

**THE RENAISSANCE OF PERFORMANCE FUNDING FOR HIGHER EDUCATION:
POLICY ADOPTION, IMPLEMENTATION, AND IMPACTS**

Amy Y. Li

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Reading Committee:

William Zumeta, Chair

Maresi Nerad

Christopher Adolph

Nicholas Hillman

Justin Marlowe

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Amy Y. Li

University of Washington

Abstract

The Renaissance of Performance Funding for Higher Education:
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Amy Y. Li

Chair of the Supervisory Committee:
Dr. William Zumeta
Evans School of Public Policy and Governance

This dissertation examines performance funding for higher education, an increasingly prevalent state policy that allocates funding to public colleges and universities based on student outcomes. In three distinct studies with individual datasets and a mixed-methods approach, this dissertation first uncovers whether policy diffusion mechanisms, political influences, and philanthropic foundation involvement contribute to the spread of performance funding. Policy redesign and micro-level campus practices are investigated, with focus on faculty incentives and data usage to improve retention of underrepresented students and in the STEM fields. Lastly, special incentives for greater STEM degree completion are analyzed to determine whether on a macro-level, STEM degrees have increased as a result of performance funding. This dissertation additionally offers implications for policy and practice regarding the role of performance funding in advancing the national college completion agenda.

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DEDICATION

I dedicate my dissertation to the wonder of the academic journey, the life of the mind, and the spirit of knowledge.

Introduction

In the last decade, state policymakers have ventured into new policy territory in efforts to incentivize improved student outcomes at public colleges and universities, catalyzed by the national college completion agenda (Russell, 2011) and increased calls for accountability and oversight (Friedel, Thornton, D'Amico, & Katsinas, 2013; Munoz, 2015). Tuition increases and growing concerns over student loan debt have placed added pressure on institutions to retain and graduate students (College Board, 2015a, 2015b). One distinctive policy emerging out of this environment is performance funding, also called performance-based funding or outcomes-based funding, which differs from historical funding formulas based primarily on enrollment numbers. Defined, performance funding connects state funding “directly and tightly to the performance of public campuses on individual indicators” or outcomes (Burke & Minassians, 2003, p. 3). Commonly measured outcomes include student retention rates, course completions, graduation rates, degrees awarded, job placement rates, completions by underrepresented students (racial/ethnic minorities, Pell grant recipients, adult learners) and completions in high-need fields such as STEM (Science, technology, engineering, and mathematics) (National Conference of State Legislatures, 2016). Performance funding has experienced periods of varying popularity, beginning with Tennessee’s inaugural policy in 1979. An increasing number of states adopted performance funding in the 1990s but many abandoned their policies in the early 2000s, often due to economic difficulties that led to greater emphasis on core operations funding (Burke, 2002; Dougherty, Natow, & Vega, 2012).

In the most recent decade, however, a growing number of states have adopted or readopted performance-funding policies. As of January 2016, there are 30 states operating an existing policy or developing a new policy (Snyder & Fox, 2016). Performance funding has also

caught the attention of influential philanthropic foundations, research institutes, and state policy organizations, such as the Bill and Melinda Gates Foundation, the Lumina Foundation, HCM Strategists, the National Conference of State Legislatures, and the National Governors Association.

Despite its growing prevalence, performance funding (PF) is not without controversy. The policy essentially applies private sector practices to public higher education via a funding for results mechanism to pay for outcomes such as degrees. This is especially true for the latest generation of policies, called PF 2.0. The first wave of the policy (PF 1.0) typically allocated a bonus, usually modest, over and above regular state funding as a reward to colleges that improved student outcomes. PF 2.0 differs in that the funding is generally more substantial and is embedded into state base funding, requiring colleges to earn back funds that were previously allocated through enrollments (Dougherty & Reddy, 2013). Colleges therefore lose funding if they do not meet performance goals or targets set for a particular outcome, which can cause backlash from colleges, particularly those being disadvantaged in the funding formulas, as well as engender unintended consequences.

In that regard, previous research has found that performance funding can lead to unintended consequences such as increased selectivity (to enroll more academically prepared students who will graduate at higher rates), faculty feeling pressured to inflate grades, the weakening of rigor in academic programs, and/or the shifting of priorities to recruit higher-paying students (Dougherty & Reddy, 2011; Kelchen & Stedrak, 2016; Lahr et al., 2014). Moreover, studies have found minimal evidence that performance funding increases aggregate graduation outcomes at 4-year colleges (Rutherford & Rabovsky, 2014; Tandberg & Hillman, 2014), 2-year colleges (Tandberg, Hillman, & Barakat, 2014), or in state-specific analyses of

Tennessee (Sanford & Hunter, 2011), Pennsylvania (Hillman, Tandberg, & Gross, 2014), and Washington (Hillman, Tandberg, & Fryar, 2015). Consequently, additional research is necessary to better understand why policymakers continue to pursue performance funding as a strategy despite mixed results and potential negative impacts, and secondly, how campuses are responding to the latest versions of the policies. Additionally, little research exists on whether special incentives within performance funding policies, specifically those for increased completions in the STEM fields, have resulted in colleges shifting attention to these fields, which are considered essential to developing a highly skilled, globally competitive workforce (National Science Board, 2015).

Summary of Research Design

Motivated by the questions raised by this literature, my dissertation focuses on the adoption, implementation, and impact of performance funding policies. These three subtopics loosely follow the actual policy process whereby first, states engage in a dynamic decision-making process to enact or adopt a performance funding policy. The introduction of the policy may immediately or very shortly after catalyze the implementation phase—institutions learn about the policy and prepare ways to respond—even before the first fiscal year that performance-based funding gets allocated (Dougherty et al., 2016). Once the policy is in full operation, colleges engage in certain behaviors, likely both adaptive and maladaptive, to seek to accomplish what is necessary to secure funding. These behaviors may subsequently produce, over time, more quantifiable impacts such as better completion numbers. The three phases of adoption, implementation, and impacts follow a natural, albeit overlapping order that can also repeat itself as a feedback loop mechanism when policymakers re-enact or discontinue policies based on observations of the implementation phase and impacts that result.

In order to address these three interrelated policy stages, my dissertation is structured in a manner that cultivates the advantages of both quantitative and qualitative methods. Quantitative analyses can model the aggregate impact of policies on a population of interest, expose statistical relationships between constructs, and infer causality when certain conditions are met (Murnane & Willett, 2011). Qualitative inquiry can explicate and deconstruct complex phenomena, human behavior, and organizational dynamics, and can formulate deeper understandings of a policy problem (Merriam, 2009). Weaving both quantitative and qualitative methods together capitalizes on the advantages of both. I conducted my dissertation as a concurrent mixed method design in which I simultaneously collected quantitative and qualitative data (Creswell & Plano Clark, 2011). Mixed methods designs “incorporate the strengths of qualitative and quantitative approaches for conducting rigorous data analyses” (Castro et al., 2010, p. 344), and by exploiting the rich, descriptive data obtained from qualitative research as well as the generalizability of quantitative research, the limitations inherent in each tradition are reduced.

To advance an understanding of performance funding policies for higher education, I conducted three studies addressing the three policy stages: adoption, implementation, and impacts, written as three stand-alone journal-style papers. The first study analyzed the growth of performance funding 2.0 policies using a national dataset and survival analysis methods to investigate policy adoption patterns across states and the state characteristics that contributed to the rise of 2.0 policies. The second study addressed the campus implementation phase of performance funding via 47 semi-structured interviews of policymakers and campus officials in two select states, Pennsylvania and Ohio, that recently redesigned or fully phased in their PF 2.0 policies, revealing insights on how campuses have responded to the policy and if policymakers were receptive to institutional feedback. In the third study, incorporating a difference-in-

differences analysis, I examined the impact of special STEM incentives embedded in multiple states' performance funding policies to determine whether the incentive prompted colleges to graduate more students in these high-need fields. Lastly in the conclusion of this dissertation, I summarize findings from all three studies and synthesize the contribution of this work.

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Covet Thy Neighbor or “Reverse Policy Diffusion”?

State Adoption of Performance Funding 2.0

Amy Y. Li

University of Washington

Amy Y. Li, Educational Leadership, Policy, and Organizations, College of Education, University of Washington. Contact: libutler@uw.edu

This study is the first of three dissertation papers on performance funding. An earlier version of this paper was presented at the 2015 conference of the Association for the Study of Higher Education in Denver, CO.

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Abstract

Performance funding has become an attractive and increasingly popular state policy to incentivize student retention and degree completion at public colleges. Using a Cox proportional hazards model on state-level data from years 2000 to 2013, this study analyzes the latest wave of policies that embed base appropriations into the state budget to fund student outcomes. Results indicate that having a greater proportion of bordering performance funding states diminishes the likelihood of policy adoption, capturing a “reverse policy diffusion” effect. Involvement from the Lumina Foundation, a prominent proponent of performance funding, increases the likelihood of policy adoptions, as did unified Republican-control of the three-chambers of power in state government. Private foundations and national advocates of performance funding are likely to drive the future growth of performance funding, at the potential expense of input from colleges themselves. This paper concludes with implications for policy and practice, and suggests areas for further research.

Keywords: performance funding; higher education finance; policy diffusion; state policy; survival analysis

Covet Thy Neighbor or “Reverse Policy Diffusion”?

State Adoption of Performance Funding 2.0

Introduction

In the last decade, state policymakers have ventured into more aggressive strategies with the goal of incentivizing better educational attainment at public colleges and universities. One distinctive policy emerging from the accountability movement in higher education is performance funding, which differs from traditional enrollment-based funding. Performance funding is also termed performance-based funding, outcomes-based funding, or abbreviated “PF”.¹ Performance funding uses a clear formula to tie the allocation of state appropriations to institutional-level student outcome metrics (Burke, 2002; Dougherty & Reddy, 2013). Commonly used metrics are degree completions, graduation rates, job placement rates, and milestone accomplishments such as year-to-year retention rates and course completions (Dougherty & Reddy, 2013; Li, 2014). Starting from 1979 when Tennessee first established a program, performance funding has gone through periods of varying popularity (Burke, 2002; Sanford & Hunter, 2011). A number of states adopted policies in the 1990’s, but many discontinued their policies around the “dot com” recession in the early 2000’s (Dougherty, Natow, & Vega, 2012). In the last decade, many states have adopted or re-adopted performance funding policies. As of 2016, approximately 30 states are operating, implementing, or designing a performance funding policy (Snyder & Fox, 2016). Performance funding has strong support from prominent foundations such as the Lumina Foundation and the Bill and Melinda Gates Foundation (Dougherty & Natow, 2015).

¹ In this paper, I occasionally refer to the policy as performance funding, or PF.

Between 1979 and 2000, 21 states established performance funding policies (Dougherty & Natow, 2015). These policies are considered “PF 1.0” and represent the first wave of policy adoptions.² In these policies, states allocated funding as a bonus on top of regular state funding. In the 2000’s decade and particularly from 2007 onwards, a new generation of policies emerged, many of which take the form of “PF 2.0”. PF 2.0 differs from 1.0 in that funding is embedded in the base formula budget (Dougherty & Reddy, 2013), and colleges can therefore lose funding if they do not meet certain targets. Policies adopted during this recent period, which I term the “renaissance of performance funding”, typically tie a higher proportion of funding to performance, although there is still substantial variation among states (Li, 2014). Eighty to 90% of appropriations in Tennessee are driven by outcomes. Ohio recently moved to 100% outcomes-based funding at 4-year colleges (excluding medical and graduate schools), while the majority of PF states are within the 5% to 10% range (National Conference of State Legislatures, 2016; Ohio Board of Regents, 2014; Snyder & Fox, 2016).

The establishment of PF 2.0 in states is attributed to various factors, one being the growing concern that too many students begin college but do not graduate. Global competition, rising tuition prices, decreasing affordability, and inequitable access to higher education have all fueled the accountability movement (Li & Zumeta, 2015; Zumeta, Breneman, Callan, & Finney, 2012). Additionally, the impact of the last recession has been particularly tough on higher education (Zumeta, 2009). Competition from other needs such as K-12 and healthcare have further motivated legislators to use policies such as performance funding to increase efficiency at public colleges (Dougherty, Natow, Hare, Jones, & Vega, 2011; Dougherty & Natow, 2015).

² Performance funding policy adoptions can occur through a legislative statute by the state, or sometimes within a public university system such as in the case of the Pennsylvania State System of Higher Education.

Yet not all states have embraced performance funding as a way to align institutional and state goals for higher education, including states such as California, which educates a large higher education student population. What differentiates non-adopters from adopters? An earlier study examined the adoption of performance accountability policies in the first wave (PF 1.0), covering years 1984 to 2002 (McLendon, Hearn, & Deaton, 2006). However, little empirical research exists on the latest wave of performance funding adoptions and of PF 2.0 in particular. Additionally, qualitative evidence from Indiana, Ohio, and Tennessee point to differences in the origins of PF 2.0 versus its predecessor (Dougherty, Natow, et al., 2014), one important factor being the influence of philanthropic foundations and policy organizations. The national spotlight on performance funding and the policy's growing popularity amongst legislators makes the study of PF 2.0 policies' origins especially relevant.

Purpose of Study

The purpose of this study was to create a better understanding of the factors associated with the renewed interest in performance funding. Investigating the interstate (across-state) spread of PF 2.0 has implications for the sustainability of this policy and a more thorough recognition of the policy's roots may help predict its longevity. This topic also has practical implications for public colleges that depend on state appropriations because if colleges do not achieve better outcomes, they are at risk of losing funding. Moreover, several recent studies analyzing PF policy effects on retention rates, graduation rates, and/or total degrees awarded have found mixed or null evidence that performance funding policies contributed to improved student outcomes (Hillman, Tandberg, & Fryar, 2015; Hillman, Tandberg, & Gross, 2014; Rutherford & Rabovsky, 2014; Tandberg & Hillman, 2014). Therefore, the current study asked why PF 2.0 continues to spread despite mixed evidence of its impact on student retention and

degree completion. The second purpose of this study was to extend the literature on high stakes accountability and funding for results by analyzing the most recent wave of performance funding policies. Ten years have passed since researchers systematically investigated the reasons behind the spread of performance funding. Thus, my study builds upon and extends the findings of McLendon, Hearn, and Deaton (2006), who uncovered factors behind policy adoptions in the earlier generation of policies. The authors analyzed data from 1979 to 2002, so the time is ripe for newer research. This study addressed the following research questions using a national dataset from years 2000 to 2013:

- 1) Does PF 2.0 diffuse across state borders? That is, do the policy adoptions of neighboring states increase or decrease the likelihood of adoption in the focal state?
- 2) Does having a history of PF in the 1.0 era influence 2.0 adoptions?
- 3) Does political party control matter?
- 4) Do visible supporters who advocate for, and fund the development of and research on performance funding policies, drive policy adoptions? This study specifically analyzed involvement by the Lumina Foundation.

Conceptual Framework

Policy Innovation and Diffusion

Theories grounded in political science framed the conceptual motivations for this study's research questions. Defined, a *policy innovation* is a program that is new to the government that is adopting it; a specific policy can be innovative in a single state even if it is not new to the American states (F. S. Berry & Berry, 2007). In any given year, state adoption of innovative policies is influenced "by both the state's internal characteristics and the previous pattern" of adoptions by nearby states, which the authors of this seminal study termed a "unified theory of

state policy innovation” (Berry & Berry, 1990, p. 400). Examples of internal characteristics include political factors such as state party control and economic factors such as state income levels. Drawing on this unified theory of policy innovation, I investigated within-state (internal) and across-state (external) factors surrounding the adoption of performance funding using survival analysis (explained in the Methods section).

The classic theory of *policy diffusion* proposed that states are most influenced by states in close geographical proximity (Walker, 1969). In the neighbor model, the probability of a state adopting a policy is hypothesized to be positively correlated with the number, or proportion, of bordering states that have adopted the policy of interest (Makse & Volden, 2011). States attempt to emulate the successful policies of nearby states, and avoid the pitfalls of unsuccessful policies (Mooney, 2001).

Additionally, policies can diffuse through *policy learning*—elected officials are exposed to options to solve a problem when looking at a set of reference states (Glick & Friedland, 2014; Makse & Volden, 2011). Observing the experiences of others allows a state to learn more about the potential political support for a policy and the policy’s effectiveness (Shipan & Volden, 2008).³ A second reason for diffusion is *policy imitation* or the goal to emulate other states (Volden, 2006). “Imitation focuses on the actor (i.e., the other government that is adopting the policy)”, as opposed to learning, which evaluates the policy itself and its political consequences (Shipan & Volden, 2008, p. 842). States choose policies that attract desirable residents and that prevent productive citizens from moving away (Cohen-Vogel, Ingle, Levine, & Spence, 2007; Walker, 1969). Applying these theories to performance funding for higher education, states may

³ In this study, performance funding effectiveness is defined as accomplishing state goals for higher educational attainment, according to performance metrics.

consider introducing PF 2.0 if the policy has captured political support in a neighboring state (policy learning), or in a state perceived to be worthy of emulation (policy imitation).

Internal State Characteristics, Hypotheses, and Variables

Previous Performance Funding Policy

Many state adoptions of PF 2.0 across 2000 to 2013 were re-adoptions of previously discontinued policies, such as in Arkansas (Dougherty & Natow, 2015; Dougherty, Jones, et al., 2014). Some states such as Indiana already operated policies using bonus funding and subsequently added a base budget component. Other states replaced their bonus budget formula altogether with a base budget formula, such as Louisiana, and in this case, PF 1.0 became PF 2.0 (National Conference of State Legislatures, 2015). In this manner, a history of performance funding could potentially have influenced the likelihood of PF 2.0 adoption. On one hand, a state could have been more receptive to policy innovations generally, and be eager to design and institute a policy that improved upon its predecessor. On the other hand, policy learning from a failed PF “experiment” could have caused a state to be more resistant to performance funding generally. In this study, I included a dummy variable equal to 1 for states that previously operated a performance funding policy. This variable also equaled 1 for states that operated 1.0 and supplanted it with 2.0, and for states that added a 2.0 component.⁴

Political Party Control

Earlier studies were not definitive as to which political party, Democrat or Republican, supported performance funding more than the other (McLendon et al., 2006). From a conservative—liberal ideological standpoint, performance funding appears more aligned with the conservative ideology of limited public spending, strong accountability, and greater efficiency in

⁴ These two operationalization choices were made for statistical reasons and to preserve power. I defined performance funding history to include states that operated a base *or* bonus funding policy before year 2000.

government by using market incentives borrowed from the private sector (Li & Zumeta, 2015; McLendon, Tandberg, & Hillman, 2014). Democrats, on the other hand, have historically been more supportive of direct funding to public services without strong conditions (Alt & Lowry, 2000). Since performance funding ties a portion of appropriations to colleges based on graduation outcomes as a tool to promote more efficient spending, the policy could be more appealing to Republican state governments and less so to Democrat-controlled governments.

