| | (0.0077) | (0.0048) |
| Log net tuition revenue/FTE | -0.0034+ | 0.0019 |
| | (0.0019) | (0.0081) |
| Log federal revenue/FTE | -0.0593** | -0.0026 |
| | (0.0226) | (0.0044) |
| Log other revenue/FTE[+] | -0.0037 | 0.0027 |
| | (0.0079) | (0.0031) |
| Percent engin/sci degrees | -0.0043 | -0.1124* |
| | (0.0050) | (0.0477) |
| Percent non-resident students | -0.0052 | 0.0165 |
| | (0.0049) | (0.0292) |
| Log total part-time students | 0.0159 | 0.0040 |
| | (0.0638) | (0.0077) |
| Log total FTE students | -0.0016 | 0.0159 |
| | (0.0326) | (0.0207) |
| Log avg. full-time faculty salary | -0.0015 | -0.0069* |
| | (0.0097) | (0.0034) |
| State unemployment rate | 0.0128 | -0.0011 |
| | (0.0186) | (0.0016) |
| Log state tax revenue | 0.0011 | -0.0690** |
| | (0.0021) | (0.0215) |
| Independent variables lagged one year | | |
| Institution fixed effects | x | x |
| Year fixed effects | x | x |
| R2 (within) | 0.024 | 0.027 |
| Observations | 15595 | 9580 |
| Institutions | 1359 | 1316 |
| F | 7.444 | 5.098 |

[+]p<0.10, *p<0.05, **p<0.01, ***p<0.001

Robust std errors in parenthes; errors clustered at institution level

[+]Includes revenue from private, local, and "other" sources (excluding auxiliary and hospital revenue)

Results presented for full sample; preferred model is outlined

**Table A.12 Correlation matrix for dependent and independent variables included in regression models**

| | Log part-time faculty | Log non-tenure track faculty | Log tenure track faculty | Part-time faculty share | Non-tenure track faculty share | Log state appropriations/FTE |
|---|---|---|---|---|---|---|
| Log part-time faculty | 1 | | | | | |
| Log non-tenure track faculty | 0.194*** | 1 | | | | |
| Log tenure track faculty | 0.365*** | 0.494*** | 1 | | | |
| Part-time faculty share | 0.557*** | -0.289*** | -0.383*** | 1 | | |
| Non-tenure track faculty share | -0.0386*** | 0.484*** | -0.259*** | 0.137*** | 1 | |
| Log state appropriations/FTE | -0.197*** | 0.217*** | 0.264*** | -0.425*** | -0.0337*** | 1 |
| State appropriations share of revenue | -0.273*** | -0.0654*** | -0.0910*** | -0.203*** | 0.0188* | 0.696*** |
| Log net tuition & fees/FTE | 0.0470*** | 0.273*** | 0.366*** | -0.322*** | -0.133*** | 0.198*** |
| Log federal revenue/FTE | -0.0517*** | 0.298*** | 0.193*** | -0.215*** | 0.103*** | 0.288*** |
| Log other revenue/FTE | 0.209*** | 0.171*** | 0.333*** | 0.00873 | -0.0404*** | -0.0885*** |
| Percent engin/sci degrees | -0.0770*** | 0.215*** | 0.230*** | -0.341*** | -0.0372*** | 0.324*** |
| Percent non-resident students | -0.133*** | 0.145*** | 0.209*** | -0.359*** | -0.137*** | 0.212*** |
| Log total part-time students | 0.667*** | 0.233*** | 0.435*** | 0.257*** | -0.102*** | -0.256*** |
| Log total FTE students | 0.547*** | 0.451*** | 0.837*** | -0.214*** | -0.271*** | 0.0337*** |
| Log avg. full-time faculty salary | 0.225*** | 0.0558*** | 0.247*** | -0.0138 | -0.201*** | -0.0267*** |
| State unemployment rate | 0.177*** | -0.00963 | 0.0928*** | 0.130*** | -0.0642*** | -0.213*** |
| Log state tax revenue | 0.349*** | -0.128*** | 0.144*** | 0.235*** | -0.204*** | -0.0855*** |

| | State appropriations share of revenue | Log net tuition & fees/FTE | Log federal revenue/FTE | Log other revenue/FTE | Percent engin/sci degrees | Percent non-resident students |
|---|---|---|---|---|---|---|
| Log part-time faculty | | | | | | |
| Log non-tenure track faculty | | | | | | |
| Log tenure track faculty | | | | | | |
| Part-time faculty share | | | | | | |
| Non-tenure track faculty share | | | | | | |
| Log state appropriations/FTE | | | | | | |
| State appropriations share of revenue | 1 | | | | | |
| Log net tuition & fees/FTE | -0.251*** | 1 | | | | |
| Log federal revenue/FTE | -0.201*** | 0.248*** | 1 | | | |
| Log other revenue/FTE | -0.510*** | 0.0251*** | 0.187*** | 1 | | |
| Percent engin/sci degrees | 0.0869*** | 0.275*** | 0.222*** | 0.0833*** | 1 | |
| Percent non-resident students | -0.0158* | 0.274*** | 0.209*** | 0.0790*** | 0.198*** | 1 |
| Log total part-time students | -0.246*** | -0.0786*** | -0.141*** | 0.198*** | -0.135*** | -0.145*** |
| Log total FTE students | -0.196*** | 0.313*** | 0.0603*** | 0.205*** | 0.149*** | 0.136*** |
| Log avg. full-time faculty salary | -0.162*** | 0.104*** | 0.00594 | 0.201*** | 0.0451*** | 0.00565 |
| State unemployment rate | -0.306*** | 0.0422*** | 0.216*** | 0.0707*** | -0.012 | -0.116*** |
| Log state tax revenue | -0.0654*** | -0.144*** | -0.164*** | 0.191*** | -0.0595*** | -0.301*** |

| | Log total part-time students | Log total FTE students | Log avg. full-time faculty salary | State unemployment rate | Log state tax revenue |
|---|---|---|---|---|---|
| Log part-time faculty | | | | | |
| Log non-tenure track faculty | | | | | |
| Log tenure track faculty | | | | | |
| Part-time faculty share | | | | | |
| Non-tenure track faculty share | | | | | |
| Log state appropriations/FTE | | | | | |
| State appropriations share of revenue | | | | | |
| Log net tuition & fees/FTE | | | | | |
| Log federal revenue/FTE | | | | | |
| Log other revenue/FTE | | | | | |
| Percent engin/sci degrees | | | | | |
| Percent non-resident students | | | | | |
| Log total part-time students | 1 | | | | |
| Log total FTE students | 0.728*** | 1 | | | |
| Log avg. full-time faculty salary | 0.195*** | 0.239*** | 1 | | |
| State unemployment rate | 0.140*** | 0.157*** | 0.120*** | 1 | |
| Log state tax revenue | 0.340*** | 0.285*** | 0.229*** | 0.252*** | 1 |

**Table A.13 The relationship between state appropriations share and log levels of part-time faculty**

| | Full sample | | 4-year Research | | 4-year Non-Research | | 2-year | |
|---|---|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
| State appropriations share of total revenue | -0.544*** | -0.354** | 0.038 | 1.836+ | -0.789* | 0.588 | -0.437*** | -0.302* |
| | (0.111) | (0.129) | (0.600) | (0.985) | (0.367) | (0.488) | (0.105) | (0.131) |
| Log net tuition revenue/FTE | | 0.070+ | | 0.385 | | 0.335* | | 0.022 |
| | | (0.042) | | (0.292) | | (0.135) | | (0.040) |
| Log federal revenue/FTE | | -0.044+ | | 0.200 | | 0.128+ | | -0.024 |
| | | (0.026) | | (0.157) | | (0.077) | | (0.031) |
| Log other revenue/FTE+ | | 0.012 | | 0.052 | | 0.074 | | 0.001 |
| | | (0.021) | | (0.064) | | (0.053) | | (0.025) |
| Percent engin/sci degrees | | -0.167 | | -1.024 | | 0.482 | | -0.282 |
| | | (0.237) | | (0.955) | | (0.777) | | (0.257) |
| Percent non-resident students | | -0.223 | | -0.976+ | | 0.183 | | -0.185 |
| | | (0.137) | | (0.555) | | (0.382) | | (0.138) |
| Log total part-time students | | 0.024 | | 0.209 | | -0.003 | | 0.131* |
| | | (0.056) | | (0.180) | | (0.113) | | (0.065) |
| Log total FTE students | | 0.599*** | | 1.175** | | 1.080*** | | 0.508*** |
| | | (0.083) | | (0.416) | | (0.237) | | (0.084) |
| Log avg. full-time faculty salary | | 0.039+ | | -0.032 | | 0.051 | | -0.017 |
| | | (0.023) | | (0.050) | | (0.034) | | (0.033) |
| State unemployment rate | | -0.009 | | 0.041 | | 0.036 | | -0.034** |
| | | (0.011) | | (0.034) | | (0.028) | | (0.011) |
| Log state tax revenue | | 0.156 | | -0.289 | | 0.278 | | 0.062 |
| | | (0.125) | | (0.307) | | (0.256) | | (0.155) |
| Independent variables lagged one year | | | | | | | | |
| Institution fixed effects | x | x | x | x | x | x | x | x |
| Year fixed effects | x | x | x | x | x | x | x | x |
| Institution- & state-level controls | | x | | x | | x | | x |
| R2 (within) | 0.152 | 0.169 | 0.180 | 0.216 | 0.192 | 0.218 | 0.128 | 0.156 |
| Observations | 15311 | 15311 | 2067 | 2067 | 3943 | 3943 | 9301 | 9301 |
| Institutions | 1358 | 1358 | 160 | 160 | 334 | 334 | 864 | 864 |
| F | 43.418 | 31.807 | 11.298 | 8.719 | 15.912 | 12.163 | 23.488 | 21.881 |

+p<0.10, *p<0.05, **p<0.01, ***p<0.001

Robust std errors in parentheses; errors clustered at institution level

**Table A.14 The relationship between state appropriations share and log levels of non-tenure track faculty**

| | Full sample | | 4-year Research | | 4-year Non-Research | | 2-year | |
|---|---|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
| State appropriations share of total revenue | -0.252+ | -0.002 | -0.114 | 0.859 | -0.381 | 0.386 | -0.055 | 0.295 |
| | (0.144) | (0.170) | (0.384) | (0.593) | (0.272) | (0.367) | (0.182) | (0.201) |
| Log net tuition revenue/FTE | | 0.067+ | | 0.112 | | 0.000 | | 0.054 |
| | | (0.035) | | (0.127) | | (0.109) | | (0.039) |
| Log federal revenue/FTE | | 0.002 | | 0.260** | | 0.102+ | | 0.047 |
| | | (0.027) | | (0.083) | | (0.053) | | (0.034) |
| Log other revenue/FTE+ | | 0.009 | | 0.026 | | -0.001 | | 0.019 |
| | | (0.020) | | (0.048) | | (0.037) | | (0.028) |
| Percent engin/sci degrees | | 0.029 | | -0.076 | | -0.192 | | -0.022 |
| | | (0.233) | | (0.607) | | (0.580) | | (0.283) |
| Percent non-resident students | | -0.139 | | 0.284 | | -0.249 | | -0.153 |
| | | (0.165) | | (0.332) | | (0.227) | | (0.227) |
| Log total part-time students | | -0.065 | | 0.124 | | -0.043 | | 0.081 |
| | | (0.045) | | (0.133) | | (0.062) | | (0.070) |
| Log total FTE students | | 0.603*** | | 0.443 | | 1.183*** | | 0.600*** |
| | | (0.086) | | (0.311) | | (0.159) | | (0.109) |
| Log avg. full-time faculty salary | | 0.009 | | -0.000 | | 0.020 | | -0.097** |
| | | (0.014) | | (0.029) | | (0.017) | | (0.033) |
| State unemployment rate | | -0.036*** | | -0.013 | | -0.016 | | -0.039* |
| | | (0.010) | | (0.016) | | (0.017) | | (0.015) |
| Log state tax revenue | | -0.116 | | -0.473 | | -0.230+ | | 0.005 |
| | | (0.095) | | (0.297) | | (0.133) | | (0.137) |
| Independent variables lagged one year | | | | | | | | |
| Institution fixed effects | X | x | x | x | x | x | x | x |
| Year fixed effects | X | x | x | x | x | x | x | x |
| Institution- & state-level controls | | x | | x | | x | | x |
| R2 (within) | 0.075 | 0.091 | 0.238 | 0.256 | 0.223 | 0.274 | 0.024 | 0.048 |
| Observations | 13723 | 13723 | 2072 | 2072 | 4024 | 4024 | 7627 | 7627 |
| Institutions | 1327 | 1327 | 160 | 160 | 333 | 333 | 834 | 834 |
| F | 23.845 | 17.242 | 16.098 | 14.506 | 21.517 | 19.329 | 6.241 | 7.083 |