Since 2007, nine states with Republican governors and four states with Democratic governors have introduced or reinstated performance funding (Dougherty & Natow, 2015). In the earlier generation, a higher proportion of Republicans in the legislature was associated with a greater likelihood of policy adoption, and no relationship was found between party affiliation of the governor and the likelihood of policy adoption (McLendon et al., 2006). Nevertheless, governors are important to the broader budgeting process (Barrilleaux & Berkman, 2003). In the case of performance funding 2.0, governors were instrumental in the development and passage of legislation in Indiana, Ohio, and Tennessee (Dougherty, Jones, et al., 2014; Dougherty, Natow, et al., 2014). “Even when they did not explicitly demand the transformation from PF 1.0 to PF 2.0, governors got performance funding onto the agenda by requesting that the coordinating boards propose policies to address new state goals for higher education and by strongly supporting their responses” (Dougherty & Natow, 2015, pp. 168-169).

Unified three-chamber government. Applying these theoretical ideas and previous research findings, I expected to find that Republican-controlled governments are more likely to adopt PF 2.0. Specifically, Republican Party dominance across all the three chambers may be most powerful in pushing through a higher education policy agenda. A unified state government is one where a single political party controls the upper house, lower house, and occupies the

governor's seat. Broadly speaking, unified governments have been shown to be more friendly to the passage of higher education finance reforms (Lacy & Tandberg, 2014), and in a separation-of-powers system, a divided government poses more challenges to the passage of legislation (Alt & Lowry, 2000). Divided governments face the most conflicts because political parties have divergent preferences that limit the ability to authorize innovative legislation (Huber, Shipan, & Pfahler, 2001). Performance funding 2.0 is an example of innovative legislation in the realm of higher education policies. To explore this hypothesis, I generated a dummy variable representing party control of all three chambers (house, Senate, and governor's seat). Each state was coded as either unified Republican control, unified Democratic control, or divided control.⁵

Citizen ideology. In addition to unified party control, I also incorporated citizen ideology scores in the analysis as a measure of conservatism-liberalism (W. D. Berry, Ringquist, Fording, & Hanson, 1998). Citizen ideology represents the position of a state's active electorate on a conservative-liberal continuum.⁶ No previous studies on higher education finance policies have considered citizen ideology scores, which has potential advantages over the previously discussed conventional unified/divided political variables. The continuous nature of ideology scores could provide more spatial variation (between states) and more temporal variation (between years) than three-chamber government dummy variables, capturing a more precise measure of state

⁵ States with an independent governor (no party affiliation) were also coded as divided. Because of its unicameral legislature, Nebraska was excluded. Excluding Nebraska reduced the total number of policy adoptions in the dataset from 21 to 20.

⁶ Citizen ideology is constructed using interest-group ratings from the Americans for Democratic Action (ADA), and the American Federation of Labor and Congress of Industrial Organizations (AFL-CIO) Committee on Political Education (COPE). Using the "distribution of votes in congressional races and ADA/COPE scores for members of Congress", this measure captures the "ideological position of the electorate" (W. D. Berry et al., 1998, p. 118). Zero represents the most conservative position while 100 represents the most liberal.

ideology. I expected to find that more conservative states would be more likely to pursue performance funding 2.0.

Supporters on the National Stage

Mentioned in the Introduction, several highly visible philanthropic foundations and policy organizations are supporters of performance funding. The Lumina Foundation and the Bill and Melinda Gates Foundation are active supporters, and both have also funded research on performance funding. The Ford Foundation, similarly, has funded performance funding research. Organizations publicizing the policy include Complete College America (CCA) and the National Center for Higher Education Management Systems (NCHEMS). Moreover, researchers from the Community College Research Center and HCM Strategists have shined a spotlight on performance funding—research which was funded in part by organizations such as Gates and Lumina (Davies, 2014; Dougherty & Natow, 2015; HCM Strategists, 2011, 2012; Jones, 2013; National Conference of State Legislatures, 2016; Snyder, 2014).

The Lumina Foundation. One especially visible example is the Lumina Foundation's 2009 state productivity grants through its College Productivity initiative. Lumina awarded \$9 million to be disbursed from years 2009 to 2013 to seven states: Arizona, Indiana, Maryland, Montana, Ohio, Tennessee, and Texas. According to the Foundation's website, states were chosen based on "degree of policy innovation, geographic and demographic diversity and the extent to which the states will address: 1. Tying public funding to increasing the overall number of college graduates; 2. Identifying instructional and operational efficiencies and cost savings

that can be reinvested in better serving undergraduate students, and; 3. Educating and training students in innovative and affordable ways” (Lumina Foundation, 2009).⁷

Therefore, I expected to find that states that received a Lumina Productivity Grant were substantially more likely to legislate a performance funding policy and specifically a 2.0 policy that used base funding to allocate appropriations. For the analysis, I included a dummy variable for each state that received the Lumina Foundation grant, coded for 2009 onwards. Additionally, I created a dummy variable for the 28 states in the dataset that belonged to Lumina’s Strategy Labs network.⁸ The goal of Lumina’s Strategy Labs is to use state policy to increase higher education attainment. I obtained this data from the Strategy Labs map on the Lumina Foundation’s website, which indicates each state’s participation in the State Authorization Reciprocity Agreement (SARA). SARA is “a voluntary initiative for states and institutions to provide online education to students regardless of geography” (Lumina Foundation, 2015). I obtained this variable and included it as a proxy, in order to represent each state’s involvement with other Lumina projects that are aligned with the educational attainment goals inherent in performance funding.⁹ All 28 SARA states were approved to join the Lumina Network between 2014 and 2016. Since the years of my study covered up to 2013, I coded all years of a state as 1

⁷ November 24, 2009. Lumina Foundation Announces State Grants To Boost U.S. Higher Education Productivity. <https://www.luminafoundation.org/news-and-events/lumina-foundation-announces-state-grants-to-boost-u-s-higher-education-productivity>

⁸ There are in fact 29 states in the Lumina Strategy Labs network, including Alaska, which is excluded in this study because it shares no borders with other states. The Lumina network states are Arizona, Arkansas, Colorado, Idaho, Illinois, Indiana, Iowa, Kansas, Louisiana, Michigan, Minnesota, Missouri, Montana, Nebraska, Nevada, New Hampshire, New Mexico, North Dakota, Ohio, Oklahoma, Oregon, South Dakota, Tennessee, Vermont, Virginia, Washington, West Virginia, and Wyoming.

⁹ Disclaimer from the Lumina Foundation website at <http://strategylabs.luminafoundation.org>: “As a private foundation, Lumina does not support or oppose any legislation. Lumina provides educational information, nonpartisan research and analysis to advance Goal 2025.” Goal 2025 is to increase the proportion of Americans with high quality degrees, certificates, and other credentials to 60% by the year 2025.

if it belonged to SARA as of October 2015, proposing that membership after 2013 signals a state's prior disposition towards performance funding.¹⁰

Economic and Higher Education Control Variables

Furthermore, I included a series of control variables that could potentially confound the effects of the main variables of interest. For instance, states with greater wealth tend to be more innovative than states with fewer resources (F. S. Berry, 1994). The design, adoption, and implementation of new policies requires resources and therefore, states with a reserve tax base are more open to innovative policies, generally speaking (McLendon, Heller, & Young, 2005). Even for policies that do not require substantial financial resources, wealthier states are more likely to explore new policies (Walker, 1969). I extend these theories to propose that *changes* in economic conditions increase or decrease the likelihood of PF 2.0 adoptions—quickly depleting resources could lead policymakers to pursue greater accountability for the allocation of higher education funds. Levels of personal income per capita represent how rich or poor a state is compared to other states, while annual percent changes measure growth or decline in wealth. Unemployment rate was also included as a more transient measure of the health of a state's economy. Family incomes have grown slowly in the last 25 years while public 4-year tuition costs have risen sharply (Delaney, 2014). Therefore, worries among state residents about college affordability may increase legislators' openness towards performance funding as a way to promote efficiency, as well as limit potential public perceptions of wasteful spending at colleges. Financial variables in this study were inflation-adjusted to 2013 dollars.

In addition, I added a number of control variables capturing higher education characteristics that might be relevant to performance funding, to control for possible endogenous

¹⁰ State Authorization Reciprocity Agreement (SARA) data was collected from: <http://www.nc-sara.org/content/sara-state-status>.

effects related to the primary research questions around policy diffusion, political ideology, and the influence of the Lumina Foundation. Higher education governance structure is related to the implementation of performance funding, however, there was no consistent relationship between a coordinating versus governing board state in the likelihood of adoption (Dougherty, Natow, et al., 2014). To further explore this previous finding, I incorporated a dummy variable for a coordinating board structure (includes planning boards) and chose governing board as the omitted category. Governing boards are more centralized, and have greater oversight and power in managing higher education systems, and therefore I hypothesized that coordinating boards are less likely to pursue performance funding as an accountability tool (McGuinness, 2002, 2003).

The selection of the remaining control variables was based on prior research on their relevance to performance funding or to higher education policy innovations, to account for enrollment size, public enrollment share of the student population versus private, degrees awarded, and/or cost (Cheslock & Hughes, 2011; Lacy & Tandberg, 2014; Rutherford & Rabovsky, 2014; Tandberg, Hillman, & Barakat, 2014; Tandberg & Hillman, 2014; Toutkoushian & Hillman, 2012; Weerts & Ronca, 2012). I included state appropriations per public college enrollment (lagged 1 year) and hypothesized that states providing more funding to higher education care more about how funds are being used. Percent changes in average resident tuition at public 4-year colleges represent the rate of tuition increases, which could further fuel state oversight (lagged 1 year). Bachelor degrees per fall enrollment at public 4-year colleges accounts for institutional effectiveness, or lack thereof, that could lead to an outcomes-based funding approach (lagged). Lastly, percent enrolled in private colleges represents the potential coverage of a new performance funding policy, and percent enrolled at 2-year colleges serves as a proxy for college readiness, with a higher percent perhaps generating more interest in

increasing transfer rates and overall college completion, a common measure of effectiveness in performance funding policies. Table 1 displays variable descriptions and sources.

[Insert Table 1]

Data

Data was collected on the 48 contiguous states for years 2000 to 2013. Alaska and Hawaii were excluded because they have no bordering states, and Nebraska was excluded because of its unicameral legislature. The time period of 2000 to 2013 was chosen because, for one, year 2000 and later represented the period well after the initial wave of policy adoptions of performance funding 1.0. Second, earlier research on 1.0 adoptions covered years 1979 to 2002 (McLendon et al., 2006). Because the present study was specifically interested in the policy innovation of PF 2.0, introducing adoption events and control variable data before the 2000's may inflate the underlying instantaneous probability of state adoptions of 2.0 (hazard rate, discussed in the Methods section). Third, multiple 1.0 policies were discontinued prior to the 2000's decade (Dougherty et al., 2012; Sanford & Hunter, 2011), which presented an opportunity to explore the research question surrounding the effect of operating a previous performance funding policy. Thus, the 2000 to 2013 time period most accurately captured the emerging trend of performance funding policies that specifically allocated base funding according to student outcomes.

There exists discrepancy among published documents regarding performance funding adoption and operational years. Rather than make potentially arbitrary decisions as to which legislative documents most accurately reflected adoption events, I chose to incorporate the

expertise of Dougherty and Natow (2015). The authors' recent book integrated numerous sources and collated years of research on performance funding policies (adoption data was listed in Table 3.1 of their book, pp. 30-34). The adoption year of a policy was defined as when it was first authorized, not the year that funding began to flow.¹¹ In the years covered by the present study, there were 20 instances of PF 2.0 adoptions (Table 2). The unit of analysis was state i in year t , and the outcome variable, also known as the event of interest, was state adoption of performance funding 2.0 in a given year.

[Insert Table 2]

Measuring Diffusion

To capture a measure of diffusion, I first created a variable representing the proportion of neighboring states to the focal state that had adopted or were currently adopting a performance funding 2.0 policy in a particular year. Being exposed to a greater proportion of performance funding 2.0 neighbors was hypothesized to increase the likelihood of adoption. My initial analyses incorporated the same-year value of the diffusion variable because even if a state had not yet adopted a policy, the activity surrounding policy design leading up to the year of adoption could have sent a message to neighboring states and prompted policy imitation or policy learning. Additionally, "a program could already begin to have impacts even prior to the onset of actual financial gains or losses because institutions may begin reacting to the *prospect* of financial repercussions" (Dougherty & Natow, 2015, p. 28). Extending this internal influence to

¹¹ Dougherty and Natow's (2015) criteria to determine whether a state had a PF policy also required that policies were a result of authoritative state decisions such as legislature approval of a budget, not just of state statute. Second, policies must have incentivized student outcomes, as opposed other outcome metrics such as university research funding.

external influences would suggest that states were exposed to the expectation of policy adoption in neighboring states. Moreover, because of the time it takes for a policy to diffuse across state borders—to be examined, developed, legislated, and so forth—in alternative models I substituted the same-year diffusion variable with a 1-year and 2-year lag, respectively. Table 3 displays summary statistics of all variables.

[Insert Table 3]

Method

Survival analysis, or event history analysis, is a technique that models the duration of time until units in a dataset experience an event. Its foundations lie in the biomedical sciences. For patients diagnosed with a disease, survival times are modeled and the effectiveness of different treatment interventions are compared (Allison, 1995). The purpose of survival analysis is to model “both the duration of time spent in the initial state and the transition to a subsequent state, that is, the event” (Box-Steffensmeier & Jones, 2004, loc 193).

In this study, the outcome variable was the instantaneous risk or probability of a state adopting performance funding 2.0 in a given year. Certain models in the survival analysis category of methods allow for time-varying covariates to examine factors that influence this probability. Adding covariates helps to explain factors that may increase or decrease time to event, or the amount of time it takes before the event occurs, also called the instantaneous risk (Allison, 1995). Survival analysis has been used to study political events such as presidential election results and United Nations peacekeeping missions, and factors associated with their occurrence (Baybeck, Berry, & Siegel, 2011; Box-Steffensmeier & Jones, 2004). Higher

education researchers have also incorporated the method to examine state policy adoption of merit aid programs (Doyle, 2006), eminent scholar programs (Hearn, McLendon, & Lacy, 2013), and different types of finance policies (Lacy & Tandberg, 2014).

The hazard rate (outcome variable) is the rate at which units experience the event at time t , given that the event has not occurred until time t (Box-Steffensmeier & Jones, 2004). The present study modeled the instantaneous risk that a state would have adopted performance funding in the year of observation. In the first year of the dataset (year 2000), all 47 states are “at risk” of adopting PF 2.0. Once a state adopted the policy, it leaves the risk set because its hazard rate of experiencing the event is now zero. The state is removed in the calculation of the hazard rate and the number of states in the risk set naturally decreases over time.¹² Sometimes theory drives a specification of the underlying shape of the distribution of events, conditional on covariates, and conceptually points to a parametric model. Parametric models are useful if the researcher suspects that the risk of an event happening changes over time in a systematic way. For example, in the case of United Nations peacekeeping missions in response to a crisis, the longer a mission lasts, the risk of it terminating at any given time decreases (Box-Steffensmeier & Jones, 2004). Because there exists no prior theory about whether the probability of a state adopting performance funding increases or decreases with time, I chose the more flexible Cox proportional hazards model.

Cox Proportional Hazards Model

The Cox model is a flexible, robust model that leaves the baseline hazard unspecified (Cox, 1972). It is especially useful when investigating research questions in the social sciences.

¹² There were no instances of states that adopted, discontinued, and then re-adopted PF 2.0 between 2000 and 2013.

While time-to-event is parameterized using covariates, the distributional form of these times is not parameterized (Fox, 2002).

The Cox model specifies the hazard rate for the i th unit as:

$$h_i(t) = h_0(t) \exp (\beta_1 x_{i1} + \beta_2 x_{i2}(t) + \dots + \beta_k x_{ik}) \quad (1)$$

where $h_i(t)$ is the hazard of adopting PF 2.0 in state i , year t , $h_0(t)$ is the unspecified baseline hazard, x_{i1} is a static covariate for state i , $x_{i2}(t)$ is a time-varying covariate for state i in year t , and β is a $k \times 1$ vector of coefficients, where k is the number of covariates (Andersen & Gill, 1982; Fox, 2002).

Notice that the Cox model does not have an intercept term α because the baseline hazard is presumed unknown. It is *semi-parametric* in the sense that “while the baseline hazard can take any form, covariates enter the model linearly” (Fox, 2002, p. 3). In the analysis, robust standard errors were estimated on 47 state clusters to help account for correlation among variables within a state over time (Cleves, Gutierrez, Gould, & Marchenko, 2010). The Breslow method was used to handle tied events, defined here as when more than one state adopted performance funding 2.0 in the same year. Reported results were compared to those generated using the Efron’s method of handling ties (Allison, 1995; Cleves et al., 2010), which resulted in substantively identical results.¹³

Modeling Approach and Diagnostics

¹³ Performance funding 2.0 adoptions occurred more often in the later years of my dataset. Because the number of state adoptions was skewed towards these later years, I examined the severity of bias introduced in the models. I ran analyses using the Breslow’s method and the Efron’s method for handling ties (Cleves et al., 2010; Fox, 2002). The directions of covariate effects were identical, and the sizes of covariate effects were statistically and substantively equivalent.

My modeling approach consisted of the following steps. First, I made descriptive plots and ran univariate analyses on the covariates. I started with a minimally specified model that included only the neighbor diffusion variable and the prior policy variable. Next, I added the Lumina Foundation variables and then the political variables, substituting in the previously noted different operational definitions of state liberalism-conservatism. Subsequently, I added the economic and higher education controls. Modeling choices were guided by conceptually based interpretations of the estimates and by model fit statistics.¹⁴ I also tested and addressed the proportional hazards assumption of the Cox model, which assumes that a covariate has the same effect on the underlying risk of an event across the entire time span observed.¹⁵

The final models included interactions with time for the following variables: tuition (annual percent change, lagged), previous policy, coordinating board, Lumina state grant, and membership in Lumina Strategy Labs.¹⁶ Reported results were generated using the Breslow's

¹⁴ Model fit was assessed using the Bayesian Information Criteria (BIC) (Allison, 2010). Nested models were compared using the likelihood ratio test (Diez, 2013; Jenkins, 2005). Collinearity was assessed using the Variance Inflation Factor (VIF) by modeling time as the outcome in a regression framework (Stine, 1995). In the reported models, the mean VIF values of each model ranged from 1.37 to 1.47. The highest VIF for any variable was 2.53, well below the problematic value of 10 or above (Eckles & Stradley, 2011). In any case, multicollinearity is a minor concern in survival analysis because each unit change in a predictor has a multiplicative effect on the hazard rate, not a linear effect (Allison, 2010).

¹⁵ If a covariate violated or nearly violated tests of the proportional hazards assumption, and if conceptually the variable could convincingly have a non-constant effect on probability of performance funding adoption, I interacted the predictor with $\ln(\text{time})$. Earlier studies in the higher education policy literature that use the Cox model placed more weight on the proportionality assumption than necessary. "Although many researchers get very concerned about whether their data satisfy this assumption [of proportional hazards in the Cox model], I believe that these concerns are often unwarranted. If the assumption is violated for a particular predictor variable, it simply means that the coefficient for this variable represents a kind of "average" effect over the period of observation. For many applications, this may be sufficient." (Allison, 2010, p. 421). Applied to the study of higher education finance policies, this average effect is more than ample for extrapolating policy implications and substantive meanings of coefficients.