+p<0.10, *p<0.05, **p<0.01, ***p<0.001

Robust std errors in parentheses; errors clustered at institution level

**Table A.15 The relationship between state appropriations share and log levels of tenure track faculty**

| | Full sample | | 4-year Research | | 4-year Non-Research | | 2-year | |
|---|---|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
| State appropriations share of total revenue | 0.217*** | 0.465*** | -0.022 | 0.550*** | 0.092 | 0.812*** | 0.346*** | 0.567*** |
| | (0.062) | (0.089) | (0.111) | (0.146) | (0.099) | (0.123) | (0.090) | (0.122) |
| Log net tuition revenue/FTE | | 0.044+ | | 0.086* | | 0.170** | | 0.010 |
| | | (0.022) | | (0.040) | | (0.053) | | (0.025) |
| Log federal revenue/FTE | | 0.019 | | 0.087*** | | 0.059*** | | 0.038* |
| | | (0.013) | | (0.021) | | (0.017) | | (0.018) |
| Log other revenue/FTE[+] | | 0.043** | | 0.063*** | | 0.049*** | | 0.055* |
| | | (0.013) | | (0.010) | | (0.010) | | (0.021) |
| Percent engin/sci degrees | | 0.124 | | -0.088 | | 0.082 | | 0.200 |
| | | (0.151) | | (0.088) | | (0.348) | | (0.200) |
| Percent non-resident students | | 0.029 | | -0.065 | | -0.020 | | 0.054 |
| | | (0.055) | | (0.066) | | (0.062) | | (0.084) |
| Log total part-time students | | -0.055* | | 0.007 | | -0.014 | | -0.079 |
| | | (0.026) | | (0.024) | | (0.021) | | (0.058) |
| Log total FTE students | | 0.471*** | | 0.562*** | | 0.618*** | | 0.489*** |
| | | (0.068) | | (0.064) | | (0.083) | | (0.101) |
| Log avg. full-time faculty salary | | 0.003 | | -0.000 | | 0.002 | | -0.022 |
| | | (0.005) | | (0.006) | | (0.005) | | (0.017) |
| State unemployment rate | | 0.005 | | -0.000 | | 0.003 | | 0.014 |
| | | (0.005) | | (0.004) | | (0.006) | | (0.009) |
| Log state tax revenue | | 0.147*** | | 0.045 | | 0.012 | | 0.281*** |
| | | (0.036) | | (0.046) | | (0.042) | | (0.078) |
| Independent variables lagged one year | x | x | x | x | x | x | x | x |
| Institution fixed effects | x | x | x | x | x | x | x | x |
| Year fixed effects | x | x | x | x | x | x | x | x |
| Institution- & state-level controls | | x | | x | | x | | x |
| R2 (within) | 0.014 | 0.072 | 0.076 | 0.221 | 0.044 | 0.172 | 0.016 | 0.069 |
| Observations | 12098 | 12098 | 2061 | 2061 | 4019 | 4019 | 6018 | 6018 |
| Institutions | 1084 | 1084 | 160 | 160 | 331 | 331 | 593 | 593 |
| F | 5.152 | 7.598 | 9.087 | 12.098 | 5.702 | 9.072 | 3.239 | 4.441 |

[+]p<0.10, *p<0.05, **p<0.01, ***p<0.001

Robust std errors in parentheses; errors clustered at institution level

**Table A.16 The relationship between state appropriations share and the share of part-time faculty**

| | Full sample | | 4-year Research | | 4-year Non-Research | | 2-year | |
|---|---|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
| State appropriations share of total revenue | -0.054* | -0.102*** | 0.009 | -0.029 | -0.074 | -0.056 | -0.071** | -0.134*** |
| | (0.022) | (0.027) | (0.083) | (0.123) | (0.051) | (0.067) | (0.026) | (0.033) |
| Log net tuition revenue/FTE | | -0.001 | | 0.004 | | 0.004 | | -0.000 |
| | | (0.007) | | (0.032) | | (0.017) | | (0.008) |
| Log federal revenue/FTE | | -0.010* | | -0.021 | | -0.004 | | -0.014* |
| | | (0.005) | | (0.017) | | (0.010) | | (0.007) |
| Log other revenue/FTE$^{+}$ | | -0.013** | | -0.009 | | 0.006 | | -0.020** |
| | | (0.005) | | (0.008) | | (0.008) | | (0.007) |
| Percent engin/sci degrees | | -0.116* | | -0.114 | | 0.039 | | -0.163* |
| | | (0.057) | | (0.121) | | (0.148) | | (0.070) |
| Percent non-resident students | | -0.083** | | -0.091 | | -0.027 | | -0.093* |
| | | (0.029) | | (0.056) | | (0.056) | | (0.038) |
| Log total part-time students | | 0.020* | | 0.036* | | 0.010 | | 0.017 |
| | | (0.009) | | (0.018) | | (0.015) | | (0.014) |
| Log total FTE students | | 0.023 | | 0.025 | | 0.070* | | 0.007 |
| | | (0.016) | | (0.049) | | (0.031) | | (0.021) |
| Log avg. full-time faculty salary | | 0.002 | | -0.003 | | 0.003 | | 0.011 |
| | | (0.004) | | (0.006) | | (0.004) | | (0.009) |
| State unemployment rate | | -0.005** | | 0.002 | | -0.001 | | -0.009*** |
| | | (0.002) | | (0.004) | | (0.004) | | (0.003) |
| Log state tax revenue | | 0.019 | | -0.021 | | 0.070 | | -0.004 |
| | | (0.023) | | (0.032) | | (0.046) | | (0.034) |
| Independent variables lagged one year | | | | | | | | |
| Institution fixed effects | x | x | x | x | x | x | x | x |
| Year fixed effects | x | x | x | x | x | x | x | x |
| Institution- & state-level controls | | x | | x | | x | | x |
| R2 (within) | 0.117 | 0.127 | 0.097 | 0.117 | 0.181 | 0.193 | 0.111 | 0.123 |
| Observations | 15789 | 15789 | 2082 | 2082 | 4100 | 4100 | 9607 | 9607 |
| Institutions | 1360 | 1360 | 160 | 160 | 334 | 334 | 866 | 866 |
| F | 32.390 | 20.513 | 5.171 | 3.953 | 15.211 | 10.207 | 17.560 | 11.785 |