¹⁶ I plotted Schoenfeld residuals (Fox, 2002), which suggested that the non-proportionality of the dummy variables was likely attributed to adoptions being heavy on the later years of the dataset; 19 of the 20 policy adoptions occurred in years 2009-2013. While 19 of the 47 states experienced the event, the

method for handling ties. As a post-estimation model fit check, I generated Cox-Snell residuals from martingale residuals, plotted against the Nelson-Aalen estimates, which determined that the models and covariates adequately fit the data.¹⁷ By examining model diagnostics and fit statistics, and interpreting results in the context of theoretical ideas described in the literature review, I ultimately arrived at the preferred models presented next.

Results

Results are displayed in Table 4. I report hazard ratios (exponentiated coefficients) and 95% confidence intervals. To interpret the direction of effects, a hazard ratio greater than 1 indicates increased risk of the state adopting performance funding 2.0, while a hazard ratio less than 1 indicates decreased risk, all other covariates held constant. A change in the level of the predictor (for continuous variables) or the presence of the predictor (for dummy variables) has a multiplicative effect on the hazard function. Column 1 of Table 4 reports estimates from the same-year value of the diffusion variable (proportion of bordering states adopted or currently adopting PF 2.0), Column 2 shows estimates using a 1-year lag, and Column 3 with a 2-year lag.

[Insert Table 4]

proportion of *state-years* in which events occurred (3%) was small in the context of survival analysis. I chose to keep entry time at 2000 after testing shorter time periods because eliminating the first half of the dataset substantially reduced heterogeneity in the time-varying predictors. Due to lags and change variables, the first possible year of an estimate was 2002. Interacting the non-proportional variables with the natural log of time [$\ln(\text{time})$] resulted in more plausible confidence intervals.

¹⁷ The Nelson-Aalen estimator generates the true cumulative hazard function, here the cumulative number of PF 2.0 adoptions over time, and for this purpose is preferred over the Kaplan-Meier estimator on small sample sizes (Jenkins, 2005). Martingale residuals estimate the “difference between the observed event count over time [applies to the single-failure data setup in this study] and the model-based expected number of events” (Ezell, Landy, & Cohenz, 2001, pp. 120-121). Residuals help assess model accuracy and are equivalent to random errors in a regression model (Therneau, Grambsch, & Fleming, 1990).

Results demonstrate that states were indeed influenced by their neighbors' adoption of performance funding 2.0. However, the effect was in the opposite direction of what was hypothesized. An increase in the proportion of neighboring states (in units of 20%) that were operating or were concurrently adopting PF 2.0 *decreased* the likelihood of adoption by 41% ($1 - 0.59 = 0.41$). To illustrate, Nevada has five border states: California, Oregon, Idaho, Utah, and Arizona. In 2012, none of these five states had adopted performance funding 2.0; zero out of five of Nevada's neighbors adopted the policy. Then in 2013, Nevada adopted the policy. Now let us consider the scenario in which California *had in fact* operated PF 2.0 in 2012. Nevada's proportion of bordering PF 2.0 states would have become one out of five instead of zero out of five, a 20% increase. Then we would expect the probability of Nevada adopting PF 2.0 in 2013 to have been 41% lower.

The bordering state diffusion variable was not significant when lagged by one year (a 1-year lag assumes that the proportion of 2009 bordering PF 2.0 states predicts 2010 policy adoptions of 2.0), nor when lagged by two years, although the 2-year lag neared significance (Table 4, Columns 2 and 3, respectively). This suggests that policy learning, or perhaps more accurately termed "policy avoidance" here, occurred even before performance funding policies were adopted. Specifically, states were negatively affected not only by bordering states that had adopted performance funding 2.0, but also by ones that were in the process of adopting the policy in the same year. Concurrent awareness of policy activity most likely contributed to this effect. In the description of results that follows, I focus primarily on estimates from the same-year diffusion model in Column 1 of Table 4.

Previous performance funding policy. As expected, a state that operated any form of performance funding policy in the past was on average 70% more likely to adopt 2.0. A state that

discontinued a policy that tied bonus funding to outcomes, or a state currently operating a bonus funding incentive structure, was significantly more open to a base-funding incentive structure when compared to states with no history, suggesting that certain states hold a higher underlying disposition towards performance funding.

Political control. A government with all three chambers controlled by Republicans was twice as likely to adopt PF 2.0 compared to a government in which Democrats controlled one or more of the three chambers. Notice that this effect was only significant in the same-year diffusion model. No differences were found between a divided government and a unified Democratic government (estimates not reported).¹⁸

In a separate analysis, I estimated results using a dummy for Republican governor, excluding the set of unified three chamber government variables. There was no difference between a Republican versus Democratic governor in the likelihood of performance funding policy adoption, other variables held constant. Similarly, I found no effect of Republican control of the legislature (neither estimates are reported). Taken as a whole, results suggest that party influences emerge only when a Republican governor enjoyed a Republican majority in both chambers of the legislature. Lastly, the citizen ideology measure was not associated with the likelihood of adopting performance funding 2.0 in any of the models estimated.

To briefly summarize results from the control variables, regarding higher education governance structure, states with a coordinating board were found to be no more or less likely to have adopted performance funding 2.0 compared to states with a governing board. With respect to appropriations, a \$1000 increase in state spending per student was associated with a 68% greater probability of adoption, confirming the hypothesized theory that states that provide more money to higher education are more concerned about how institutions use this money.

¹⁸ Estimates not reported for sake of space. Please contact author if interested in tables.

The Lumina Foundation. Estimates also pointed to the apparent influence of the Lumina Foundation, a strong advocate of performance funding and the national college completion agenda. States that were awarded the Lumina grant to design an outcomes-focused approach to higher education were, as hypothesized, more likely to adopt a PF 2.0 policy. Moreover, state membership in Lumina’s Strategy Labs, detailed earlier as a consortium that advocates for higher education attainment and access, also contributed to a higher likelihood of policy adoption. Empirically demonstrated, and convincing on a practical level, receiving a Lumina Foundation grant was evidently a compelling force behind state adoption of performance funding. Yet interestingly, state participation in the network, despite not being directly connected to performance funding specifically, was also a driving factor in 2.0 legislation, a finding I explore further in the Discussion section.¹⁹

I considered the possibility that Lumina’s choices of which states to award the grant and which states to participate in the Strategy Labs network was contingent upon the states’ existing interest and infrastructure to improve college outcomes. This potential selection bias raises the question of whether these selected states were more likely to adopt performance funding anyway due to existing environments conducive to accountability practices. I explored this question by running the same models reported in the results, and excluding first, the Lumina grant variable, then the Lumina Strategy Labs variable, and finally both variables. Results for all other variables were remarkably similar, offering substantive support that the Lumina variables increased the likelihood of adopting performance funding 2.0 above and beyond what otherwise would have been expected. Particularly for states receiving the grant, I suspect that they were already

¹⁹ Mentioned earlier, the hazard ratios reported on the two Lumina Foundation variables were estimated on the variables’ interaction with $\ln(\text{time})$ to accommodate the proportionality assumption of the Cox model. Average effects across the entire time period are likely smaller than reported since the time interaction places greater weight on the latter years of the dataset during which more adoptions occurred.

interested in performance funding, and the Lumina grant provided the resources, and perhaps public attention, necessary for the policy to overcome potential political roadblocks or institutional resistance.

Discussion

Limitations

Before discussing the implications of this study's results, I point to some limitations. For one, only neighboring state diffusion was analyzed, as is standard in the policy diffusion literature. However, media coverage of and research on performance funding places it beyond the confines of states' nearest neighbors. As an example, states in all regions have reportedly looked to Tennessee when designing policies and Ohio modeled its performance funding metrics for the 2-year sector on Washington state's policy (Dougherty & Natow, 2015; Dougherty & Reddy, 2013).

Second, the event of switching from bonus funding to base funding in a continuously operating performance funding policy could be viewed as practically different from adopting a new base funding policy. My study did not capture this distinction, a decision made because of the small sample size (47 states). Another relevant factor may be the proportion of funding tied to outcomes, which ranged across PF 2.0 states from 1% to 100%, with most states around 5% to 10%. My study treated the adoption of any policy with a base-budget incentive as the same event when in practice there are differences in policy strength among adoptions. Future studies on policy adoption could consider differentiating between policy designs, including the "dosage" of the funding incentive, especially as performance funding continues to evolve.

Economic and Higher Education Control Variables

The main purpose of this study was to investigate influences of policy diffusion, political party control, and philanthropic foundations relevant to performance funding 2.0 policy adoption. Even so, I briefly summarize results of the control variables analyzed. Year to year changes in state wealth was unrelated to PF 2.0 policy adoption. A possible explanation is that policymakers in states that have experienced major budget shortfalls (e.g. Arizona) operate in different environments that can influence the tendency to pursue PF 2.0 as an accountability tool. States that adopted PF 2.0 policies spent more per student on higher education appropriations, consistent with the theorized notion that legislators demand more accountability and efficiency from colleges when more funding is allocated.

Contrary to my hypothesis that coordinating and planning boards would be more protective against performance funding 2.0, I do not find this to be the case. Results also did not support qualitative findings about coordinating boards being influential in the latest performance funding policy developments in Indiana, Ohio, and Tennessee (Dougherty, Jones, et al., 2014; Dougherty, Natow, et al., 2014). My results suggest that states with a centralized higher education governing board were no more or less inclined to encourage performance funding agendas than their coordinating board counterparts. One explanation is that there is variation among states in the complexities higher education boards face in their interactions with each institution and with legislators and therefore, no specific structure drives performance funding 2.0. Moreover, neighboring state activity and initiatives from the Lumina Foundation may be overpowering any impact of governance structure. In the remainder of this paper, I suggest policy and practice implications from results of the main research questions under study.

“Reverse Policy Diffusion”

An unexpected finding in this study was the effect of the neighboring state variable. As the proportion of neighboring states with PF 2.0 increased, the likelihood of a state adopting its own policy decreased. States are engaging in a form of negative policy learning from their neighbors, actually delaying policy adoption in what I term “reverse policy diffusion”. State officials choose to wait and observe the impact and implementation of policies in nearby states. By watching the policy “play out” over time, legislators might be better prepared for the potential consequences or rewards of applying the policy to their own public colleges. Rather than prompting policy imitation or emulation, PF 2.0 in neighboring states seems to inhibit adoptions by bordering states. Furthermore, the estimates from the same-year diffusion variable were significant, while the 1-year lag and 2-year lag of the variable neared but did not reach significance. From a policy perspective, this result demonstrates that policy development activity occurring in the same year within a state is a signal to legislators in neighboring states more so than activity one or two years ago. Granted, this phenomenon needs to be further explored and is a potential area of future research.

One explanation for the reverse diffusion finding is the controversy surrounding effectiveness of performance funding and the political obstacles to adopting such policies. Do these policies incentivize better student retention and degree outcomes? Recent evidence points to a cautious “no”. One national study analyzing the impact of performance funding on bachelor’s degree completions found very modest improvements after multiple years (Tandberg & Hillman, 2014), while another study found no impact on degrees per FTE, graduation rates, nor retention rates at 4-year colleges (Rutherford & Rabovsky, 2014). At community colleges, associate degree completions did not improve as a result of performance funding, although heterogeneity in outcomes was observed across states (Tandberg et al., 2014). Granted, these

studies have mostly tested PF 1.0 since 2.0 has not been in place long enough to analyze changes in degree completions. Regardless, there is limited evidence thus far that performance funding works to achieve the broader goal of increased higher education attainment, which combined with political resistance, may deter adoption when examined by neighboring states. The political battles and resistance surrounding performance funding in nearby states may also prompt the witnessing state to proceed with caution. Coupled with evidence of undesirable consequences at the institutional level (e.g. narrowing academic missions, potential creaming), state officials might be hesitant to enact performance funding despite its national presence and advocacy by foundations and policy organizations.

Results of my study are also intriguing when considering the “anti-diffusion” finding, termed by Lacy and Tandberg (2014, p. 642), in which the outcome variable was state adoption of any of six different finance innovations in higher education, including both performance funding 1.0 and 2.0 policies. Across years 1979 to 1990, the existence of such policies in neighbor states increased the likelihood of adoptions. Yet by 1998 this trend had reversed, when policies started to reverse diffuse, a trend that continued to 2008, the last year analyzed. The authors argued that “for many of our policies, research suggests that changes in the financing of postsecondary education can lead to less desirable behaviors at both the individual and institutional levels. In light of this, we argue that as the second order effects of finance innovations became known, policymakers were in turn less likely to enact such changes because the consequences were understood” (Lacy & Tandberg, 2014, pp. 641-642). In light of the current study’s results, I propose that the impact of higher education performance funding policies are not as clearly demonstrated as other policies shown to diffuse according to policy learning and strategic competition, such as lottery policies and anti-smoking legislation. Further

investigation into this topic could help build a more testable theory for how states choose to pursue which higher education policies and why.

PF 2.0 Policies as a Form of Policy Innovation

As hypothesized, states that previously operated a performance funding model were more likely to have adopted a model that embeds base funding into the budget formula. Policymakers that abandoned earlier performance funding policies might see PF 2.0 as a fresh policy innovation fundamentally different from earlier policies, with potentially higher chances of effectiveness in boosting student outcomes, rather than as a repeat of formerly unsuccessful policies. Abandonment of PF 2.0 policies was common in the 1990's and early 2000's and my study confirms that states learn from their own histories in addition to those of other states'. Policymakers' experience gained from earlier periods of performance funding can be supplemented with what we now understand to be evidence-based best practices and design principles including using a limited number performance metrics and allowing institutions to choose optional metrics aligned with strategic plans. I expect interest in performance funding to continue in future years, with an eye towards modifying and improving policy designs. Policymaker goals such as reducing college costs, decreasing the need for student loans, improving the student experience, and college for all are "catchy", popular goals that resonate with the public. Such pressures will contribute to more accountability practices as students, families, and voters expect colleges to hold more responsibility for completion rates.

Support from Republican Governments

This study's finding that a unified three-chamber Republican state government was more than twice as likely as other partisan configurations to have adopted a performance funding 2.0 policy is consistent with the hypothesis that the policy's market-based incentives are

representative of Republican political ideologies. On the other hand, this effect was not supported when using the ADA-COPE measures of citizenship ideology, a measure that captures the political ideology of active voters in the state. To elucidate this somewhat puzzling finding about citizen ideology, a more detailed description of the ideology variable is warranted. The citizen ideology composite is derived from legislator ideologies and its validity depends on voters' accurate perceptions of these ideologies (W. D. Berry, Fording, Ringquist, Hanson, & Klarnar, 2010). The citizen ideology measure is most useful when we can assume that voters vote according to their own ideologies. However in the case of performance funding, it may be unclear to voters whether a candidate for elected office would support such a policy, or the issue of performance funding is simply unimportant or unknown to voters. More research is encouraged to explore the applicability of citizen ideology scores to higher education finance policies. Future research could also benefit from analyzing the influence of political champions, such as key governors behind higher education reform including former Governor Ted Strickland (D) of Ohio and current governor John Kasich (R) of Ohio. Political champions and policy entrepreneurs encompass a whole other area of worthy research.

Influential National Advocates and Philanthropic Supporters

This study provides empirical support for the indirect (though potentially direct) influence of the Lumina Foundation on the recent rise of performance funding policies. Results may also apply to other notable, well-resourced foundations such as the Bill and Melinda Gates Foundation. Furthermore, a group of visible organizations are connected to the national agenda to achieve a broad set of higher education goals around access, attainment, and affordability. These include non-profit advocacy groups such as Complete College America (a vocal supporter of performance funding); consulting firms such as HCM Strategists (which has secured funding

from both Lumina and Gates for performance funding work with states); higher education associations such as the American Association of State Colleges and Universities, and non-profit research organizations such as RTI International. In short, performance funding policies are less and less confined to the individual states in which policies are adopted, and the future continuation of these policies could be increasingly driven by stakeholders outside of the colleges that are the ultimate targets of such accountability policies.²⁰

Higher education policymakers in the seven states that received a combined total of \$9 million in grants from the Lumina Foundation not only benefited from the obvious financial resources, but also from the research, expertise, and advocacy organized by the Foundation and its subsidiaries to support the development of outcomes-based financing approaches to public higher education. Despite the possibility that Lumina selected these states because of favorable environments and dispositions towards performance funding, the states partnering with Lumina had committed to a goal, and even established an informal obligation, given the grant, to adamantly push a performance funding agenda towards legislation.

These findings about the Lumina Foundation have strong implications for the future of performance funding, which I anticipate will be continually and significantly shaped by “power players” on the national stage. Support in the way of grants and research may well affect

²⁰ An earlier version of this paper examined whether regional higher education compacts were related to the adoption of performance funding. Interstate compacts serve as vehicles for policy discussion and collaboration. States in a compact hold meetings and discuss ways to improve quality, efficiency, and access to higher education (SHEEO, 2015). The adoption of performance funding in one state may prompt other states within the compact to also consider the policy, by way of imitation or competition within regions. The four compacts are: the New England Board of Higher Education (NEBHE); the Southern Regional Education Board (SREB); the Midwestern Higher Education Compact (MHEC); and the Western Interstate Commission for Higher Education (WICHE). New York, New Jersey, and Pennsylvania do not belong to any compact, and in my dataset, I grouped them with the New England states. My analyses excluded the neighbor policy diffusion variable. Results pointed to no regional effects that could be attributed to a discussion of performance funding among states within the same compact. If interested in seeing these results and the rationale for accounting for compacts, please contact author.

policymaker priorities around higher education finance. Further research is recommended to uncover how state participation in the Lumina Strategy Labs network increased performance funding's popularity. Specifically, there may be specific discussions and activities that states participated in, or other higher education issues raised relevant to student success such as developmental education or financial aid reform, all of which may be related to which states chose to pursue performance funding.

Furthermore, the practice implications of influential advocacy groups and foundations are significant at the campus level. Performance funding is a policy targeted at colleges, and the financial component is the “carrot and stick”—the policy tool intended to alter campus activities and behaviors. College administrators, faculty, and staff presumably need to adapt to a performance funding policy when the policy gets adopted. Essentially, do stakeholders at the campus level have a voice in decisions around performance funding metrics, timelines to adoption, and policy redesigns after adoption? College administrators, faculty, and staff are the individuals who interact with students on a day-to-day basis and can engage in programmatic and instructional activities that support student retention and completion. This line of research is a fruitful area with potentially wide-reaching implications for the future growth, sustainability, or fall of performance funding policies.

In conclusion, this study investigated state adoption of performance funding policies in the last decade and specifically policies that embedded incentive funding into the base budgeting formula for public institutions. The origins of such policies are pertinent to their future sustainability and success, success defined as improvement in student outcomes, and a broader accomplishment of increased access, affordability, and attainment in higher education. Time and additional research will provide a clearer picture of this new generation of higher education

funding policies, and the effectiveness of funding for results policies that aim to advance the national college completion agenda.

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COVET THY NEIGHBOR OR “REVERSE POLICY DIFFUSION”? STATE ADOPTION OF PERFORMANCE FUNDING 2.0

Insert Tables

Table 1. Variable Descriptions and Sources

Variable	Description	Source
Adoption of PF 2.0; base budget formula	Coded 1 in a state-year if a state adopted the policy in that particular year	Dougherty & Natow (2015)
Previous operation of any PF policy	Coded 1 for a state that: previously operated and discontinued any type of policy; replaced a bonus funding formula with a base funding formula, or; added a base funding component to an existing bonus funding formula	Dougherty & Natow (2015)
Diffusion	Proportion of neighboring states adopting or operating PF	Author’s calculations
Lumina grant	Coded 1 for the 7 states that were awarded a Lumina grant to develop a performance funding approach to higher education (coded from years 2009-2013)	Lumina Foundation website
Lumina Strategy Labs	State participation in the Lumina network aimed to achieve various higher education completion goals	Lumina Foundation website
Political party control	Republican majority in the legislature; Republican governor; Unified Republican control	National Conference of State Legislatures (NCSL); Census abstracts; David Tandberg, personal communication
Citizen ideology	Composite measure of voters in a state on a liberalism-conservatism continuum (Berry et al.)	Carl Klarner and NCSL data via Richard Fording, University of Alabama website

Table 1 continued. Variable Descriptions and Sources, continued

Variable	Description	Source
Income per capita	State income per population (lagged)	US Dept of Commerce, Bureau of Economic Analysis
Unemployment rate	Percent of population defined as unemployed (lagged)	Bureau of Labor Statistics
Coordinating board	Higher education board is a coordinating or planning board; Omitted category is governing board (coded 0)	Education Commission of the States
Appropriations per student	Appropriations per fall enrollment at all public institutions (lagged)	State Higher Education Executive Officers (SHEEO), State Higher Education Finance database (SHEF)
BA degrees per student	Bachelor degrees awarded per fall enrollment at public 4-year colleges (lagged)	IPEDS via webCASPAR
Tuition	Average undergraduate, resident tuition at public 4-year colleges (lagged)	IPEDS via webCASPAR
Private enrollment	Percent of students enrolled at private colleges	IPEDS via webCASPAR
2-year enrollment	Percent of students enrolled at 2-year colleges	IPEDS via webCASPAR

Financial variables inflated to 2013 values. Lagged indicates a 1-year lag.

Table 2. State Adoption of Performance Funding 2.0

State	Year
2002	PA
2009	OH, IN
2010	LA, TN
2011	AR, IL
2012	NM, SD, WY
2013	FL, MA, ME, MN, MS, MT, ND, NV, TX, WI

Source: Dougherty and Natow (2015)

Table 3. Summary Statistics

Variable	Mean	Std. Dev.
Proportion of neighbor states with PF 2.0	0.37	0.25
Prior PF in focal state	0.54	
Lumina state grant (% of states)	0.14	
Lumina Strategy Labs (% of states)	0.58	
Unified Republican control	0.25	
Republican governor	0.50	
Republican-controlled legislature	0.49	
Citizen ideology (0 = most conservative, 100 = most liberal)	51.01	15.57
Income per capita (% change)	0.77	2.37
Unemployment rate (% change)	7.00	25.10
Coordinating board	0.52	
Higher education appropriations/student (*1000)	6.10	1.59
Average in-state, 4-year tuition (% change)	7.14	4.73
BA degrees per 100 enrolled students	17.20	2.50
Percent 2-year enrollment (*100)	4.82	6.95
Percent private enrollment (*100)	26.43	12.65

N = 624 to 672 (depending on lags and change variables)

Variables displayed in units used in analysis. Percent change variables represent percentage point change. Discrete variables displayed as proportion of state-years.

Table 4. State Adoption of Performance Funding 2.0 (Hazard Ratios)

	(1) Same-year diffusion	(2) 1-year lag	(3) 2-year lag
Diffusion ^a	0.59* (0.39, 0.90)		
Diffusion (1-yr lag)		0.65 (0.38, 1.11)	
Diffusion (2-yr lag)			0.63+ (0.39, 1.01)
Prior PF ×	1.70* (1.06, 2.73)	1.70* (1.09, 2.64)	1.75* (1.11, 2.78)
Lumina grant ×	1.99* (1.18, 3.37)	2.05* (1.16, 3.62)	2.14* (1.17, 3.92)
Lumina labs ×	1.76* (1.09, 2.84)	1.55* (1.02, 2.37)	1.60* (1.05, 2.45)
Unified Republican	2.25* (1.05, 4.81)	1.95+ (0.90, 4.22)	2.13+ (0.95, 4.78)
Citizen ideology	1.01 (0.98, 1.04)	1.01 (0.98, 1.04)	1.01 (0.98, 1.04)
Per capita income Δ	0.92 (0.75, 1.13)	0.96 (0.80, 1.15)	0.96 (0.80, 1.16)
Unemployment rate Δ	1.01 (0.99, 1.03)	1.02 (1.00, 1.04)	1.02 (1.00, 1.04)
Coordinating board ×	1.20 (0.82, 1.76)	1.21 (0.79, 1.85)	1.21 (0.82, 1.81)
HE\$ per student (lag)	1.68*** (1.25, 2.26)	1.68*** (1.24, 2.27)	1.76*** (1.30, 2.36)
BAs per student (lag)	0.94 (0.77, 1.14)	0.98 (0.82, 1.17)	0.99 (0.84, 1.17)
Tuition Δ× (lag)	0.95 (0.89, 1.02)	0.95 (0.89, 1.02)	0.96 (0.90, 1.03)
Percent private	0.99 (0.96, 1.03)	1.00 (0.97, 1.03)	1.00 (0.97, 1.04)
Percent 2-yr	1.04 (0.96, 1.12)	1.03 (0.96, 1.11)	1.03 (0.96, 1.11)
BIC	210.70	213.49	212.59
N. of state-years)	532	532	532

Hazard ratios are exponentiated coefficients.

Change variables and percent variables are in percentage point units.

Δ denotes a change variable. × denotes interaction with $\ln(\text{time})$.

^a Diffusion variable is in units of 20 percentage points.

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

Performance Funding in Action:
The Campus Implementation Phase in Pennsylvania and Ohio

Amy Y. Li
University of Washington

Amy Y. Li, Educational Leadership, Policy, and Organizations, College of Education,
University of Washington. Contact: libutler@uw.edu

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Abstract

This study investigates the campus implementation of performance funding, a policy that funds public colleges based on student outcomes, in Pennsylvania and Ohio. Focusing on 4-year colleges, I apply principal-agent theory to conceptualize the relationship between policymakers and campuses, as well as among different professional roles within four select campuses. I conduct semi-structured interviews of 47 policymakers and campus officials occupying three role categories (high-level administrator, mid-level administrator, faculty and staff). Findings suggest that in Pennsylvania, strong faculty unions restrict campus budget flexibility and prompts campus administrators to create special incentives for faculty to pursue targeted retention activities for students. In both Ohio and Pennsylvania, campuses respond to performance metrics, particularly for underrepresented student populations, with plans to incorporate more centralized data analytics. In addition, policymakers and administrators in both states tend to portray higher education as a business enterprise, recognizing that strategic revenue generation is increasingly necessary to operate in state environments with declining or stagnant funding.

Keywords: performance funding; policy implementation; principal-agent theory; faculty incentives

Performance Funding in Action:
The Campus Implementation Phase in Pennsylvania and Ohio

Introduction

Performance funding is a state policy that essentially applies private sector incentives to public higher education. Briefly, the policy utilizes a funding formula to tie a portion of state appropriations to public institutions according to specific student outcome metrics such as retention rates and degree completions (Burke, 2002; Dougherty & Reddy, 2013). As of January 2016, 30 states are operating an existing or developing a new performance funding policy (Snyder & Fox, 2016). More states are tying higher percentages of the state portion of the institutional budget, up to 80% to 100%, to incentivize institutions to change campus practices in ways that ultimately increase college completion (Snyder, 2014). Frequently incentivized undergraduate metrics are retention rates and degrees awarded, with some states awarding extra funding for enrollment, retention, and graduation of underrepresented students (first-generation, Pell grant recipients, underserved racial and ethnic groups) and completions in “high demand” STEM fields (science, technology, engineering, mathematics) (Li, 2014).

In contrast to the earlier generation of performance funding policies (PF 1.0) that allocated bonus funding, a new wave of policies (PF 2.0) hold back a portion of an institution’s base budget and institutions must earn this funding (Dougherty & Reddy, 2013). Performance funding 2.0 is an accountability tool that emerged in part from the last recession and decreasing taxpayer revenue. The policy gained prominence in an environment of public perceptions of wasteful spending in higher education, concerns over rising tuition costs, increasing student loan debt, and disconcertingly low college completion rates (Li & Zumeta, 2015; Statistics, 2015).

Policymakers and philanthropic foundations are strong proponents of the policy, which incorporates the basic private sector logic to financially reward organizations for desired outputs with the expectation that organizations will alter practices to secure this money.

Despite this underlying logic behind performance funding and the policy's recent proliferation, studies have found minimal evidence to support any aggregate impact of the policy on undergraduate degree outcomes nationally at 4-year colleges (Rutherford & Rabovsky, 2014; Tandberg & Hillman, 2014), 2-year colleges (Tandberg, Hillman, & Barakat, 2014), or in state-specific analyses of Tennessee (Sanford & Hunter, 2011), Pennsylvania (Hillman, Tandberg, & Gross, 2014), and Washington (Hillman, Tandberg, & Fryar, 2015). In addition, qualitative research conducted primarily in Indiana, Ohio, Tennessee, and Washington found that while high-level administrators are knowledgeable about performance funding, mid-level administrators and faculty are less informed and less likely to take responsibility for responding to the policy (Dougherty & Natow, 2015; Jenkins, Wachen, Moore, & Shulock, 2012; Li, 2016).

Moreover, there exists limited research on faculty and staff responsiveness to performance funding policies. A recent study in Washington state found that faculty tended to be less receptive to the logic behind performance funding, and staff such as academic advisors are especially uninformed about the policy (Li, 2016). Yet in many respects, faculty and staff are the very individuals that performance funding ultimately targets. These individuals work on the ground with undergraduate students, interacting with students in both formal and informal contexts. Scholars have suggested that faculty affect student retention and completion inside and outside the classroom (Braxton, 2008; Pascarella, Seifert, & Whitt, 2008). For example, academic advisors and financial aid counselors are positioned to help students achieve the very outcomes measured and rewarded in performance funding, such as year-to-year retention and

retention of students with financial need. Faculty and staff create environments that support (or do not support) student retention—the central goal of performance funding policies (Reason, 2009; Tinto, 1998).

The purpose of this study was to investigate the campus-level implementation of performance funding 2.0 in two states that recently redesigned their policies. Pennsylvania has a history of performance funding that began in 2002 for the 14 universities in the State System of Higher Education (PASSHE). A 2010 policy redesign provided universities more flexibility in choosing optional metrics and designing institution-specific metrics (Cavanaugh & Garland, 2012). These changes offered an opportunity to research the feedback loop whereby institutional feedback gets incorporated into policy redesigns.

Second, Ohio's history of PF 1.0 began with its Success Challenge in 1996, which continued until 2009, during which a PF 2.0 policy was enacted (Dougherty & Reddy, 2013). The PF 2.0 policy was implemented in phases from 2010 to 2014, progressively shifting to 100% outcomes-based funding for 4-year institutions starting in FY 2015 (Ohio Board of Regents, 2014; Snyder & Fox, 2016). A previous study of campuses in Ohio using data from fall 2011 to fall 2013 uncovered obstacles to accomplishing performance goals, such as insufficient campus knowledge of the policy and institutional resistance (Pheatt et al., 2014). By collecting data beyond 2013, I aimed to explore whether these campus perspectives may have changed.

In this study of Pennsylvania and Ohio, I posed the following research questions:

- 1) According to state policymakers and college administrators, faculty, and staff, how is performance funding expected to work? What policy tools are being used?
- 2) Have state policymakers responded to institutional feedback? How are policies being redesigned, revised, or refined over time?

- 3) What is happening at the campus implementation phase? How have administrators, faculty, and staff responded to the policy?

Conceptual Framework

Because the present study aimed to examine how campuses responded to performance funding policies designed at the state level, I applied principal-agent theory. In this conceptual framework, the principal and the agent enter into a formal or informal contract in which the agent is charged with carrying out certain actions to deliver results aligned with the principal's goals (Lane, 2007). In this study, principal-agent theory frames two key relationships. First is the relationship between state policymakers as the principal and campuses as the agent, in which the principal expects the agent to accomplish goals including greater student retention and completion (Kivistö, 2008; Weimer & Vining, 2011). Yet, the principal-agent problem arises because principals and agents often have different interests and because it is implausible for the principal to fully monitor the agent's actions (Bohren, 1998). Therefore, principals design structures, using policy tools such as financial incentives, to align interests between the two entities (Stone, 2012). Recent studies conducted by Hillman et al. (2014, 2015) have applied principal-agent theory to conceptualize performance funding as the state-level oversight body and campuses as agents charged with producing improved student outcomes for the state.

The second level of principal-agent relationships exists within campuses. In order for campuses to meet state goals for college completion, campus leaders may need to communicate such goals using policy tools such as information dissemination and internal financial incentives (Stone, 2012). An institution consists of multiple layers of the principal-agent relationship with each level from president to entry-level staff conceivably possessing distinctive incentives and interests. Consistent with Li's (2016) proposed framework, campus leaders become both

principal and agent. For instance, a president aims to improve on the performance funding metric of first-to-second-year student retention, which stimulates actions from the provost and the vice president of student affairs, both of whom occupy the role of agent. These two agents also take on the role of principal, by communicating and collaborating with their respective deans and directors (e.g. of institutional research, student engagement) to establish specific tactics to improve retention. In the next layer, a dean may charge department chairs and faculty to evaluate course completions, while a director of centralized undergraduate advising may task academic advisors to ensure students register for appropriate second year courses. In short, information about external policies such as performance funding gets filtered within a campus¹.

In connection to the principal-agent relationship, policy implementation is what occurs between the determination of a policy's targeted outcomes and the perceived or actual policy results (DeLeon & DeLeon, 2002). Implementation also concerns "whether, and how, policy-making principals control the discretion of their implementing agents" (Meyers & Vorsanger, 2003, p. 246). In my study, implementation is defined as the way college administrators, faculty, and staff put performance funding policy goals into action.

Method

Framed within principal-agent theory, this study investigated the alignment of goals between states and campuses, and across multiple roles within campuses to capture a nuanced picture of policy implementation of performance funding 2.0 in Pennsylvania and Ohio. In this methods section, I provide a brief overview of performance funding policies in the two focal states. I subsequently describe the sampling process of policy organizations and a total of four institutions, as well as the sampling of administrators, faculty, and staff within the institutions. A

¹ The within-campus principal-agent relationship does not imply strictly a top-down direction since faculty can influence actions of high-level administrators and vice versa.

total of 47 participants participated in semi-structured interviews. At the end of this section, I explain steps of data analysis employed to uncover findings on policy tools, policy redesigns, and campus responses.

Selecting States

This study's research design incorporated purposeful sampling to select two focal states, organizations and campuses within these states, and individual participants (Merriam, 2009). I chose Pennsylvania as the first state for several reasons, the first being its long performance funding history. The Pennsylvania State System of Higher Education² (PASSHE) first adopted performance funding in 2002 for its 14 institutions, allocating 8% of base state appropriations based on improvements in retention rates, degree completions, research productivity, and institutional efficiency, among other metrics (Cavanaugh & Garland, 2012). The second reason for selecting Pennsylvania was the policy revision that occurred in 2010, providing an opportunity to address my second research question regarding the dynamic flow of feedback between state policymakers and institutions, whereby institutional feedback gets incorporated into policy redesigns. Starting in FY 2012-13, the state system began allocating 2.4% of its total operating budget, rather than the former 8% of state appropriations, based on performance metrics to "stabilize the amount of performance funding as state appropriations declined rapidly" (Cavanaugh & Garland, 2012, p. 37).

In this study, the policy change of interest was that the redesigned policy allowed mission differentiation in performance metrics. Each university was newly required to be funded based

² The Pennsylvania State System of Higher Education (PASSHE) is the governing board responsible for oversight of the 14 universities in the state system. The Board of Governors "establishes broad educational, fiscal, and personnel policies. Among other tasks, the Board appoints the chancellor [Chief Executive Officer of the State System] and each university president, approves new academic programs, sets tuition, and coordinates and approves the annual State System operating budget." (Pennsylvania State System of Higher Education, 2016). Note that PASSHE does not include public universities such as University of Pittsburgh and Pennsylvania State University.

on 10 metrics total from three groups of metrics, Groups 1, 2, and 3. Group 1 consists of mandatory metrics such as the number of associate's degrees, bachelor's degrees, and graduate degrees conferred; total bachelor's degrees per FTE student, and; separate metrics for completions among Pell-eligible students and those from underrepresented racial groups (defined in Pennsylvania as African American, Hispanic/Latino) to emphasize access goals. Each campus then chose three to five recommended metrics from Group 2, which includes third- to fourth-year retention and STEM degrees awarded. Lastly, Group 3 metrics are specific to institutional strategic plans, developed by institutional leaders with approval from the Chancellor (Cavanaugh & Garland, 2012). The third reason for selecting Pennsylvania as a focal state was because a study conducted by Hillman et al. (2014) utilizing a quasi-experimental design concluded that the performance funding policy did not incentivize greater degree completions. Therefore, Pennsylvania offered an opportunity to conduct qualitative research to reveal campus responses in a case where quantitative analysis suggested insignificant impacts on degrees.

The second state focal state I selected was Ohio, which is particularly fascinating because it is one of few states that now funds nearly 100% of state higher education appropriations based on performance metrics. Ohio's PF 2.0 policy was adopted in 2009 and after a policy phase-in period from enrollment-based to outcomes-based funding, by FY 2015 institutions received state funding purely based on courses and degrees completed (HCM Strategists, 2011; Ohio Board of Regents, 2014). The formula calculates extra weight for STEM courses and degrees, as well as for completions by students who are on Pell grants, age 25 or over, and/or who are African American, Hispanic/Latino, or Native American. The extra incentives allocated for STEM and for underrepresented students in both Pennsylvania's and Ohio's policies afforded this study the

ability to explore campus strategies to retain student subgroups, a topic of growing interest for many states looking to design or redesign their performance funding formulas (Davies, 2014).

Sampling Organizations and Campuses

In both Pennsylvania and Ohio, I engaged in purposeful sampling by initiating recruitment (via email or phone) of the higher education organization that designed the performance funding policies (Merriam, 2009). In Pennsylvania, I contacted the State System of Higher Education and requested to interview individuals directly involved with the funding formula. Recruitment also consisted of opportunistic or snowball sampling, where participants suggested additional individuals to contact, which was useful for finding politically important cases—salient individuals who should be included in the study because they are actively connected to the funding formula (Miles, Huberman, & Saldana, 2014).