$^{+}$p<0.10, *p<0.05, **p<0.01, ***p<0.001

Robust std errors in parentheses; errors clustered at institution level

**Table A.17 The relationship between state appropriations share and the share of non-tenure track faculty**

| | Full sample | | 4-year Research | | 4-year Non-Research | | 2-year | |
|---|---|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
| State appropriations share of total revenue | -0.059* | -0.082** | 0.045 | 0.155+ | -0.094* | -0.067 | -0.038 | -0.063+ |
| | (0.027) | (0.030) | (0.057) | (0.093) | (0.041) | (0.053) | (0.034) | (0.035) |
| Log net tuition revenue/FTE | | -0.009 | | 0.022 | | -0.012 | | -0.011 |
| | | (0.008) | | (0.020) | | (0.017) | | (0.009) |
| Log federal revenue/FTE | | -0.008 | | 0.023+ | | 0.006 | | -0.006 |
| | | (0.006) | | (0.014) | | (0.008) | | (0.007) |
| Log other revenue/FTE+ | | -0.008 | | -0.002 | | -0.001 | | -0.011 |
| | | (0.005) | | (0.007) | | (0.008) | | (0.007) |
| Percent engin/sci degrees | | 0.013 | | 0.043 | | -0.050 | | 0.018 |
| | | (0.063) | | (0.119) | | (0.111) | | (0.085) |
| Percent non-resident students | | -0.000 | | 0.055 | | 0.021 | | -0.010 |
| | | (0.032) | | (0.059) | | (0.032) | | (0.045) |
| Log total part-time students | | -0.002 | | 0.027 | | 0.003 | | 0.005 |
| | | (0.010) | | (0.022) | | (0.009) | | (0.017) |
| Log total FTE students | | 0.013 | | -0.004 | | 0.060* | | 0.013 |
| | | (0.018) | | (0.053) | | (0.031) | | (0.024) |
| Log avg. full-time faculty salary | | 0.001 | | -0.001 | | 0.004+ | | -0.008+ |
| | | (0.002) | | (0.005) | | (0.002) | | (0.005) |
| State unemployment rate | | -0.004+ | | -0.001 | | -0.001 | | -0.005+ |
| | | (0.002) | | (0.003) | | (0.003) | | (0.003) |
| Log state tax revenue | | -0.058* | | -0.097+ | | -0.023 | | -0.088* |
| | | (0.023) | | (0.057) | | (0.020) | | (0.043) |
| Independent variables lagged one year | | | | | | | | |
| Institution fixed effects | x | x | x | x | x | x | x | x |
| Year fixed effects | x | x | x | x | x | x | x | x |
| Institution- & state-level controls | | x | | x | | x | | x |
| R2 (within) | 0.020 | 0.024 | 0.207 | 0.228 | 0.110 | 0.121 | 0.008 | 0.013 |
| Observations | 15771 | 15771 | 2082 | 2082 | 4100 | 4100 | 9589 | 9589 |
| Institutions | 1360 | 1360 | 160 | 160 | 334 | 334 | 866 | 866 |
| F | 9.584 | 7.398 | 22.044 | 15.939 | 10.148 | 8.642 | 3.561 | 2.848 |

+p<0.10, *p<0.05, **p<0.01, ***p<0.001

Robust std errors in parentheses; errors clustered at institution level

**Table A.18 The relationship between state appropriations volatility and log level of part-time faculty**

| | Full sample | | 4-year Research | | 4-year Non-Research | | 2-year | |
|---|---|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
| **Volatility in state appropriations/FTE student** | 0.3654 | 0.4319+ | -0.7923 | -1.2322 | -0.1244 | 0.1228 | 0.4744+ | 0.5317* |
| | (0.2585) | (0.2329) | (1.9697) | (1.8058) | (0.3778) | (0.3883) | (0.2550) | (0.2259) |
| Log state approps/FTE | | 0.0298 | | 0.4111 | | 0.5246 | | -0.0638 |
| | | (0.0752) | | (0.3300) | | (0.3196) | | (0.0823) |
| Log net tuition revenue/FTE | | -0.0686 | | -0.4040 | | 0.2017 | | -0.0813 |
| | | (0.0698) | | (0.3078) | | (0.1796) | | (0.0796) |
| Log federal revenue/FTE | | -0.1115* | | -0.1389 | | -0.0148 | | 0.0096 |
| | | (0.0567) | | (0.3521) | | (0.1112) | | (0.0652) |
| Log other revenue/FTE[+] | | -0.0144 | | 0.4370* | | -0.0996 | | -0.0376 |
| | | (0.0448) | | (0.1746) | | (0.1049) | | (0.0459) |
| Percent engin/sci degrees | | -0.2529 | | -2.9969+ | | 0.0661 | | -0.0668 |
| | | (0.5560) | | (1.7077) | | (1.3486) | | (0.7307) |
| Percent non-resident students | | 0.1918 | | -0.9081 | | -0.1066 | | 0.5342 |
| | | (0.3098) | | (1.1485) | | (0.8836) | | (0.3281) |
| Log total part-time students | | 0.1289 | | 0.5797* | | 0.0618 | | 0.2761* |
| | | (0.0932) | | (0.2753) | | (0.2015) | | (0.1318) |
| Log total FTE students | | 0.4778** | | 0.4131 | | 0.7791* | | 0.3707* |
| | | (0.1537) | | (0.6951) | | (0.3580) | | (0.1773) |
| Log avg. full-time faculty salary | | 0.0549+ | | -0.0485 | | 0.0601 | | 0.0006 |
| | | (0.0294) | | (0.1008) | | (0.0455) | | (0.0364) |
| State unemployment rate | | -0.0074 | | 0.1076 | | -0.0219 | | -0.0199 |
| | | (0.0280) | | (0.0682) | | (0.0813) | | (0.0329) |
| Log state tax revenue | | -0.3125 | | -1.1300* | | -0.2585 | | -0.2793 |
| | | (0.2436) | | (0.4808) | | (0.4743) | | (0.2133) |
| Independent variables lagged one year | | | | | | | | |
| Institution fixed effects | x | x | x | x | x | x | x | x |
| Year fixed effects | x | x | x | x | x | x | x | x |
| R2 (within) | 0.182 | 0.215 | 0.225 | 0.385 | 0.219 | 0.254 | 0.164 | 0.222 |
| Observations | 2213 | 2213 | 292 | 292 | 568 | 568 | 1353 | 1353 |
| Institutions | 1304 | 1304 | 159 | 159 | 333 | 333 | 812 | 812 |
| F | 97.538 | 23.329 | 20.100 | 4.552 | 34.264 | 7.721 | 47.377 | 14.986 |