To identify institutions within the two focal states, I incorporated a maximum variation sampling strategy (Miles et al., 2014). First, I sought variation in institutional missions and student demographics served. All PASSHE universities have a primary teaching mission, so within the system I considered campuses that served a comparatively high proportion of low-income students versus those with more affluent populations. Additional sampling criteria required one campus to have chosen to be funded by the optional STEM performance funding metric and one campus that, according to PASSHE, implemented innovative ideas to bolster student retention and completion. Discussions with the State System senior staff led to my recruitment of five potential campuses to study, and ultimately, two campuses were selected based on the sampling criteria described and campuses' openness to participation.

In Ohio, I contacted the Ohio Department of Higher Education (formerly the Board of Regents), which was charged by the governor to initiate the performance funding policy, to

recruit several staff participants holding multiple roles (e.g. legislative relations, data analysis, institutional relations). I also recruited policymakers at the Inter-University Council, an organization that represents interests of all 4-year universities before state agencies and meets regularly with university leadership. Similar to Pennsylvania, I sampled Ohio universities with a range of institutional missions and student demographics served³. To maintain comparability with the teaching-oriented missions of the Pennsylvania State System universities, I contacted master's comprehensive universities with a teaching-oriented mission as well access institutions—a group of designated Ohio institutions with a mission to serve underrepresented students and minimize their barriers to entry. Ultimately, participants from two institutions in Ohio (one teaching/research focused, one access institution) and two in Pennsylvania were included in this study.

Sampling Participants within Campuses

Once campuses agreed to participate, I purposefully sampled individuals in three main professional role categories: 1) high-level administrators (presidents, vice presidents, provosts); 2) mid-level administrators (associate and assistant vice presidents, directors of institutional research, deans), and 3) faculty and staff (department chairs, faculty members, and staff members such as financial aid counselors and data analysts). Differentiating among roles and

³ This study was part of a larger research project in which I also interviewed individuals at an Ohio research-intensive university to cover a wide range of institutional missions. However, ultimately this study relied on two selected universities in Ohio, one with a more teaching focus (although some research) and one with an access mission. I excluded the Ohio research-intensive university from the analysis to better explore how institutions with stronger emphasis on teaching and access addressed retention of underrepresented students and to ensure consistency with the institutional missions of the two Pennsylvania universities.

leadership levels was informed by this study's conceptual framework of principal-agent relationships *within* the institution⁴.

In the administration category, I recruited presidents, provosts, and vice presidents or directors of units representing: budgeting and finance, enrollment planning and recruitment, student success, student affairs, multicultural student success, and institutional research. Within the faculty category, I recruited faculty known to be involved with performance funding such as those who served on a student outcomes evaluation committee. Moreover, faculty may hold different perspectives depending on their discipline and thus I recruited one group of faculty from the social sciences and practice-oriented fields (e.g. political science, public affairs, education). The second group was strategically recruited from STEM fields to uncover specific departmental strategies in response to the two states' STEM performance metrics. Third, the staff members included advisors working directly with students in financial aid, academic advising, or in data analysis within colleges/schools or departments. After initiating contact, I relied to some extent on convenience sampling based on participants' availability. This initial recruitment subsequently led me to use network or snowball sampling. I asked participants, prior to arriving on campus and during interviews, to suggest additional key individuals who could best describe campus implementation of performance funding—this study's phenomenon of interest (Merriam, 2009; Miles et al., 2014).

In total, I interviewed 19 participants in Pennsylvania and 28 in Ohio for a total of 47 participants (Table 1). Participants in both states consisted of state policymakers and participants

⁴ Described in the conceptual framework, on the one hand, presidents and vice presidents hold knowledge on institutional-level responsiveness to state performance funding (as the agent) and interface with external policymakers (principals). On the other hand, these same individuals act as the principal and can also discuss how they seek to align the interests of their employees with the institution's broader goals.

occupying the three main campus roles, across four total campuses with slightly different institutional missions⁵.

[Insert Table 1]

Table 1: Participants by State, Campus, and Role		
Pennsylvania		
Policymaker/Higher Ed Agency	5	
	PA Campus 1	PA Campus 2
High-level administrator	4	3
Mid-level administrator	4	2
Dept chair, faculty, staff	0	1
Subtotal by campus	8	6
Ohio		
Policymaker/Higher Ed Agency	9	
	OH Campus 1	OH Campus 2
High-level administrator	1	2
Mid-level administrator	5	3
Dept chair, faculty, staff	6	2
Subtotal by campus	12	7
Both States		
All Pennsylvania Participants	19	
All Ohio Participants	28	
Total Participants	47	

Data Collection and Interviews

Consistent with previous studies of performance funding policy implementation, I employed semi-structured interviews to explore my research questions (Dougherty et al., 2014). Interviews are especially useful when participant behavior is not directly observable, and can

⁵ In Pennsylvania, it was especially challenging to recruit faculty and staff members for this study in part because of collective bargaining, which I describe as a finding in the Results section. Individuals in role category 3 (department chairs, faculty, and staff) were not available to be recruited from PA Campus 1.

reveal participants' viewpoints and actions. In particular, semi-structured interviews are valuable when "specific information is desired from all the respondents", yet multiple perspectives are also essential (Merriam, 2009, p. 90).

Driven by the present study's research questions, I drafted interview protocols to cover fundamental topics and to ensure that procedures (though not necessarily all questions or topics) were consistent across participants (Patton, 2003). It was important to pose questions on the topics from multiple angles to first increase the likelihood of data saturation wherein reoccurring themes emerge within and across interviews, and second; to create opportunities for triangulation of perspectives within each interview and across interviews (Merriam, 2009). Sample interview protocols are presented in the Appendix.

Data collection took place in two phases, with the first fieldwork trip in September 2015 and the second in January 2016. Each trip covered different organizations and institutions in Pennsylvania and Ohio. The majority of interviews were conducted one-on-one. In a few instances, I interviewed more than one participant together when participants requested such a setup (e.g. a participant in a new role who included another participant to discuss continuity of the policy, more than one participant in the same organization). Interviews ranged from 30 minutes for individual interviews to 90 minutes for group interviews with most at 60 to 75 minutes. I took notes throughout all interviews. Interviews were audiotaped with the participants' permission and later transcribed⁶.

Data Analysis

⁶ Two participants requested no audiotaping but allowed note taking and inclusion of their interviews in the study. A few of the audiotaped participants requested short segments of their interviews to be off the record, and thus these discussions were excluded from the analysis.

Having personally conducted the interviews gave me the awareness and context necessary to begin data analysis by selecting salient interviewees who discussed topics most relevant to this study's research questions (e.g. policy redesign, campus responses) (Miles et al., 2014). I first selected a total of 10 salient interviews of both policymakers and campus participants in Pennsylvania and Ohio. This subset of interviews consisted of campus participants in the three role categories from institutions of different missions, in order to extract relevant information that I later extended to the analysis of the larger set of interviews. I began the data analysis phase by conducting an open coding of the transcripts. An open code is supported by at least one unit of data, defined as "any meaningful (or potentially meaningful) segment" of text (Merriam, 2009, p. 176). Each unit must "reveal information relevant to the study and stimulate the reader to think beyond that particular bit of information" (Lincoln & Guba, 1985, p. 345).

During this phase, I read through each transcript in the selected 10 interviews, cross-referenced with my notes, and identified interesting or thought-provoking segments of text, phrases, and concepts. This meant creating a list of informal codes, keeping in mind the study's theoretical framework and research questions. I demonstrate an example of the open coding process with a quote from a policymaker:

"If the idea of this [performance funding] is not only to see metric increases as a measure of success, but more importantly, change the behavior behind the metric to make sure that you're seeing more successful metrics at the end, what have you really accomplished? And so as I started to work on [performance funding] here [in Pennsylvania], and still believe there has to be enough invested in it to get people's

attention and then theoretically help incentivize them to change their behavior in positive ways to ultimately increase metric success.”

Here I wrote the codes “policy design”, “incentives”, “changing behavior”, and “what defines success?” In the next example, a college president stated:

“It's very much like a number of performance indicators [metrics], you have to put in place the structure of the mechanism, the planning and so forth before you can actually achieve the performance outcome [improved student retention and completion]. And that's another reason why performance indicators, to be effective, need to be consistent over a reasonable amount of time. Because you have to prepare the campus to achieve the outcome.”

Here again I added the codes “policy design” and “incentives”, as well as “what defines effectiveness?” I continued this process by comparing open codes from each interview to the previous interviews. After completing open coding of the 10 interviews, I arrived at a series of approximately 20 codes that I then utilized to construct categories.

The second phase consisted of analytical coding during which I constructed, named, and defined categories, known as a “primitive outline or classification system” (Merriam, 2009, p. 181). To generate meaning from the data, I compared and contrasted across participant interviews and clustered concepts to condense and distill the data (Miles et al., 2014). For example, I constructed a category titled “policy revision and evolution”, which spanned across multiple interviews and “captured some recurring pattern that cuts across the data” (Merriam, 2009, p. 181). Creating this classification system provided a solid structure to continue the analytical process of using transcripts and notes to code the full 47 interviews in Pennsylvania and Ohio. I grouped, ungrouped, and regrouped new and existing codes and ensured

triangulation of categories, and verified that each category contained a series of codes (Gagnon, 2010; Patton, 2003).

The third and final step involved identifying patterns in the categories and asking how these patterns addressed the research questions of this study in order to form themes. Here I contextualized categories to form a coherent story of performance funding policy implementation. This step represented a shift from the primarily inductive to the primarily deductive phase of qualitative data analysis (Merriam, 2009), where “the researcher uses analytical constructs, or rules of inference, to move from the text to the answers to the research questions” (White & Marsh, 2006, p. 27). My objective was to craft a “logical chain of evidence” where relationships among the categories formed themes (Miles et al., 2014, p. 290). Table 2 outlines the data analysis process by providing examples of how open codes formed categories, categories developed into themes, and themes were defined. Later in the Findings section, I present the themes discovered, but first I acknowledge limitations of this study, as well as ways that qualitative validity was established.

[Insert Table 2]

Table 2: Examples of Open Coding to Theme Development

Examples of Open Codes	Examples of Categories	Theme	Description of Theme
When there are changes to funding, there is apprehension; generally collaborative design process; fundamental flaw; performance metrics guide allocation of resources; tweaking the policy	Mandatory metrics, optional metrics, and institution-specific metrics offer variety	Policy design and revision	Components of policy design and redesign that affect impacts or implementation
	Flexibility in choosing institution's metrics is beneficial		
	Better alignment of institutional and state goals		
Intimately engaged with student success; faculty start to notice; faculty grumble; faculty work very hard; faculty champions; high-impact practices	Administrator states that they cannot convince faculty to do anything	Faculty incentives	Ways to incentivize faculty to try new activities aimed at boosting student retention and thus performance on metrics
	Faculty champions can influence faculty's own behavior		
	Faculty contribute service to the university that targets undergraduate retention		
Centralized data system; student records, performance report; resistance to data use; student transition points	Intentional about handling student information	Data analytics	Using data, predictive analytics, or centralized systems to inform student retention strategies
	Need to do a better job of collecting student data		
	Focus on institutional-level decision making		
Financially profitable; financial health; space utilization; making payroll; paying dividends; getting reimbursed; start-up costs; higher education is a business	Playing a game of jackpot or powerball in the performance funding formula	Business of higher education	Participant approaches policy or institutional strategies by focusing on finances and a bottom line
	Expanding campus facilities (e.g. dorms, recreation center) is paying dividends		
	Increase enrollment to make up a deficit from the state		

Limitations

A limitation of this study was potential self-selection in the sampling process. Because interviewees volunteered to participate, there is potential bias based on interviewees' willingness

to converse with me about performance funding. That is, interviewees who have less knowledge of or interest in performance funding were probably less inclined to participate and the interviews analyzed may characterize perspectives of those with comparably greater responsiveness to performance funding. A second limitation of this study was the focus on two states. There is large variation in performance funding policy designs across states and this study's findings about Pennsylvania and Ohio are not generalizable or intended to represent policy implementation in other states. Rather, the purpose of this study was to offer an in-depth look at policy redesign and the campus implementation phase of select institutions in Pennsylvania and Ohio, both prominent states in the performance funding landscape. Future research is encouraged on the experiences of performance funding in other states.

Trustworthiness, Reliability, and Qualitative Validity

I employed a number of strategies to enhance trustworthiness, reliability, and qualitative validity—credibility that the data formed the themes presented next (Merriam, 2009). First, throughout each interview, I paraphrased responses and summarized interview topics to ensure I interpreted participant comments as they intended. Second, an additional investigator participated in conducting the first round of interviews in Ohio and we independently coded segments of interviews to assess triangulation of findings. As a third step, after developing preliminary findings, I returned to select participants as a member check to elicit feedback on whether my interpretations “rang true” (Merriam, 2009, p. 217).

Fourth, I engaged in peer review by sharing segments of transcripts with outside researchers with expertise in qualitative analysis and higher education, who also conducted an open coding of their own, and discovered results that both confirmed as well as challenged my findings. By comparing our interpretations and enlisting their feedback during the analysis and

writing stages, I contemplated rival explanations as well as ensured my findings were plausible (Patton, 2003). Lastly, from the inception of this study to the writing stage, I referred to my earlier pilot study of campus responses to performance funding in Washington state—the impetus for the present study’s research design. By comparing findings in Pennsylvania and Ohio to Washington and assessing patterns in findings, I added another layer of validity. Therefore, through an extensive process of testing and confirming findings (Miles et al., 2014), I arrived at the following findings regarding the policy implementation of performance funding.

Findings

To remind the reader, this study posed the following research questions:

- 1) According to state policymakers and college administrators, faculty, and staff, how is performance funding expected to work? What policy tools are being used?
- 2) Have state policymakers responded to institutional feedback? How are policies being redesigned, revised, or refined over time?
- 3) What is happening at the campus implementation phase? How have administrators, faculty, and staff responded to the policy?

I identified four themes regarding performance funding policy implementation. The first two emerged solely from interviews in Pennsylvania, because of the state’s unique recent policy redesign and its collective bargaining environment, and the last two themes emerged from interviews in both Pennsylvania and Ohio. The first theme was related to a policy design in Pennsylvania’s funding formula that delayed reporting of performance funds allocated and consequently affected how the policy was expected to incentivize campus behaviors. Second, strong collective bargaining was unique to Pennsylvania and contextualized faculty incentives to help retain students. The third theme emerged out of interviews in both states, in which

campuses pursued advanced data analytics to improve student retention, especially for underrepresented students. Finally, the fourth theme I present concerns policymakers and high-level administrators who framed performance funding as a policy congruent with the business of higher education. When presenting findings, I use pseudonyms and general professional titles to protect the identity of participants.

Policy Design

Funding unpredictability—the fatal flaw. The first theme I discovered in Pennsylvania were the presence of converging views on performance funding among the state policymakers and the campus participants, specifically on challenges in the budgeting process, as well as the benefit of the 2010 policy revision that gave institutions opportunities to customize certain performance metrics. Both PASSHE system employees and campus officials were vocal about the flaws of the current performance funding policy, and in particular the unpredictability of funding. For example Marcia at the State System office described:

“So they're [colleges] already a quarter of the way into their fiscal year before they know how much money they got from performance funding. So if last year you got a million dollars, we tell you, plan on getting a million dollars this year, but it could be that this year they're going to get 500,000 or they're going to get two million, and they don't know. There's less swing like that occurring right now, although I can tell you this year, there's one university that lost a million dollars in performance funding this year. So that's a pretty big swing. So how do you budget for performance funding?”

High-level administrators such as presidents, vice presidents, and those working in finance and administration such as Ira echoed this sentiment:

“The fundamental flaw in this performance thing is I just found out in January what my performance funding was for the fiscal year that started last July. That makes no sense to me whatsoever. They should be telling me in January what my number's going to be for July. I don't even know what some of my indicators are that I'm being measured against until it's all over. So how do I manage those numbers when I don't even know what the number is?”

These two quotes represent the general sentiment of multiple interviewees in Pennsylvania who pinpointed the unpredictability of funding, due to a lag in reporting, as the fatal flaw of the performance funding setup. This 6-month delay generated confusion and apprehension over how much a university should spend throughout the year, for instance from July 2015 to January 2016, for fear of actually receiving less money once the annual budget is determined in January 2016 and being forced to scramble to accommodate the shortfall. Mid-level administrators who directly handled the university's budget expressed frustration and even dismay. Additionally, the delay in connecting student outcomes directly to changes in the funding allocations created ambiguity in whether campus actions in fact contributed to greater performance. Institutions coped with this policy design flaw by enlisting their institutional research offices and budgeting offices to try to better predict potential funding based on current and prior year's performance numbers. Despite criticisms from campuses, as well as recognition of the flaw by several PASSHE employees, there were no apparent plans for providing a more predictable budgeting process.

Policy revision: The door opens for future opportunities. On the other hand, interviewees also recognized a positive feature of the performance funding policy design. This feature resulted from the 2010 revision that provided institutions the opportunity, in addition to

mandatory metrics, to choose from a set of optional metrics as well as to propose metrics aligned with institutional strategic plans. Interviewees from PASSHE were particularly enthusiastic about this policy revision, an enthusiasm shared by numerous high-level and mid-level campus administrators. Both the state and the campuses perceived that the policy had undergone a necessary and welcome revision that allowed customization that bolstered stakeholder buy-in, and enhanced future continuity in campus strategic missions. One high-level administrator, Barak, applauded the optional metrics and university-designed metrics for the following reason:

“Well, I think to continue that flexibility and setting the performance metrics is very important to the institutions because we are different. We all operate in a little bit different context, even though our mission is somewhat similar.”

The enthusiasm shared by institutions about the policy revision may enhance future sustainability of performance funding in Pennsylvania. The alignment of interests between the state (principal) and the campuses (agent) suggested that the funding formula was being improved, revised, and redesigned with institutional feedback in mind. While there existed some tension between PASSHE and institutions in designing institution-specific metrics, most participants held positive outlooks on the design changes. A quote from Samuel at the PASSHE office summarizes this theme on policy revision:

“We get into some of these little individual conversations about individual metrics and how they're counted. Of course everybody wants the money, so they'll always try to work a metric to their advantage, and claim foul that the sun got in my eyes [when their performance in the formula was lower than expected]. But largely, not only is it a solid process here [at PASSHE institutions], the people who oversee it and make it work are

solid in their focus on it. And generally speaking, [the campuses] seem to be very interested in the changes we're talking about making to it [the policy design].”

Faculty Incentives in an Environment of Collective Bargaining

The next theme I discovered was around faculty incentives to retain and engage undergraduates, which was a key pattern of within-campus policy implementation of performance funding in Pennsylvania. To contextualize, Pennsylvania is a powerful labor state where collective bargaining amongst faculty can incur a significant cost to universities in the way of salary, benefits, and contractual obligations that may inhibit flexibility. All 14 campuses in the PASSHE system are part of a single faculty pay schedule negotiated by the labor union. From new assistant professors to full professors, salary schedules for each level must be consistent across disciplines, meaning that an assistant professor in English makes a comparable salary as an assistant professor in engineering.

In Pennsylvania, where state appropriations have remained flat in the last eight years and institutions now generate a higher than ever proportion of their revenues through tuition, several interviewees at the state system hinted a desire to “phase out” or encourage retirement of senior faculty who were too comfortable in their positions to respond to changing fiscal climates that demanded greater effort into student retention. Moreover, some high-level administrators wanted to shift resources that paid faculty salaries in academic programs experiencing declining student demand into the hiring of new faculty in programs of increasing student interest and greater institutional priority (e.g. engineering)⁷. However, according to interviewees, strong unions caused the state system and institutions to encounter limited flexibility in making such decisions.

⁷ From another perspective, because English professors are normally less expensive to employ than engineering professors, universities may raise tuition dollars from programs with lower costs of delivery to subsidize engineering. At a university where this is less the case, the temptation to switch resources to STEM will be higher.

Within the broader context of budgetary constraint, institutions described ways to incentivize existing faculty despite perceived collective bargaining restrictions on hiring new faculty to adjust to changing student demand. With respect to how campus interviewees responded to performance funding, department chairs and deans tasked faculty to pursue a wealth of activities that previously received lesser emphasis. These activities were aimed at improving student persistence overall, increasing STEM degrees, and creating high impact practices—a university-specific performance metric. Both Pennsylvania institutions had selected, as an optional performance metric, high impact practices, or those practices believed to increase student engagement, retention and/or graduation. High impact practices included study abroad, internships, and undergraduate research. According to campus interviewees in all three professional role categories, administrators charged faculty to experiment with new teaching practices expected to promote student retention (e.g. incorporating more technology in the classroom) and outside-the-classroom programming (e.g. undergraduate research). To illustrate, Curtis, a Dean of Science and Engineering, stated:

“And one of those high impact practices...is going to be undergraduate research. That, to me, within our college, that, to me, is probably the most important aspect that I think that we can do.”

Even though campuses had limited budgets to hire new faculty, administrators and faculty employed creative ideas to cultivate existing faculty expertise. One institution designed an integrative STEM minor composed of courses already being taught. Heather, an engineering faculty member, described:

“And I recently became more engaged in the whole movement with the STEM education.

So I'm leading the effort on campus for a new minor for early childhood ed majors in integrative STEM, so it just got approved last year [by the department and state system], and now I advise all of those minors."

According to interviewees at the Pennsylvania institutions, the optional and university-specific metrics in the performance funding formula effectively directed attention to STEM education as well as generated conversations, at least among some faculty and administrators, about high impact practices. More significantly, the Pennsylvania State System's 2010 policy revision gave high- and mid-level administrators an effective tool to place added pressure on faculty to align within-departmental activities with institution-level strategic goals and the state's goals.

Yet administrators interviewed also admitted that incentivizing faculty was a challenge. Administrators recognized that faculty members were overburdened and faced time constraints. For instance, Jamaad, a mid-level administrator, characterized this burden as "*people have limited bandwidth*"—faculty have limited time, resources, and energy to excel in all three required areas of teaching, research and service, much less respond to further demands from high-level administration. From the interviewees' perspective at one Pennsylvania institution though, providing small incentives in an environment of limited resources helped motivate faculty. Specifically, the president and provost at this campus prioritized expansion of online and hybrid courses (combination of online and in-class instruction) to first accommodate student schedules to support timely degree completion, and second, to keep pace with students' preferences for technology usage.

Betty, a Dean of Arts and Sciences who reported to the provost, engaged with faculty in her departments and presented recommendations based on scholarly research, which suggested

that technology enhances student learning. Betty created a seed grant program for faculty interested in crafting online or hybrid courses—an example of an internal campus policy tool to facilitate implementation of performance funding goals. Faculty applied for the seed grant, received a stipend to develop the course, and a stipend after teaching the course and writing a report. According to Betty:

“And then what happened was I got, actually, a large number of more senior faculty, which is a bit surprising. The junior faculty aren't afraid of technology. They grew up with it. They're like of course I'll do that. You don't have to pay me extra...The senior faculty...it's a bigger learning curve, and they're not necessarily sold on the idea. So the key was getting senior faculty who are well respected here to try it, find out that it's useful to students, and then show everybody else the way. And those are your peer changers. They change the culture.”

As illustrated, by offering a system of rewards at the faculty level as well as cultivating support amongst junior and senior faculty alike, Betty contributed to the institution's accomplishment of a strategic goal to deliver more online and hybrid courses—consistent with the performance metric. Ultimately, Betty's seed grant incentivized even “less technologically advanced” senior faculty to undertake the president's and provost's goals, effectively applying the policy tool of incentives within her college (Stone, 2012).

Policy Implementation via Data Analytics

While the previous two themes about policy design flaws and collective bargaining emerged solely from Pennsylvania, participants at all four institutions in both Pennsylvania and Ohio described using data analytics as one approach to implementing performance funding. Specifically, institutions incorporated, or strived to incorporate in the future, improved software

systems and data analytics to better track students' academic progress. This particular finding was informed by my interviews of faculty, staff, and mid-level administrators who had more frequent interactions with students. Data analytics required institutions to identify critical intervention points when students were likely to drop out (e.g. between first and second semester, after failing a course) in efforts to proactively reach out to students who might benefit from additional attention. Interviewees echoed a common thread—performance funding drew greater attention to student retention and completion, particularly for racial/ethnic minorities. Both the Pennsylvania and Ohio funding formulas have designated metrics for underrepresented student completion. Outlined earlier in this paper, the Pennsylvania formula defined minorities as African American and Hispanic/Latino and Ohio's formula defined minorities as African American, Hispanic/Latino, and Native American. Both states emphasized Pell-grant recipients and Ohio also allocated extra funding for completions by adult students (age 25 and older).

Aligned with state goals for added attention to underrepresented student retention, one institution in Ohio hired a new employee (Veora⁸) in institutional research to implement a centralized data system and conduct advanced predictive analytics based on student characteristics. While still at an early implementation stage, the institutional research office designated faculty and student success staff as target data users (examples of student success staff are academic advisors and financial aid counselors). Veora explained that the data system had three key components. The first was using data on student characteristics (e.g. high school GPA, race) to predict likelihood of course passage rates and retention. The second was a faculty alert system that tells faculty which students in their course are at greater risk of failing the

⁸ Veora had expertise in predictive analytics and previously worked at a different institution where she successfully implemented a centralized data system.

course. The third was faculty input—Veora explained that faculty would be asked to submit information into the data system about issues such as:

“Are you worried about the student's attendance? Are you worried about their low grades? Do you have any social/personal concerns with the student or the student's behavior?”

Once faculty submitted this information into the data system, student success staff would contact students at risk of withdrawing from or failing the class. This particular university in Ohio had ambitious plans to implement the centralized data analytics system, an impetus for Veora's newly created position. Yet, it remains to be seen how the institution will convince faculty to participate and how faculty will be incentivized to fill out data on each student they teach.

Relatedly, a Pennsylvania institution also strived to incorporate better data usage based on student characteristics. George was a new dean of a social sciences college. He described his desired approach to data usage as well as admitted he expected some faculty resistance:

“First, I want to really dig into the data that are available to everyone, including department chairs, related to recruitment, persistence, graduation rate, all of it. And we can drill down to the department level. So I can show them the data and I can say, here's what your numbers look like. You have 200 kids in the program, five of them are students of color. Are you happy about that?...I know that historically there have been pockets of resistance to the use of data. I don't need to use data to know that I'm doing a good job in the classroom. That's the sort of battle cry of that group.”

George expressed passion for recruiting and retaining underrepresented students and to enable his department chairs to pursue this goal, consistent with Pennsylvania's performance funding

goals and the purpose of the underrepresented student metrics. Yet despite acknowledging potential resistance, George presented no tangible plans on how to “really dig into the data” to inform within-college initiatives to retain students. Despite grand plans outlined by multiple high-level and mid-level administrators, particularly deans and institutional researchers, interviewees at all four institutions in Ohio and Pennsylvania offered few concrete strategies to incorporate better data usage among faculty.

The faculty I interviewed in Ohio and Pennsylvania expressed limited knowledge and time to add data analytics to their existing teaching and advising responsibilities. Instead, faculty relied on their own experiences to support students at risk of failing a course. For instance, an engineering department chair (Cathy) at an Ohio access institution utilized within-department data on course passage rates, observations of student struggles, and her own experience as a former student to inform the design of a retention program. Cathy created a peer-mentoring program to connect lower-division students with upper-division students. Here is a segment of our conversation:

Cathy: “...I have a call out [advertisement], right now in fact, for seniors who are willing or able, have the time, to [mentor in course X]. Then I give that list to the faculty member who's teaching it, and then they pick one or two [students].”

Amy: “Did these peer mentors get paid or compensated?”

Cathy: “Absolutely. We have decided that this is really important for retention and for success, and we actually pay for it out of our course fees. So the students, they can say, why do I have these course fees?...Well, here's why. Those course fees are being used to help you succeed... There's a lot of studies-- I don't want to emphasize just the females, because the females are so low in numbers in our department. But there's lots of studies

that say this type of peer interaction is highly conducive to retention for females, much more even than males, statistically.”

Cathy continued by describing her own experience as a female studying engineering in a male-dominated field, challenges she faced, and faculty and peer mentors who contributed to her success. In short, university-wide centralized data analytics did not prompt Cathy’s development of the peer mentor program, which rather was informed by within-departmental data on course passage rates, her personal experiences, and a passion for student success, all of which were not directly motivated by the Ohio performance funding policy. Regardless, high-level administrators interviewed applauded Cathy for her efforts, especially since these efforts aligned with the extra funding provided to course and degree completions in STEM.

Along with faculty, staff members interviewed also directly interacted with students in ways that could boost retention as well as connect students with campus support services. One university in Ohio responded to performance funding, combined with the university’s strategic goals, by offering targeted students more complete financial aid packages consisting of both need- and merit-based aid. The first goal was to recruit “better students”, which the campus determined using entering high school GPA’s and ACT scores. In addition to recruiting more academically prepared students, the university also tracked existing students to identify those at risk of dropping out. Rose, an interviewee who worked in financial aid, summarized a strategic process (that was corroborated by triangulation with a mid-level administrator’s interview):

“[If the enrolled student is] not up to par with their GPA for financial aid and academic progress, and they're not completing their courses, or one or the other—we have a partnership with our [university student success center] and their staff advisors where we will allow a student to receive their financial aid for one semester during that

probationary period... As long as the student agrees to work with an advisor through the center who will help them and monitor their academic progress throughout the semester. They will get them tutoring, they will talk with them about how their classes are going, they will have them sit in on study groups, etc.”

This example represents a strategy that campus interviewees in both Pennsylvania and Ohio discussed that is often called intrusive advising, a well-known retention strategy to connect a student with academic and support services when the student exhibits potential signs of dropping out. From the policymakers’ perspective, several interviewees at the Pennsylvania State System and the Ohio Department of Higher Education lauded the ongoing work of institutions across their system for using data analytics and intrusive advising to accomplish performance funding retention goals.

The Business of Higher Education

According to interviews of state policymakers and campus officials in Pennsylvania and Ohio, performance funding was a result of a necessity for public higher education to accommodate changing fiscal conditions and a more prominent policy emphasis on college completion. I termed the perspectives on these pressures the business of higher education, in which institutions approached students more as customers and engaged in strategic planning from a fiscal standpoint with an eye on the bottom line. As institutions received less funding from the state as a proportion of total funding, they increasingly relied on tuition dollars, student fees, and philanthropy. Institutions also paid more attention to the revenues generated from auxiliaries (self-sustaining campus services such as dorms and parking).

Perceptions of the business of higher education varied according to the role of the interviewee. Policymakers commended performance funding as the way to signal to campuses

the importance of delivering results and balancing budgets. Some high-level administrators portrayed students as consumers who paid for and expected delivery of a product or service, and they recognized the necessity of pursuing alternative sources of revenue. In contrast, mid-level administrators, faculty, and staff appeared to hold a more cynical view that performance funding perpetuated the notion of higher education as a business enterprise, at the detriment of focusing on serving the student.

When describing performance funding, policymakers and high-level administrators used terms such as “*paying dividends*”, “*generate higher profit margins*”, “*deploying funds elsewhere*”. Aaron, a Vice President of Student Affairs at a Pennsylvania campus provided two examples of what he termed “*enterprises*”, the first was his institution’s private foundation, and the second was a building project to construct new student dorms that will become self-sustaining. Enterprises such as these previously focused on covering their own operational costs, but now have been transformed to focus on generating new funds:

“But I think the ultimate goal was also that as some of those nonprofits turned a profit, that some of the proceeds would then go back to the university to help fund their budgets. A traditional model had always been: plow your profits back into the enterprise to keep the cost as low as possible for the next students. It's a little bit different today.”

Aaron recognized that “*profits*” earned by the institution could not all be funneled back to the institution in ways that kept student costs down, but rather must be more carefully divided to supplement the institution’s ability to prepare for potential future funding losses potentially incurred by even less state funding. Moreover, a president of a Pennsylvania institution (Barak) stated:

“So we have an economy of scale that allows us to generate a higher profit margin with additional student enrollees than most of the other institutions in the system. So our enrollment growth has helped make up the deficit between funds that we receive from the state, and tuition, and our cost, our mandatory cost increases.”

Similar to other high-level administrators interviewed, Aaron and Barak framed various campus strategies as needing to meet bottom lines, balance the budget, limit expenditures, and collect more revenues. These high-level administrators pinpointed students as a major source of revenue—a reality that would continue into the future.

Policymakers interviewed also framed campus strategies as following the money tied to performance funding. Ohio’s funding formula allocates extra funding for students who are on Pell-grants, age 25 or older, and/or who are underrepresented racial/ethnic minorities. Park, a policymaker in Ohio, openly admitted that if institutions were to study the funding formula, they could choose to enroll the *“most financially profitable student”* to complete courses and thus collect extra funding. In summary, policymakers and campus leaders recognized that in order to survive in an environment of increased oversight and decreasing or stagnant public funding, universities must adjust by finding alternative sources of money, treating student tuition and fees as strategic revenue generation, and engaging in recruitment and enrollment strategies that may result in extra funds calculated by the performance funding formula. Ira, a high-level administrator, bluntly stated:

“And I hate to tell people, but higher education is a business. We're \$120 million business on the E&G [Education and General funds] side, and another 40 million on the auxiliary. So it's \$160 million it takes to run this operation.”

On the other hand, there was some emerging evidence that faculty members and staff were more critical of the underlying logic of performance funding as paying for degrees and high-level administrators' viewpoints of students as "*cash cows*". In Ohio, a faculty member in education (Jesse) stated that to compete for funds in the performance funding pot of money, there had to be "*winners and losers*" among the institutions. Because of this competition surrounding performance funds, faculty members and staff perceived that high-level administrators were tempted to make decisions steered by the funding allocations to the potential detriment of the students' best interests.

Discussion

In this study, I highlight the perspectives of state policymakers and college administrators, faculty, and staff regarding the campus implementation phase of performance funding 2.0 policies at four institutions in two focal states. With respect to the first research question of how performance funding is expected to work, I find that delayed funding allocations in Pennsylvania's formula created challenges for institutions to budget for performance funds. Yet, findings also pinpoint increased alignment of policymaker and campus goals via the institution-designed, institution-specific performance metrics.

Regarding the second research question about policymaker responses to institutional feedback, policymakers in Pennsylvania did in fact engage in redesign and refinement of the funding formula, which was well-received by the campuses⁹. In response to my third research question on what is happening at the campus implementation phase, I find that campus interviewees in Pennsylvania and Ohio responded to performance funding by incorporating predictive analytics and centralized data systems to better track student progress. These actions

⁹ While not a focus of this study's analysis, the policy redesign process was evident in Ohio as well, to a lesser degree.

are particularly motivated by emphasis on underrepresented student retention in both states' funding formulas. Additionally because of Pennsylvania's unique collective bargaining environment, there is added need for special or more creative incentives to motivate faculty to pursue more institution-level strategic goals. Lastly, the mechanism of performance funding as paying for greater retention and completion contributes to evolving viewpoints consistent with a business-oriented approach to higher education, specifically among policymakers and high-level administrators.

Overall, findings from this study suggest that 4-year institutions in Pennsylvania and Ohio, despite facing challenges of greater accountability oversight and lesser state funding as a proportion of all funding, are indeed responsive to performance funding. The relationship is a two-way street because policymakers are receptive to institutional feedback and attuned to the interests of institutions, in concerted efforts to increase undergraduate completion. Performance funding is especially powerful as a vehicle for administrators to communicate with faculty and staff, via consistent policy signals, the urgent need to focus on completion numbers since budgets are dependent on such metrics.

In light of these findings, I first consider connections to the existing literature on performance funding policy implementation. My study finds that similar to research conducted by Dougherty et al. (2014b), the financial incentives component of performance funding policies is a key policy tool incorporated by state policymakers to target the behavior of institutions. My study expands on this financial incentive tool and indicates that within campuses, high-level and mid-level administrators apply similar incentives to motivate faculty in Pennsylvania. The necessity of inducements to ensure better compliance from faculty is an example of principal-agent relationships within campuses. In the performance funding formula, institutional

performance is measured at the campus level and to improve on overall performance metrics, administrators must cultivate a shared sense of responsibility among faculty and staff members. Consistent with earlier findings from Indiana, Ohio, and Tennessee (Dougherty et al., 2014), faculty in my study of Pennsylvania and Ohio were also charged with using centralized data systems that when fully implemented, send early warning alerts about students at risk of dropping out.

Yet, questions remain around how directly the performance funding policy motivates within-department activities among faculty, especially faculty who are more resistant to change. Moreover, numerous participants noted that faculty members are overburdened, similar to findings from Indiana and Tennessee on increased workload placed on faculty to pursue data-oriented activities (Lahr et al., 2014). My study also emphasizes that according to administrators, faculty can be especially resistant to oversight mechanisms driven by performance funding, which supports findings on 2-year colleges in Washington state (Li, 2016). Additional research is recommended to explore different incentives for faculty and staff, and further tie the connection between a macro-level external funding policy to micro-level, departmental activities.

Implications for Policy and Practice

This study's finding of campus intentions to use predictive analytics suggests that centralized data systems may take on a bigger role in the future, particularly to improve retention efforts for underrepresented students (racial/ethnic minorities, Pell-grant recipients, first generation, adult learners). Enhancements in technology and institutional commitment to making data-driven decisions are aligned with two critical goals of performance funding. The first is to increase access and within this goal, ensure that institutions are not penalized for enrolling underrepresented students who need more resources to graduate. The second is performance

funding's aim to promote better data usage among campuses. Institutional researchers and policymakers may wish to collaboratively consider how centralized data systems may be better utilized to predict individual student performance and then intervene as necessary.

This study contributes to the body of literature on performance funding policy impacts by highlighting the campus implementation phase in Pennsylvania, in which little qualitative research has previously been conducted. Because of Pennsylvania's unique collective bargaining structure and historically stagnant levels of state funding, institutions struggle to meet their bottom lines as well as re-allocate resources. Future research is recommended to determine how and if the performance funding policy should be fine-tuned to account for these challenges. Additionally, the policy redesign features in Pennsylvania are particularly encouraging for the future of performance funding to converge interests between states and campuses. Perhaps other states can look to Pennsylvania as a model to allow for design of institution-specific metrics.