[+]p<0.10, *p<0.05, **p<0.01, ***p<0.001

Robust std errors in parentheses; errors clustered at institution level

**Table A.19 The relationship between state appropriations volatility and log level of non-tenure track faculty**

| | Full sample | | 4-year Research | | 4-year Non-Research | | 2-year | |
|---|---|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
| **Volatility in state appropriations/FTE student** | 0.3128 | 0.1412 | 0.6105 | 1.0377 | -0.0863 | 0.3562 | 0.5106 | 0.2088 |
| | (0.2893) | (0.2745) | (1.5702) | (1.5530) | (0.2621) | (0.3905) | (0.3196) | (0.3780) |
| Log state approps/FTE | | 0.0448 | | 0.4386+ | | 0.3742 | | -0.0337 |
| | | (0.0758) | | (0.2434) | | (0.2272) | | (0.0891) |
| Log net tuition revenue/FTE | | 0.1690* | | -0.1444 | | 0.1750 | | 0.1424 |
| | | (0.0757) | | (0.2248) | | (0.1957) | | (0.0878) |
| Log federal revenue/FTE | | -0.0309 | | 0.0067 | | 0.1421 | | 0.0476 |
| | | (0.0583) | | (0.1666) | | (0.1202) | | (0.0765) |
| Log other revenue/FTE[+] | | 0.0136 | | -0.1365 | | 0.0019 | | 0.0746 |
| | | (0.0421) | | (0.1017) | | (0.0808) | | (0.0576) |
| Percent engin/sci degrees | | 0.4843 | | -0.8066 | | 1.9907 | | -0.6367 |
| | | (0.7561) | | (0.8924) | | (2.3184) | | (0.7441) |
| Percent non-resident students | | -0.4676+ | | -0.6673 | | 0.2670 | | -0.6023+ |
| | | (0.2707) | | (0.7268) | | (0.4438) | | (0.3651) |
| Log total part-time students | | 0.0092 | | 0.1504 | | -0.0492 | | 0.3059* |
| | | (0.0848) | | (0.2619) | | (0.1469) | | (0.1199) |
| Log total FTE students | | 0.8282*** | | 1.1263* | | 1.4872*** | | 0.5439** |
| | | (0.1603) | | (0.4714) | | (0.3910) | | (0.1861) |
| Log avg. full-time faculty salary | | 0.0586+ | | 0.0709 | | 0.0476 | | 0.0194 |
| | | (0.0330) | | (0.0669) | | (0.0383) | | (0.0788) |
| State unemployment rate | | -0.0123 | | -0.0860+ | | 0.0443 | | -0.0036 |
| | | (0.0263) | | (0.0509) | | (0.0478) | | (0.0392) |
| Log state tax revenue | | -0.3433+ | | -0.7088* | | -0.3978 | | -0.3440 |
| | | (0.1895) | | (0.3427) | | (0.3084) | | (0.2710) |
| Independent variables lagged one year | | | | | | | | |
| Institution fixed effects | x | x | x | x | x | x | x | x |
| Year fixed effects | x | x | x | x | x | x | x | x |
| R2 (within) | 0.086 | 0.152 | 0.170 | 0.304 | 0.138 | 0.255 | 0.051 | 0.140 |
| Observations | 1990 | 1990 | 294 | 294 | 577 | 577 | 1119 | 1119 |
| Institutions | 1210 | 1210 | 159 | 159 | 329 | 329 | 722 | 722 |
| F | 36.109 | 11.317 | 13.886 | 7.578 | 20.143 | 5.591 | 9.666 | 6.881 |

[+]p<0.10, *p<0.05, **p<0.01, ***p<0.001

Robust std errors in parentheses; errors clustered at institution level

**Table A.20 The relationship between state appropriations volatility and log level of tenure track faculty**

| | Full sample | | 4-year Research | | 4-year Non-Research | | 2-year | |
|---|---|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
| **Volatility in state appropriations/FTE student** | -0.0726 | -0.0582 | -0.7821* | -0.4460 | -0.4806* | -0.2596+ | -0.0293 | -0.0098 |
| | (0.0603) | (0.0526) | (0.3894) | (0.2801) | (0.1989) | (0.1452) | (0.0613) | (0.0546) |
| Log state approps/FTE | | 0.0793* | | 0.2014*** | | 0.1245+ | | 0.0548 |
| | | (0.0350) | | (0.0508) | | (0.0646) | | (0.0408) |
| Log net tuition revenue/FTE | | 0.0405 | | 0.0026 | | 0.2147 | | -0.0038 |
| | | (0.0405) | | (0.0513) | | (0.1553) | | (0.0333) |
| Log federal revenue/FTE | | -0.0623* | | 0.0652 | | -0.0009 | | -0.0748+ |
| | | (0.0259) | | (0.0459) | | (0.0503) | | (0.0447) |
| Log other revenue/FTE[+] | | 0.0554** | | 0.0697** | | 0.0382 | | 0.0677* |
| | | (0.0190) | | (0.0223) | | (0.0243) | | (0.0303) |
| Percent engin/sci degrees | | -0.2768 | | -0.2423 | | 0.7192 | | -0.6546 |
| | | (0.4072) | | (0.1857) | | (0.9710) | | (0.5437) |
| Percent non-resident students | | 0.2184 | | 0.0340 | | -0.0163 | | 0.3901 |
| | | (0.1730) | | (0.1459) | | (0.1344) | | (0.2866) |
| Log total part-time students | | -0.1181** | | 0.0179 | | -0.0308 | | -0.1890+ |
| | | (0.0409) | | (0.0309) | | (0.0505) | | (0.1019) |
| Log total FTE students | | 0.5718*** | | 0.6011*** | | 0.7239*** | | 0.6422*** |
| | | (0.1362) | | (0.0843) | | (0.1979) | | (0.1806) |
| Log avg. full-time faculty salary | | -0.0099 | | -0.0354 | | 0.0576 | | -0.1984 |
| | | (0.0812) | | (0.0545) | | (0.0480) | | (0.2203) |
| State unemployment rate | | 0.0173+ | | -0.0020 | | -0.0036 | | 0.0572*** |
| | | (0.0098) | | (0.0076) | | (0.0209) | | (0.0172) |
| Log state tax revenue | | 0.3231** | | -0.0500 | | 0.0478 | | 0.9051*** |
| | | (0.0996) | | (0.1123) | | (0.1042) | | (0.2540) |
| Independent variables lagged one year | x | x | x | x | x | x | x | x |
| Institution fixed effects | x | x | x | x | x | x | x | x |
| Year fixed effects | x | x | x | x | x | x | x | x |
| R2 (within) | 0.004 | 0.112 | 0.136 | 0.480 | 0.069 | 0.279 | 0.009 | 0.153 |
| Observations | 1739 | 1735 | 296 | 296 | 580 | 580 | 863 | 859 |
| Institutions | 1017 | 1017 | 160 | 160 | 330 | 330 | 527 | 527 |
| F | 1.431 | 4.704 | 10.588 | 8.205 | 7.877 | 6.912 | 1.557 | 2.838 |

[+]p<0.10, *p<0.05, **p<0.01, ***p<0.001

Robust std errors in parentheses; errors clustered at institution level

**Table A.21 The relationship between state appropriations volatility and the share of part-time faculty**

| | Full sample | | 4-year Research | | 4-year Non-Research | | 2-year | |
|---|---|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
| **Volatility in state appropriations/FTE student** | 0.0421 | 0.0547 | -0.1619 | -0.1876 | 0.0282 | 0.0107 | 0.0471 | 0.0627 |
| | (0.0458) | (0.0423) | (0.2024) | (0.1767) | (0.0436) | (0.0488) | (0.0514) | (0.0461) |
| Log state approps/FTE | | -0.0288* | | -0.0045 | | -0.0563 | | -0.0296+ |
| | | (0.0135) | | (0.0413) | | (0.0409) | | (0.0155) |
| Log net tuition revenue/FTE | | -0.0088 | | -0.0480 | | 0.0259 | | -0.0106 |
| | | (0.0127) | | (0.0407) | | (0.0306) | | (0.0150) |
| Log federal revenue/FTE | | -0.0046 | | -0.0096 | | 0.0054 | | -0.0012 |
| | | (0.0108) | | (0.0391) | | (0.0228) | | (0.0146) |
| Log other revenue/FTE[+] | | -0.0040 | | 0.0356+ | | -0.0048 | | -0.0084 |
| | | (0.0100) | | (0.0197) | | (0.0169) | | (0.0137) |
| Percent engin/sci degrees | | -0.1201 | | -0.2808 | | -0.2472 | | -0.0419 |
| | | (0.1366) | | (0.1884) | | (0.4063) | | (0.1690) |
| Percent non-resident students | | -0.0184 | | -0.0652 | | -0.0945 | | 0.0424 |
| | | (0.0618) | | (0.1230) | | (0.1683) | | (0.0702) |
| Log total part-time students | | 0.0208 | | 0.1063** | | -0.0182 | | 0.0357 |
| | | (0.0169) | | (0.0322) | | (0.0305) | | (0.0294) |
| Log total FTE students | | 0.0166 | | -0.0471 | | 0.0091 | | 0.0075 |
| | | (0.0283) | | (0.0810) | | (0.0654) | | (0.0372) |
| Log avg. full-time faculty salary | | 0.0049 | | -0.0035 | | 0.0049 | | 0.0025 |
| | | (0.0054) | | (0.0122) | | (0.0079) | | (0.0092) |
| State unemployment rate | | -0.0069 | | 0.0150+ | | -0.0167 | | -0.0092 |
| | | (0.0046) | | (0.0077) | | (0.0110) | | (0.0062) |
| Log state tax revenue | | -0.0339 | | -0.1186* | | 0.0211 | | -0.0694 |
| | | (0.0339) | | (0.0528) | | (0.0572) | | (0.0480) |
| Independent variables lagged one year | | | | | | | | |
| Institution fixed effects | x | x | x | x | x | x | x | x |
| Year fixed effects | x | x | x | x | x | x | x | x |
| R2 (within) | 0.131 | 0.152 | 0.142 | 0.291 | 0.200 | 0.222 | 0.110 | 0.140 |
| Observations | 2257 | 2257 | 294 | 294 | 585 | 585 | 1378 | 1378 |
| Institutions | 1310 | 1310 | 159 | 159 | 333 | 333 | 818 | 818 |
| F | 70.594 | 12.169 | 11.556 | 2.918 | 31.248 | 5.223 | 33.997 | 5.948 |

[+]p<0.10, *p<0.05, **p<0.01, ***p<0.001

Robust std errors in parentheses; errors clustered at institution level

**Table A.22 The relationship between state appropriations volatility and the share of non-tenure track faculty**

| | Full sample | | 4-year Research | | 4-year Non-Research | | 2-year | |
|---|---|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
| **Volatility in state appropriations/FTE student** | 0.0179 | 0.0223 | 0.1684 | 0.1577 | 0.0438 | 0.0805* | 0.0140 | 0.0186 |
| | (0.0259) | (0.0232) | (0.2442) | (0.2691) | (0.0270) | (0.0401) | (0.0294) | (0.0257) |
| Log state approps/FTE | | 0.0160 | | 0.0640 | | 0.0348 | | 0.0158 |
| | | (0.0144) | | (0.0432) | | (0.0274) | | (0.0152) |
| Log net tuition revenue/FTE | | -0.0167 | | -0.0316 | | 0.0069 | | -0.0227 |
| | | (0.0258) | | (0.0394) | | (0.0283) | | (0.0313) |
| Log federal revenue/FTE | | -0.0132 | | -0.0258 | | 0.0201 | | -0.0122 |
| | | (0.0134) | | (0.0309) | | (0.0169) | | (0.0202) |
| Log other revenue/FTE+ | | 0.0083 | | -0.0334+ | | 0.0049 | | 0.0166 |
| | | (0.0102) | | (0.0196) | | (0.0166) | | (0.0149) |
| Percent engin/sci degrees | | -0.0825 | | -0.0731 | | -0.1720 | | -0.1237 |
| | | (0.1643) | | (0.1578) | | (0.2766) | | (0.2447) |
| Percent non-resident students | | 0.0503 | | -0.1476 | | 0.0390 | | 0.1336 |
| | | (0.1058) | | (0.1515) | | (0.0790) | | (0.1698) |
| Log total part-time students | | 0.0105 | | 0.0288 | | -0.0158 | | 0.0424 |
| | | (0.0179) | | (0.0465) | | (0.0191) | | (0.0346) |
| Log total FTE students | | 0.0200 | | 0.1078 | | 0.1221 | | -0.0287 |
| | | (0.0301) | | (0.0877) | | (0.0770) | | (0.0402) |
| Log avg. full-time faculty salary | | -0.0017 | | 0.0098 | | -0.0004 | | -0.0102 |
| | | (0.0040) | | (0.0114) | | (0.0048) | | (0.0065) |
| State unemployment rate | | -0.0040 | | -0.0170+ | | 0.0053 | | -0.0074 |
| | | (0.0050) | | (0.0098) | | (0.0085) | | (0.0072) |
| Log state tax revenue | | -0.0706+ | | -0.1491* | | -0.0534 | | -0.0755 |
| | | (0.0363) | | (0.0645) | | (0.0413) | | (0.0745) |
| Independent variables lagged one year | | | | | | | | |
| Institution fixed effects | x | x | x | x | x | x | x | x |
| Year fixed effects | x | x | x | x | x | x | x | x |
| R2 (within) | 0.035 | 0.047 | 0.115 | 0.239 | 0.098 | 0.148 | 0.021 | 0.042 |
| Observations | 2253 | 2253 | 294 | 294 | 585 | 585 | 1374 | 1374 |
| Institutions | 1310 | 1310 | 159 | 159 | 333 | 333 | 818 | 818 |
| F | 17.163 | 4.343 | 8.469 | 4.431 | 14.466 | 4.101 | 6.163 | 1.961 |

+p<0.10, *p<0.05, **p<0.01, ***p<0.001

Robust std errors in parenthes; errors clustered at institution level

**Table A.23 Sensitivity check (3 periods of volatility): relationship between state appropriations volatility and log levels of part-time faculty**