Lastly, the concept of applying private sector incentives to public higher education deserves more scholarly attention. Presented in this study of Pennsylvania and Ohio, institutions are increasingly pressured and motivated to consider bottom lines, revenue generation strategies, and strategic recruitment of students in pursuit of tuition dollars. Considering that students and families are paying more for a college education, future research is recommended to better understand the positive and negative consequences of these business-like attitudes, which could affect the longevity and future expansion of performance funding policies for higher education.

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Appendix A

Interview Protocol for Policymakers, Staff, and Agency Officials

Thank you for agreeing to participate in this interview. Today we would like to talk to you about the [XYZ] performance funding initiative aimed at improving student outcomes through financial incentives. (Go over informed consent if participant has any questions)

We would like to interview you because we think you may be knowledgeable about the policy. I would like to accurately capture our discussion. Would it be all right with you if I audio record this conversation? (See informed consent)

Background Questions

- What is your role at this state agency [or the legislature]?
- What are your responsibilities as they relate to performance funding (if any)?
- What do you know about the [XYZ] performance funding policy?

Policy Design and Goals

- 1) *Why and how were the specific outcomes targeted by the PF policy chosen?*
 - a. To what extent were higher education representatives / college leaders involved in this and other aspects of the policy's design?
 - b. *Are there any signs that you can see of resistance to the policy or aspects of it from the institutions or groups within them?*
- 2) Please explain how outcomes and improvements in them are [or will be] measured and describe any challenges you see with measurement.
- 3) *What is the underlying "theory of action / change" behind the performance funding policy?*
 - a. What is expected to happen at colleges to improve student outcomes?
 - b. How can you attribute any changes on outcomes to the PF policy, as opposed to other initiatives or forces at work?
- 4) To what extent does the state/agency care about *how* institutions get results as long as they get them?
- 5) What do you know about the specific funding formula?
 - *How funding is calculated?*
 - For example, optional (college chosen) versus required metrics
 - Ask about STEM
 - Ask about traditionally underrepresented students
- 6) Do you think the details of the funding formula are well understood by colleges?

- 7) *Maybe: Do you have longitudinal, institution-specific data* comparing say enrollments, selectivity (entering ACT scores, acceptance rates), and graduation?

College Capacity

- 8) What resources have (or will) the state provide colleges to facilitate implementation of the policy (if any)?
- 9) Are data systems adequate for institutions to tell whether what they are doing to improve student outcomes is working?
- 10) Were any resources for training provided to college personnel? (This could include attending conferences or learning from other institutions)
- 11) Have institutions requested additional resources for personnel to address student outcomes (such as for retention specialists or counselors)?
- 12) Have institutions sought resources for research on how best to improve performance on the targeted student outcomes?

Implementation and Impact

- 13) How often do you check in with the institutions?
- 14) How much progress do you perceive in their taking of steps to improve performance on the targeted outcomes?
- a. *How even or uneven is progress across the institutions?*
 - b. *Any challenges faced that are specific to a particular type of institution?*
- 15) *What specific steps are the institutions taking?*
- 16) What do you learn from the reports of student outcomes provided by institutions?
- a. Have these reports led to any changes in the PF policy at the state level?
 - b. Do you see signs that results have modified what institutions are doing to implement the policy?
- 17) Do you or others at the state level explicitly compare institutions' performance or is each institution simply compared against its own past performance on the indicators?
- 18) *What are your views about the sustainability of this policy over time?*

Appendix B

Interview Protocol for University Administrators, Staff, and Faculty

Thank you for agreeing to participate in this interview. Today we would like to talk to you about the [XYZ] performance funding initiative aimed at improving student outcomes through financial incentives. (Go over informed consent if participant has any questions)

We would like to interview you because we think you may be knowledgeable about the policy. I would like to accurately capture our discussion. Would it be all right with you if I audio record this conversation? (see informed consent)

Background Questions

- What is your professional role at this college?
- What are your responsibilities as they relate to performance funding (if any)?

Knowledge and Perspectives

- 19) *What do you know about the [XYZ] performance funding policy?*
 - a. How is funding calculated?
 - b. What about optional versus required metrics?
- 20) *What are your reactions to and perspectives on the performance initiative?*
 - a. *Do you “buy into” the policy’s theory of action (i.e. using financial incentives to motivate improvement in student outcomes)?*
- 21) *How much do faculty / department chairs know about specific funding formula details, and do they even need to know?*

Institutional Capacity, Implementation and Impact

- 22) *Administrators: Who on campus is seen as responsible for improving student performance outcomes?*
 - a. Is there a person whose specific responsibility is oversight of campus response to the policy?
 - b. Do you have a campus-level coordinator who responds to state data requests about college performance?
- 23) *Is the necessary data capacity available for relevant actors to know in a timely way whether what they are doing is working to improve outcomes?*
- 24) *What kind of training (if any) is/was provided, if any, to help improve performance on the targeted dimensions at your college?*
- 25) *Any steps that have been taken specifically to improve the targeted outcomes? (e.g. personnel additions, training, travel)*
- 26) *How are units below the institutional level specifically incentivized to improve outcomes? Is any data collected at the unit level?*
- 27) *What happens when a department/unit is performing poorly?*

28) What actions have been taken on this campus to improve student outcomes? What actions have you or your unit taken in support of the broader campus strategy?

a. If Faculty:

- i. What actions have you taken through your teaching to improve student outcomes?
- ii. Has your unit revised its curriculum or course requirements?
- iii. Are there any changes in your expectations of students or grading criteria?
- iv. Have you treated your advising role any differently as a result of the performance funding policy?

29) What can department chairs do and what are their strategies with respect to the funding formula's incentives?

30) *How do you measure the connection between institutional actions and student outcomes?*

a. How do you know that what you are doing is successful?

31) Does the policy seem to be working as intended by the State?

32) Has the State system responded to any feedback from your institution?

33) *Are there any unanticipated outcomes of the policy?*

Concluding Remarks

- 1) Is there anything you would like to add?
- 2) Who else would you recommend I talk to?

Extra

- 3) If Yes in informed consent – May I follow up with you by phone or email if I need clarification on anything or have additional questions?
- 4) Would you like a copy of publications or reports from the study? How about a copy of the interview transcript?

In High Demand: Performance Funding Policy Impacts on STEM Degree Attainment

Amy Y. Li

University of Washington

Amy Y. Li, Educational Leadership, Policy, and Organizations, College of Education,
University of Washington. Contact: libutler@uw.edu

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Abstract

Performance funding policies allocate appropriations to public colleges based on student outcomes such as retention rates and degree completions. This study investigates whether a special STEM incentive in policies leads to greater undergraduate degree completions in STEM fields. Using panel data from 1995 to 2013, I apply difference-in-differences to analyze the policy impact. Results suggest that the STEM incentive did not lead to more degrees. Possible explanations for the null impact of the policy include unclear pathways between performance funding budget allocations and institutional actions that may improve student retention and completion in STEM fields, and challenges experienced by lower-resourced colleges serving a greater proportion of underrepresented students.

Keywords: performance funding; STEM; difference in differences; policy impact

In High Demand: Performance Funding Policy Impacts on STEM Degree Attainment

Introduction

Performance funding for higher education is a budgeting model that links state funding “directly and tightly to the performance of public campuses” on selected student outcomes (Burke & Minassians, 2004, p. 3). In an environment of decreased taxpayer revenue, increased public criticism of rising tuition costs, and mounting student debt, performance funding (PF) has become a prevalent policy tool intended to promote efficiency in public higher education and improve student retention and graduation (Dougherty & Natow, 2015; Li & Zumeta, 2015). As of July 2015, 32 states operate, are implementing, or plan to implement a performance funding policy (National Conference of State Legislatures, 2016). While performance funding began as early as 1979 in Tennessee (Banta, Rudolph, Dyke, & Fisher, 1996) and experienced phases of waxes and wanes in popularity (Dougherty & Reddy, 2013), the policy has gained substantial new traction in recent years. Moreover, performance funding enjoys the support of visible foundations such as the Bill and Melinda Gates Foundation and the Lumina Foundation, as well as prominent state organizations including the National Conference of State Legislatures (Lumina Foundation, 2015; National Conference of State Legislatures, 2016).

The Obama administration’s call for more college graduates, particularly in the STEM fields, has further fueled performance funding’s policy renaissance. The National Science Foundation defines STEM as science, technology, education, and mathematics (National Science Foundation, 2016). NSF has consistently emphasized the importance of STEM fields in higher education to prepare graduates with advanced skills necessary for an increasingly competitive workforce (National Science Board, 2016). In response to a shortage of STEM graduates,

particularly among underrepresented racial/ethnic groups and among females (Wang, 2015), several states now incorporate an added financial incentive for degree completions in STEM (National Conference of State Legislatures, 2016; Snyder & Fox, 2016). Yet, no research thus far has tested the impact of performance funding specifically on STEM outcomes. Recent national studies investigating the impact of performance funding on retention rates and degree completions on all academic disciplines combined have found mixed evidence of the policy's impact (Hillman, Tandberg, & Gross, 2014; Rutherford & Rabovsky, 2014; Tandberg & Hillman, 2014). However, a performance metric targeted specifically at STEM is a clear policy signal for institutions to direct attention to such fields and may stimulate strategic efforts to graduate more STEM students.

Therefore, the present study examines whether the prioritization of STEM fields within a performance funding policy increases STEM degrees. Facilitating undergraduate retention and completion in STEM fields will prepare graduates for high-demand, highly paid jobs, and fulfill a critical workforce need for national innovation and competitiveness, according to the National Science Board (2015). This study investigates whether state performance funding contributes to these goals by addressing the following research questions:

- 1) Do performance funding policies with a special STEM incentive impact STEM degree completions at public 4-year institutions?
- 2) How long does it take for impacts to be seen, if any?

This paper first reviews literature on STEM attainment in higher education as well as performance funding nationally, including examples of state policies with special STEM

incentives. Subsequently I describe the research design, which incorporates data from the Integrated Postsecondary Education Data System (IPEDS), and explain the difference-in-differences method to analyze STEM degree completions. I then presents results from the analyses and conclude with a discussion that suggests implications for policy.

Literature Review

The prioritization of STEM fields in performance funding policies is a relatively new phenomenon, although on a macro-level there are strong forces behind the impetus for STEM achievement in higher education. I incorporate the National Science Foundation's (NSF) definition for STEM as covering the following broad academic disciplines: biological sciences, chemistry, computer science, engineering, geological sciences, mathematics, physics, and astronomy (National Science Foundation, 2016). The urgency behind a national commitment to STEM in particular seeks to prepare more students and workers who will increase the United States' status as a global economic leader in an era when technology-based products and services are seen as key to growth and prosperity (U.S. Department of Education, 2015). While in 2010, the U.S. awarded only 15.6% of all bachelor's degrees in STEM, China awarded 46.7%, South Korea awarded 37.8%, and Germany awarded 28.1% (BHEF, 2010, p. 4). In short, greater STEM degree attainment is seen as necessary to boost the United States' ability to compete in an increasingly globalized marketplace.

As a result, the Obama administration has initiated multiple programs to increase STEM achievement across the P-20 pipeline, via strategies to prepare more STEM teachers and generate more interest among high schoolers to pursue STEM fields in college. Initiatives also aim to cultivate STEM interest and preparation among young girls and students from underrepresented racial and ethnic groups in order to reduce achievement gaps and enhance the STEM talent pool.

The Obama administration also partners with philanthropic foundations and the private sector to nurture underutilized sources of talent among college STEM graduates (The White House Office of the Press Secretary, 2015).

Another driving force behind STEM education initiatives is the benefits expected for college graduates themselves. According to the U.S. Department of Commerce, STEM bachelor's degree holders earn approximately 26.7% more per hour than non-STEM degree holders (Langdon, Beede, & Doms, 2011). Unemployment rates for college graduates in STEM are lower than for the college-educated labor force as a whole (National Science Board, 2016). These data have stimulated strong interest among policymakers to utilize public institutions as vehicles to train more STEM workers. More college graduates in STEM is proposed to drive innovation, competitiveness, and new technologies that can lead to economic benefits—both societal and individual (Langdon et al., 2011; Wang & Wickersham, 2013).

Barriers to STEM Degree Attainment

However, there exists a leaky pipeline for STEM fields within higher education. Only 40% of students who enter college with an intent to major in a STEM field ultimately complete a STEM degree (Fry, 2014). After the first year, 35% of STEM majors switch to a different major. Oftentimes, students leave STEM after taking an introductory math, science, or engineering course because these prerequisite courses are challenging, frequently taught in large sections, and have highly competitive grading criteria. Furthermore, educational attainment gaps in STEM persist across racial groups. Participation and attainment rates for African American and Hispanic/Latino students continue to lag behind those of Whites and Asian Americans (Anderson & Kim, 2006; Wang & Wickersham, 2013). Notably, these underrepresented students enter 4-year institutions with intentions to major in STEM at similar rates compared to White and Asian

American students, yet tend to leave STEM fields in the latter two years of college, suggesting that they were academically prepared to and successfully completed the “weed out” courses.

Anderson and Kim (2006) proposed that underrepresented students were instead leaving due to campus climate issues or lack of financial and social support.

Additionally, a gender gap exists in STEM education and particularly for women of color (Espinosa, 2011). Even though women on average earn higher GPAs than their male counterparts in STEM majors, women still graduate at lower rates (Gayles & Ampaw, 2014). Women face negative experiences such as a chilly, male-dominated classroom climate and have fewer faculty mentors because gender gaps persist into the professoriate (Jackson, Starobin, & Laanan, 2013; Wang, 2013; Xu, 2008). Women who were initially drawn to STEM fields might decide to select a different major upon matriculation, choose to switch to a different major even after starting coursework towards earning a STEM degree, or may finish a degree in STEM but choose to work in a different career field (Gayles & Ampaw, 2014).

In summary, the leaky pipeline phenomenon refers to several critical junctures students face on the pathway to earning a degree in STEM and securing employment in STEM. Consequently, there is a pressing need for colleges to better support, retain, and graduate more students in STEM fields, especially for subgroups with lower retention and completion rates. Catalyzed in part by a national priority for STEM education, states have pursued performance funding as one means to achieve this goal.

States and Performance Funding Policies

Performance funding is a state policy that emerged in part from the national commitment to and advocacy for more STEM graduates. Defined earlier, performance funding utilizes a funding formula that allocates some portion of state appropriations to colleges based on student

outcomes, and has evolved in some states to emphasize STEM attainment (Burke & Minassians, 2004; Dougherty & Reddy, 2013). Among the 32 states that operate or are developing a performance-based funding formula, 26 states operate policies for the 4-year sector (National Conference of State Legislatures, 2016). Performance funding (PF) differs from historical funding models for higher education, which, for example, typically allocated funds for course enrollments rather than completions (Burke, 2002). States vary in their policy designs on factors such as the percentage of total appropriations allocated based on outcomes, the sectors and systems affected, and the specific outcomes rewarded—outcomes are also known as performance metrics or performance measures (Li, 2014). Nevertheless, in the 4-year sector, degree outcomes, whether measured using total degrees awarded, degrees per FTE, and/or graduation rates are universally incentivized in performance funding formulas.

The purpose of a STEM incentive within a general performance funding policy is to further reward colleges for graduating students in such high-demand fields. In 2005, Kansas was the first state to adopt a performance funding STEM incentive—funding STEM degrees as a separate metric in addition to a metric for degrees in all fields. Since Kansas, 12 other states have adopted a new performance funding policy that includes a STEM incentive or added a STEM incentive to an existing policy: Arizona, Arkansas, Illinois, Indiana, Kansas, Maine, Michigan, Minnesota, Mississippi, Nevada, New Mexico, Ohio, and Pennsylvania (Cavanaugh & Garland, 2012; Florida Board of Governors, 2014; National Conference of State Legislatures, 2015, 2016). Table 1 displays the year that each state began a STEM performance funding metric.

[Insert Table 1: STEM Metric in State Performance Funding Policy]

In these 13 state performance funding policies, bachelor's degrees completed in STEM majors are funded as a separate metric or weighted more heavily than degrees in other fields such as humanities or social sciences (Davies, 2014). In this study, I use the terms STEM incentive and STEM metric interchangeably. States provide bonus funding in STEM fields because the cost of instruction in many STEM fields tends to be higher—composed of higher costs for labs, equipment, and faculty salaries. If state funding is enrollment-based or otherwise undifferentiated by field, it does not cover the extra costs of STEM instruction and much less encourages expanding undergraduate education in such courses. The second purpose of a special STEM incentive, and the focus of this study, is to encourage institutions to recruit and retain more students in these disciplines by placing a higher premium on STEM fields versus non-STEM fields. For example in the Ohio performance funding formula calculation, STEM weighting is applied at both the course and degree level which “provides additional funding to these higher cost degrees and provides incentives to complete student in the STEM fields” (Ohio Board of Regents, 2014, p. 5).

Another example is the Pennsylvania State System of Higher Education, which implemented a performance funding policy in 2002 for all 14 universities in the system (Cavanaugh & Garland, 2012). In 2010, the system's Board of Governors and the Council of Presidents revised the funding formula so that starting in FY 2012-13, universities could also select from a set of optional metrics, one being the number of degree completions in STEM, including health fields. Pennsylvania's example illustrates a choice I made in this paper to consider the year of policy adoption as the first year colleges are subject to the policy (i.e. year of legislation or passage through a governing body overseeing higher education). This is because performance funding provides not only a financial incentive, but is also a signaling tool; the

adoption of a STEM metric signals to colleges and to the public that the state invests in education in these particular subfields (Stone, 2012). Even before institutions experience tangible financial consequences for failing to increase STEM degrees (or rewards for improving STEM completions), planning for these future rewards and consequences of the new policy can motivate institutional level changes, known as anticipatory changes (Husig & Mann, 2010). Anticipatory changes occur when organizations “take action as soon as new ideas can be implemented or are responsive to trends that are assumed or expected to emerge” (ibid, p. 182). On the other hand, institutions may wait to respond to the policy after the financial consequences are salient. Therefore in the analysis, I consider an alternative institutional response where the STEM incentive produces lagged impacts on degree outcomes.

The financial incentive and signaling policy tool behind the STEM performance funding metric can be conceptualized using principal-agent theory. According to this framework, principals and agents enter into an informal contract in which the principal provides resources to the agent and the agent acts on behalf of the principal to advance the principal’s agenda (Kivistö, 2008). However, principals and agents often have different agendas and the principal cannot fully monitor the agent’s activities, and therefore, principals design structures to better align interests with the agent and ensure delivery of goals (Holmstrom, 1979). Applied to performance funding, the state acts as the principal and public institutions within the state act as the agents. The state allocates institutions funding based on degrees completed and offers a higher incentive for STEM degrees as a way to align institutional actions with state goals.