| | Full sample | 4-year Research | 4-year Non-Research | 2-year |
|---|---|---|---|---|
| | (1) | (2) | (3) | (4) |
| **Volatility in state appropriations/FTE student (lagged one year)** | 0.1533 | -0.5361 | -0.5926 | 0.1824+ |
| | (0.1071) | (1.4521) | (0.4442) | (0.1094) |
| Log state approps/FTE | 0.0542 | 0.3636 | 0.2553 | 0.0257 |
| | (0.0443) | (0.3111) | (0.1952) | (0.0433) |
| Log net tuition revenue/FTE | 0.1044 | -0.0769 | 0.2510 | 0.0598 |
| | (0.0944) | (0.3412) | (0.2132) | (0.1081) |
| Log federal revenue/FTE | -0.0285 | -0.2081 | 0.1746+ | 0.0030 |
| | (0.0431) | (0.1828) | (0.0961) | (0.0546) |
| Log other revenue/FTE+ | 0.1111* | -0.0147 | 0.1749* | 0.0867 |
| | (0.0460) | (0.0923) | (0.0685) | (0.0647) |
| Percent engin/sci degrees | -0.2230 | -1.8693 | -0.0748 | -0.2341 |
| | (0.3656) | (1.4997) | (0.9899) | (0.4138) |
| Percent non-resident students | 0.0866 | -1.0983 | 0.6697 | 0.0745 |
| | (0.2416) | (0.6908) | (0.5158) | (0.3194) |
| Log total part-time students | 0.1411+ | 0.6265* | 0.0096 | 0.3205** |
| | (0.0775) | (0.2420) | (0.1349) | (0.1049) |
| Log total FTE students | 0.6876*** | 0.6617 | 1.3584*** | 0.4775** |
| | (0.1334) | (0.5420) | (0.3345) | (0.1598) |
| Log avg. full-time faculty salary | -0.3275+ | -0.6692 | -0.7294 | -0.1366 |
| | (0.1845) | (0.9837) | (0.5618) | (0.1893) |
| State unemployment rate | -0.0035 | 0.0654 | 0.0287 | -0.0317 |
| | (0.0170) | (0.0432) | (0.0422) | (0.0199) |
| Log state tax revenue | -0.0608 | -0.7161+ | -0.0959 | -0.0364 |
| | (0.1732) | (0.4238) | (0.3304) | (0.2028) |
| Independent variables lagged one year | | | | |
| Institution fixed effects | x | x | x | x |
| Year fixed effects | x | x | x | x |
| R2 (within) | 0.215 | 0.385 | 0.254 | 0.222 |
| Observations | 2213 | 292 | 568 | 1353 |
| Institutions | 1304 | 159 | 333 | 812 |
| F | 23.329 | 4.552 | 7.721 | 14.986 |

+p<0.10, *p<0.05, **p<0.01, ***p<0.001

Robust std errors in parenthes; errors clustered at institution level

**Table A.24 Sensitivity check (3 periods of volatility): relationship between state appropriations volatility and log levels of non-tenure track faculty**

| | Full sample | 4-year Research | 4-year Non-Research | 2-year |
|---|---|---|---|---|
| | (1) | (2) | (3) | (4) |
| **Volatility in state appropriations/FTE student (lagged one year)** | 0.3682+ | -0.2689 | 0.2875 | 0.4013+ |
| | (0.1999) | (0.7871) | (0.3172) | (0.2173) |
| Log state approps/FTE | -0.0173 | 0.3483 | 0.0668 | -0.0247 |
| | (0.0694) | (0.2168) | (0.1605) | (0.0753) |
| Log net tuition revenue/FTE | -0.0117 | 0.0059 | -0.2090 | -0.0456 |
| | (0.0747) | (0.1694) | (0.1400) | (0.0890) |
| Log federal revenue/FTE | -0.0986* | 0.0517 | 0.1399+ | -0.0662 |
| | (0.0478) | (0.0965) | (0.0771) | (0.0679) |
| Log other revenue/FTE$^{+}$ | 0.0798* | 0.1560+ | -0.0674 | 0.1504** |
| | (0.0362) | (0.0834) | (0.0505) | (0.0573) |
| Percent engin/sci degrees | -0.2312 | -0.1538 | -0.4807 | -0.3299 |
| | (0.3277) | (1.0966) | (1.0960) | (0.3677) |
| Percent non-resident students | 0.0284 | 0.1514 | 0.2998 | -0.3299 |
| | (0.3462) | (0.4427) | (0.3238) | (0.5737) |
| Log total part-time students | -0.0995 | 0.1187 | 0.0215 | 0.0003 |
| | (0.0763) | (0.1758) | (0.1067) | (0.1351) |
| Log total FTE students | 0.5411*** | 0.4903 | 0.7754** | 0.6646** |
| | (0.1544) | (0.3940) | (0.2788) | (0.2099) |
| Log avg. full-time faculty salary | -1.4276*** | -1.1480+ | -1.9677*** | -1.2846*** |
| | (0.2547) | (0.6320) | (0.5369) | (0.3056) |
| State unemployment rate | 0.0107 | 0.0061 | 0.0510* | 0.0098 |
| | (0.0154) | (0.0192) | (0.0249) | (0.0250) |
| Log state tax revenue | -0.0653 | -0.4616 | 0.1020 | -0.1574 |
| | (0.1613) | (0.4141) | (0.2230) | (0.2592) |
| Independent variables lagged one year | | | | |
| Institution fixed effects | x | x | x | x |
| Year fixed effects | x | x | x | x |
| R2 (within) | 0.070 | 0.232 | 0.240 | 0.053 |
| Observations | 3222 | 474 | 956 | 1792 |
| Institutions | 1256 | 159 | 333 | 764 |
| F | 9.556 | 8.638 | 14.379 | 3.825 |

$^{+}$p<0.10, *p<0.05, **p<0.01, ***p<0.001

Robust std errors in parenthes; errors clustered at institution level

**Table A.25 Sensitivity check (3 periods of volatility): relationship between state appropriations volatility and log levels of tenure track faculty**

| | Full sample | 4-year Research | 4-year Non-Research | 2-year |
|---|---|---|---|---|
| | (1) | (2) | (3) | (4) |
| **Volatility in state appropriations/FTE student (lagged one year)** | 0.0853+ | -0.1137 | 0.1373 | 0.0762+ |
| | (0.0438) | (0.2320) | (0.1615) | (0.0447) |
| Log state approps/FTE | 0.1141*** | 0.1294* | 0.2326*** | 0.0867* |
| | (0.0320) | (0.0593) | (0.0583) | (0.0373) |
| Log net tuition revenue/FTE | 0.0061 | 0.0652 | 0.1219 | -0.0374 |
| | (0.0296) | (0.0450) | (0.0816) | (0.0344) |
| Log federal revenue/FTE | -0.0103 | 0.0465+ | 0.0214 | 0.0013 |
| | (0.0165) | (0.0273) | (0.0250) | (0.0259) |
| Log other revenue/FTE+ | 0.0423** | 0.0437** | 0.0318* | 0.0523* |
| | (0.0158) | (0.0149) | (0.0152) | (0.0241) |
| Percent engin/sci degrees | 0.2154 | -0.1909 | 0.5195 | 0.3333 |
| | (0.2984) | (0.1316) | (0.6570) | (0.4298) |
| Percent non-resident students | 0.0437 | -0.0010 | 0.0225 | 0.0540 |
| | (0.1355) | (0.0666) | (0.1087) | (0.2375) |
| Log total part-time students | -0.0726* | 0.0226 | -0.0232 | -0.1625* |
| | (0.0307) | (0.0304) | (0.0285) | (0.0750) |
| Log total FTE students | 0.4019*** | 0.5386*** | 0.6961*** | 0.4695*** |
| | (0.0950) | (0.0939) | (0.1493) | (0.1417) |
| Log avg. full-time faculty salary | 0.0196** | -0.0003 | 0.0101 | 0.0141 |
| | (0.0074) | (0.0070) | (0.0095) | (0.0224) |
| State unemployment rate | 0.0209* | -0.0014 | 0.0003 | 0.0523** |
| | (0.0084) | (0.0051) | (0.0138) | (0.0172) |
| Log state tax revenue | 0.2509*** | 0.0839 | -0.0116 | 0.6265*** |
| | (0.0683) | (0.0612) | (0.0900) | (0.1840) |
| Independent variables lagged one year | x | x | x | x |
| Institution fixed effects | x | x | x | x |
| Year fixed effects | x | x | x | x |
| R2 (within) | 0.063 | 0.370 | 0.242 | 0.067 |
| Observations | 2693 | 463 | 917 | 1313 |
| Institutions | 1032 | 160 | 330 | 542 |
| F | 7.801 | 10.610 | 10.827 | 3.076 |

+p<0.10, *p<0.05, **p<0.01, ***p<0.001

Robust std errors in parenthes; errors clustered at institution level

**Table A.26 Sensitivity check (3 periods of volatility): relationship between state appropriations volatility and the share of part-time faculty**

| | Full sample | 4-year Research | 4-year Non-Research | 2-year |
|---|---|---|---|---|
| | (1) | (2) | (3) | (4) |
| **Volatility in state appropriations/FTE student (lagged one year)** | 0.0231 | 0.0020 | -0.1123 | 0.0282 |
| | (0.0212) | (0.1599) | (0.0702) | (0.0212) |
| Log state approps/FTE | -0.0190* | -0.0353 | -0.0373 | -0.0195+ |
| | (0.0095) | (0.0392) | (0.0296) | (0.0104) |
| Log net tuition revenue/FTE | 0.0178 | -0.0307 | -0.0027 | 0.0258 |
| | (0.0181) | (0.0315) | (0.0239) | (0.0220) |
| Log federal revenue/FTE | -0.0000 | -0.0203 | 0.0163 | -0.0080 |
| | (0.0090) | (0.0224) | (0.0160) | (0.0120) |
| Log other revenue/FTE+ | 0.0058 | -0.0211 | 0.0290** | -0.0023 |
| | (0.0083) | (0.0128) | (0.0104) | (0.0124) |
| Percent engin/sci degrees | -0.0073 | -0.3001 | 0.2952 | -0.0245 |
| | (0.0822) | (0.2251) | (0.2221) | (0.0979) |
| Percent non-resident students | -0.0383 | -0.1206+ | 0.0577 | -0.0333 |
| | (0.0522) | (0.0660) | (0.0747) | (0.0790) |
| Log total part-time students | 0.0471*** | 0.0914*** | 0.0323 | 0.0457* |
| | (0.0127) | (0.0246) | (0.0205) | (0.0188) |
| Log total FTE students | 0.0365 | -0.0509 | 0.0982* | 0.0104 |
| | (0.0247) | (0.0777) | (0.0474) | (0.0315) |
| Log avg. full-time faculty salary | 0.0452 | 0.0312 | 0.1267 | 0.0538 |
| | (0.0392) | (0.1391) | (0.0964) | (0.0462) |
| State unemployment rate | -0.0081** | 0.0058 | -0.0030 | -0.0141*** |
| | (0.0029) | (0.0062) | (0.0058) | (0.0043) |
| Log state tax revenue | -0.0275 | -0.0581 | -0.0196 | -0.0251 |
| | (0.0292) | (0.0430) | (0.0511) | (0.0473) |
| Independent variables lagged one year | | | | |
| Institution fixed effects | x | x | x | x |
| Year fixed effects | x | x | x | x |
| R2 (within) | 0.157 | 0.140 | 0.222 | 0.167 |
| Observations | 3660 | 475 | 972 | 2213 |
| Institutions | 1334 | 159 | 334 | 841 |
| F | 22.711 | 3.519 | 9.082 | 14.432 |

+p<0.10, *p<0.05, **p<0.01, ***p<0.001

Robust std errors in parenthes; errors clustered at institution level

**Table A.27 Sensitivity check (3 periods of volatility): relationship between state appropriations volatility and the share of non-tenure track faculty**

| | Full sample | 4-year Research | 4-year Non-Research | 2-year |
|---|---|---|---|---|
| | (1) | (2) | (3) | (4) |
| **Volatility in state appropriations/FTE student (lagged one year)** | 0.0601+ | -0.0040 | 0.0369 | 0.0626+ |
| | (0.0337) | (0.1379) | (0.0530) | (0.0351) |
| Log state approps/FTE | -0.0257+ | 0.0596+ | -0.0068 | -0.0286+ |
| | (0.0144) | (0.0333) | (0.0180) | (0.0165) |
| Log net tuition revenue/FTE | -0.0124 | -0.0087 | -0.0373 | -0.0144 |
| | (0.0208) | (0.0325) | (0.0242) | (0.0248) |
| Log federal revenue/FTE | -0.0222** | -0.0025 | 0.0140 | -0.0219+ |
| | (0.0083) | (0.0171) | (0.0101) | (0.0114) |
| Log other revenue/FTE$^{+}$ | 0.0090 | 0.0073 | 0.0001 | 0.0129 |
| | (0.0072) | (0.0099) | (0.0074) | (0.0109) |
| Percent engin/sci degrees | -0.0537 | 0.0905 | -0.0888 | -0.0793 |
| | (0.1130) | (0.1641) | (0.2102) | (0.1375) |
| Percent non-resident students | -0.0196 | 0.0552 | 0.0586 | -0.0795 |
| | (0.0531) | (0.0885) | (0.0455) | (0.0806) |
| Log total part-time students | -0.0007 | 0.0140 | 0.0128 | 0.0060 |
| | (0.0153) | (0.0324) | (0.0159) | (0.0267) |
| Log total FTE students | 0.0156 | 0.0247 | 0.0321 | 0.0271 |
| | (0.0393) | (0.0697) | (0.0438) | (0.0534) |
| Log avg. full-time faculty salary | -0.1580*** | -0.1805+ | -0.3068*** | -0.1328* |
| | (0.0478) | (0.0982) | (0.0869) | (0.0592) |
| State unemployment rate | -0.0023 | 0.0001 | 0.0043 | -0.0049 |
| | (0.0027) | (0.0035) | (0.0043) | (0.0044) |
| Log state tax revenue | -0.0492 | -0.1037 | 0.0244 | -0.0986 |
| | (0.0321) | (0.0725) | (0.0276) | (0.0613) |
| Independent variables lagged one year | | | | |
| Institution fixed effects | x | x | x | x |
| Year fixed effects | x | x | x | x |
| R2 (within) | 0.031 | 0.182 | 0.144 | 0.025 |
| Observations | 3654 | 475 | 972 | 2207 |
| Institutions | 1334 | 159 | 334 | 841 |
| F | 5.862 | 7.394 | 9.410 | 2.487 |

$^{+}$p<0.10, *p<0.05, **p<0.01, ***p<0.001

Robust std errors in parenthes; errors clustered at institution level

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