Research Design

Data

To address this study’s research questions of whether state performance funding policies

with a special STEM incentive impact STEM degree completions, and how long it takes for potential impacts to emerge, I built a panel dataset with outcome and predictor variables measured for the same institutions across years 1995 to 2013. This time period covers the years during which a majority of performance funding policy adoptions for 4-year colleges took place. I gathered data on states operating performance funding from two sources: Tandberg and Hillman (2014) for years 1995 to 2009, and Dougherty and Natow (2015) for years 2010 to 2013. These authors examined numerous policy documents and peer-reviewed articles in establishing the start-years of each state's policy, so I relied on their master data. Displayed earlier in Table 1, I added data for the state policies that incorporated a STEM-specific metric using the latest information from the National Conference of State Legislatures and from policy reports, legislative statutes, and websites of higher education boards (Cavanaugh & Garland, 2012; Davies, 2014; Friedel, Thornton, D'Amico, & Katsinas, 2013; HCM Strategists, 2011, 2012; Indiana Commission for Higher Education, 2013; National Conference of State Legislatures, 2016; Snyder, 2014).

I considered the first year of policy operation to be the year when legislation was passed, or when a university system first approved the STEM metric. Funding typically gets allocated in the following fiscal year. As introduced in the literature review, the passage of a STEM metric sends a signal to institutions that their future budgets will be affected by degree completions in STEM fields. Therefore, to account for these anticipatory effects (Angrist & Pischke, 2009), I chose the adoption year to represent the first year of the policy. Performance funding policies often take several years to develop and design, via discussions among multiple stakeholders such as the higher education governing board or coordinating board, the institutions affected, the legislators, and are sometimes informed by studies of other state's models (HCM Strategists,

2011, 2012). Additional time is necessary for the legislature or higher education system to then approve the proposed policy before funding allocations are made. Therefore, institutions could start changing behaviors to prepare for upcoming allocations to be made based on STEM degrees.

The presence of a STEM performance metric—the policy treatment variable—exists at the state level and performance funding incentivizes outcomes at the institution level, nested within states. The unit of analysis in this study is institution-year and an institution is subject to the policy during the years when a STEM performance metric was in place, starting with the adoption year. I coded this variable at the state level if all 4-year colleges were subject to the policy, and coded it at the system level if the policy only applied to a subset of 4-year colleges¹.

STEM policy treatment variable. I explored three versions of the STEM performance funding policy treatment. The first was a binary variable equal to 1 for each institution subject to the policy in that specific year, which assumes that degree outcomes change once the policy begins and stay constant at this new level after the initial change. I also analyzed this variable using 1-year, 2-year, and 3-year lags. Next, I interacted this binary variable with the number of years the policy has been in place (coding becomes 1 for the adoption year, 2 for the first operating year, and so forth), which assumes a linear trend in changes to STEM degree completions post-policy. In other words, the policy incentivized a steady growth in STEM degrees that continues across each year the policy existed. This coding scheme also allows a positive policy effect to emerge in years after the adoption year without the policy having an immediate effect. Third, I relaxed this linear trend assumption using a policy year dummy that

¹ In Pennsylvania, only the 14 state-controlled institutions in the Pennsylvania State System of Higher Education (PASSHE) are subject to performance funding. Minnesota is similar in that not all 4-year institutions are subject to performance funding but rather only the University of Minnesota System institutions. Four-year institutions outside these two states' systems are coded in my dataset as non-STEM (National Conference of State Legislatures, 2016).

estimates a separate coefficient for each year the policy existed (again inclusive of the adoption year), representing years 1 through 9 (nine being the longest the policy has existed in a state: Kansas started in 2005 and thus in 2013 the year dummy for the variable “9 years” equals 1). This third model allowed for the possibility that as institutions adjusted to the new policy, STEM degrees may have increased in one year yet decreased in the next, which could also signal inherent noise in the data.

Outcome variable. To generate the outcome variable (STEM bachelor’s degrees completed at each institution in each year), I added degree data for the same years, 1995 to 2013, from the U.S. Department of Education’s Integrated Postsecondary Education Data System (IPEDS), downloaded via WebCASPAR. IPEDS collects institution-level data on degree completions, graduation rates, enrollments, student characteristics, tuition, and other factors. To be included in my dataset, institutions were filtered according to the following criteria. Institutions must have had a “public” control designation (public college, not private) and specifically “public, 4-year or above”, with a 2010 Basic Carnegie classification of “Baccalaureate college” or above (i.e. excludes “Associate’s college” and “Baccalaureate/Associate’s college”). Degree completions at the level of “bachelor’s degree” were counted. Using the IPEDS “academic discipline, broad” filter, degrees from the following fields were defined in my dataset as STEM: engineering, physical sciences, geosciences, math and computer sciences, life sciences, and science and engineering technologies. The final dataset consisted of 486 public, bachelor’s granting institutions across years 1995 to 2013 in all 50 states for a sample size of 9037 institution-years.

To address the skewness in the distribution of total STEM degrees across institutions caused by large states such as California and Texas that have higher college enrollments overall,

I logged the outcome. Figure 1 displays changes across 1995 to 2013 in logged STEM degrees by state (degrees at the institution level are summed at the state level, then logged). The shaded blue areas represent operating years of a performance funding policy, with or without a STEM metric. Simply for visualization purposes, for states that discontinued an earlier performance funding policy, I graphed the latest stint of the policy since it captures the phase when states began to incorporate the STEM metric. The red dashed lines show the year that a state's STEM metric began, consistent with the years displayed in Table 1. Note that Indiana and Pennsylvania began the STEM incentive after previously implementing a general performance funding policy.

As seen descriptively, there is a national, gradual, upward trend in STEM degrees in many states. Some of the growth in STEM degrees is likely attributed to overall enrollment growth and therefore I controlled for enrollment numbers in the analytical model, presented in the Methods section². In Figure 1, we can see that in some states such as Indiana and Ohio, there is a gradual upward trend in STEM degrees before the policy, and a steeper incline in years after the policy. However, in New Mexico, the pre-policy and post-policy periods show similar, rather stagnant STEM degree completion numbers. Furthermore in Arizona, a clear upward trend in STEM degrees that began in about 2007, the pre-policy period, continues rising at the same pace in the post-policy period starting in 2012.

[Insert Figure 1]

² As an alternative outcome, I examined STEM BA degrees as a proportion of all BA degrees. This outcome variable is intended to capture whether over time, institutions shifted focus from non-STEM fields into STEM fields. Figure 2 in the Appendix shows STEM BA degrees as a proportion of all degrees in states across years 1995 to 2013. The shaded green areas represent years of a performance funding policy, with or without a STEM metric while the red dashed lines show the year that a state's STEM metric began. As seen, STEM BA degrees as a proportion of all BA degrees grew in some states across years and declined in other states. Because this alternative outcome does not meet the common trends assumption in the difference-in-differences analyses described in the Methods section, I do not present results.

Method

As described, my dataset includes institutions that were affected by the STEM policy metric and institutions that were not, as well as year-to-year changes in the STEM degree outcome pre- and post-policy. If the STEM policy incentive increased degree completions in these fields, institutions subject to the incentive (the treatment group) would be expected to produce significantly more STEM degrees *after* the policy was put in place, compared to *before*, after accounting for other influences on STEM completions. However, it is impossible to observe the counterfactual—what *would have* happened with STEM completions at institutions subject to the policy had they *not* been. Since the dataset also consisted of institutions *never* subject to a STEM incentive (the comparison group), yet were exposed to the same unobserved yearly state-level time trends, we can compare changes in STEM degrees across treatment and comparison groups, before and after the policy, to test the policy effect.

I applied a difference-in-differences approach to test the effect of the STEM policy incentive. Difference-in-differences is a quasi-experimental design in a regression framework that estimates the aggregate policy treatment effect by calculating two differences. The first is the difference between the pre- and post- levels of the outcome, for both treatment and comparison groups. The second is the difference between these two differences, or the difference-in-differences (Angrist & Pischke, 2009; Lechner, 2010).

The formal model:

$$y_{ist} = \alpha + \delta (STEM)_{st} + \gamma_s + \eta_t + \beta_1 X_{st} + \beta_2 X_{ist} + \varepsilon_{ist} \quad (1)$$

where y is logged STEM bachelor's degrees for institution i in state s in year t , α is the

intercept, and *STEM* is the policy treatment variable. δ is the estimated policy effect, equivalent to the difference-in-differences estimate of the causal effect of the STEM policy on STEM degrees, conditional on covariates. The variable γ_s represents state fixed effects and η_t represents year fixed effects. State fixed effects control for time-invariant characteristics within states that affect all institutions nested in the state, such as changing population demographics. Year fixed effects account for any national trends that affect both policy and non-policy states, such as the growth of online degree programs or macroeconomic conditions. Adding two-way fixed effects is especially useful for panel data to control for unobserved factors that may be correlated with variables in the model (Wooldridge, 2010). X_{st} and X_{ist} are vectors of time-varying state- and institution-level control variables, respectively, and lastly, ε_{ist} is the error term (Angrist & Pischke, 2009). I estimated models using robust standard errors clustered on institutions to address potential serial correlation of the outcome across time (Bertrand, Duflo, & Mullainathan, 2004).

Next, the common trends assumption in the difference-in-differences approach states that if the treated group had not been subject to the treatment, both treated and comparison groups would have experienced the same time trends, conditional on control variables (Lechner, 2010). As described earlier, institutions within states that were not subject to any performance funding STEM incentive in that particular year formed the first comparison group. To assess the common trends assumption, in years before any STEM incentive was put in place, I visually inspected the levels of logged STEM degrees in Figure 1. In years before the policy treatment, the slopes of this outcome for STEM performance funding states appear comparable to non-STEM performance funding states—the first comparison group that includes states that *never* adopted performance funding as well as states that operated a performance funding policy without a

STEM component. Specifically, total logged STEM degrees appear generally flat across the majority of states in years 1995 to about 2000. Then we see a slight upward trend from 2000 to 2005 that rises more sharply in some states around year 2010 and later. The second comparison group consists of states subject to a general performance funding policy but not a specific STEM incentive. In the analyses I detail next, I compared year-to-year changes in STEM degrees at institutions within states that operated a STEM performance metric at any point in the dataset with the same outcome among the two non-treated comparison groups.

Noted in equation 1, in the difference-in-differences design, I also included a series of time-varying institution- and state-level controls to account for exogenous variables that could confound the policy effect. Introduced in the literature review, previous research suggests that degree completions and STEM degrees in particular are influenced by student demographics and institutional characteristics, which affects the institution's ability to respond to the STEM incentive. Specifically, student characteristics that affect 4-year degree completion include race and ethnicity, gender, and enrollment intensity of the student, meaning part-time versus full-time enrollment (Gayles & Ampaw, 2014; Pike & Graunke, 2014; Pike, 2013; Titus, 2006, 2009). Institutional characteristics that relate to degree completion include state-need based aid provided to the institution's students, state appropriations for higher education to the institution, tuition and fees, and institutional enrollment size (Pike & Graunke, 2014; Pike, 2013; Titus, 2006, 2009). Therefore, I added the following institution-level controls for each year: percent of total enrolled undergraduate students from underrepresented racial groups (African American, Hispanic/Latino, and American Indian/Alaska Native), percent of undergraduates who are female, percent part-time undergraduates, undergraduate resident tuition and required fees, total state grant aid per student at all degree levels (logged), total state appropriations per student at all

degree levels, and total undergraduate enrollment (logged). Mentioned in the Data section, total undergraduate enrollment was included to control for degree increases driven primarily by enrollment growth.

Moreover, I included each institution's Carnegie classification to control for institutional mission, which has been shown to be associated with retention and completion and thus may be related to how responsive an institution could be to a STEM degree incentive and its focus on undergraduate versus graduate education (Pike, 2013; Rutherford & Rabovsky, 2014). Carnegie classification also represents resources available because mission is connected to the expenditures institutions are able to provide for instruction, academic support, and student services, all of which contribute to retention (Powell, Gilleland, & Pearson, 2012). In addition, Carnegie classification affects the probability of degree completion in STEM fields at 4-year colleges (Gayles & Ampaw, 2014). The differential opportunities provided to students to engage in STEM-related research at baccalaureate colleges compared to research universities might also affect student interest in pursuing STEM degrees. Thus, my models incorporated a discrete variable for each of the five Basic Carnegie classifications: baccalaureate colleges as the baseline category, master's comprehensive, doctoral/research university, research university with high research activity, and research university with very high research activity. Lastly, because state economic conditions affect support for higher education and also relates to institutions' ability to respond to external policies, I controlled for state income per capita and unemployment rate (Rutherford & Rabovsky, 2014). These economic characteristics help capture differences across states, recession years, and further control for exogenous shocks that may affect degree completions. Table 2 displays data sources for this study and Table 3 displays summary statistics of all variables. Financial variables were CPI-adjusted to 2013 dollars.

[Insert Table 2: Data Sources]

[Insert Table 3: Summary Statistics]

Limitations

I note three limitations of this study before describing results. First was the short time frame that the STEM performance metric has been in place in many states, shown previously in Table 1 and Figure 1. To preserve sample size, I included these states in the dataset.

Baccalaureate-granting institutions likely require at least four years after the introduction of the incentive policy before degree effects would logically appear because institutions require time to understand and respond to a new funding formula. Among institutions that enroll high proportions of part-time and less academically prepared students, improving degree completions can take even longer. Thus, institutions may require more years than what was feasible in the dataset to incorporate changes in academic and student support activities that will ultimately retain and graduate more students in STEM. Future research would benefit from additional years of data to determine, within states that have more recently adopted the policy, whether the STEM metric is in fact producing, or failing to produce, more graduates.

Second, omitted variable bias is a limitation in studies that aim to isolate a policy treatment effect, and adding more control variables in my analyses may have provided further precision in capturing such an effect. Nevertheless, I did incorporate a robust series of control variables deemed relevant by the literature, as well as state and year fixed effects to ensure that my analyses was able to capture an effect of the STEM performance metric to the extent possible (Lechner, 2010).

Results

I begin by discussing results from the model incorporating the binary policy variable, which estimates an average treatment effect across all institution-years of the performance funding STEM metric on the outcome of logged STEM degrees. Next, I present the second policy treatment interaction that assumes a linear change in degrees from year-to-year, starting with the adoption year. Finally, I present results from the third model that allows STEM degrees to increase or decrease from one year to the next. In each of the three reported estimates in Tables 4, 5, and 6, respectively, I compared the treatment group of institutions subject to the STEM metric to two comparison groups. The comparison group in Column 1 consists of all institutions *not* subject to a STEM metric, which includes institutions in performance funding states *without* a STEM metric. Column 2 shows estimates for the treated group versus the second comparison group—institutions in performance funding states *not* subject to a STEM metric.

Regression estimates in Table 4 show the average impact of the STEM performance funding metric on STEM degrees using the binary policy variable specification. Results suggest that no significant differences exist between institutions subject to the STEM metric versus those that are not, and this applies for both comparison groups³. As seen, some of the control variables are significant and I discuss these in greater detail later in this Results section. In an alternative specification, I analyzed 1-year, 2-year, and 3-year lags of the STEM binary policy variable to determine whether policy impacts emerged in future years as institutions became more familiar with the policy. Consistent with results reported in Table 4, the STEM performance metric did not have an effect on STEM degrees even up to three years after policy adoption (results not

³ I began the modeling procedure by analyzing logged STEM degrees using the STEM binary policy variable with no state or year fixed effects. Results pointed to a positive effect of the STEM incentive. After adding state and year fixed effects, the policy effect disappeared. I then added sets of the control variables, all models of which generated results consistent with the models reported.

reported⁴).

[Insert Table 4: Impact of STEM Policy (Binary Variable) on Logged STEM BA Degrees]

Next, in Table 5, I compared the treated institutions subject to the STEM performance metric with the same two comparison groups, but the policy treatment here was an interaction term defined as the number of years each institution was subject to the STEM metric. Similar to estimates in Table 4, we see no difference between institutions subject to the STEM metric and institutions that were not. If these results *were* significant, the coefficient would be interpreted as the change in logged STEM degrees as a year-to-year linear trend representing an annual treatment effect in the years the policy existed.

[Insert Table 5: Impact of STEM Policy*Year Interaction on Logged STEM BA Degrees]

In contrast to the model reported in Table 5, the model reported in Table 6 allowed the direction of the impact of the STEM metric to vary from year-to-year. That is, institutions subject to the STEM metric could experience growth in degrees in one year while experiencing declines in the next, and the model could capture potential inherent noise in year-to-year degree changes as institutions adjusted to the policy. In Table 6, I display separate estimated coefficients for each year of the STEM policy treatment, with the first year being the policy adoption year. For sake of space, I exclude estimates of the control variables, which are in the same directions and significance levels as those reported in Tables 4 and 5. Similar to the previously described results, there were no measurable differences in STEM degrees regardless of whether an

⁴ Contact author if interested in results from the lagged policy binary variables.

institution was subject to a STEM metric in a performance funding policy.

[Insert Table 6: Impact of STEM Policy (Each Year of Policy) on Logged STEM BA Degrees]

Carnegie classification and institutional mission. The uniformly null results for the impact of performance funding STEM incentives deserve additional exploration and thus I conducted a secondary analysis. Results from the three models reported in Tables 4, 5, and 6 indicate that institutional mission was significantly related to STEM degree completions. Across all years, institutions with a Carnegie classification of master's comprehensive, doctoral/research, research university with high research activity, and research university with very high research activity all graduated more STEM students compared to the baseline category of baccalaureate college. These findings are conceptually logical given a greater emphasis on the liberal arts disciplines at baccalaureate colleges (i.e. more non-STEM disciplines) versus at research-intensive universities. However, even after controlling for Carnegie classification, the performance funding STEM incentive did not appear to impact degree completions. Therefore as a secondary analysis, I subset the data and applied the same difference-in-differences technique to model the STEM treatment variable on the outcome, *within* each Carnegie classification. To preserve sample size in each category, I combined the two research university classifications (very high research activity, high research activity) into one group.

Estimates analyzing STEM degree completions within each of the four Carnegie classification groups confirmed the earlier results that the STEM incentive had no impact on STEM degree completions (table of results not reported for sake of space⁵). When compared to institutions with similar missions, after controlling for student characteristics, institutional

⁵ Contact author if interested in results from the Carnegie classification analyses.

characteristics, year-specific trends, and state-specific characteristics, the STEM metric in performance policies still did not incentivize greater STEM degree completion. Across all models tested, results suggest that the STEM metric did not achieve its goal of increasing the number of undergraduate degrees in STEM fields at public, 4-year institutions in the sample.

Control variables. I return to results from the primary analyses reported in Tables 4, 5, and 6 and discuss estimates of various institution-level control variables, including those that are consistent with prior research. Percent of female undergraduate enrollment was negatively related to STEM bachelors' degrees, that is, institutions serving higher proportions of female students awarded fewer degrees in the STEM fields, which is consistent with previous studies such as Wang (2013). As expected, enrollment intensity was also related to completion with more part-time students associated with fewer STEM degrees awarded. An institution's undergraduate enrollment of underrepresented students (African American, Hispanic/Latino, and American Indian/Alaska Native) was surprisingly unrelated to STEM degree awards, although these results should be taken with caution because the point estimates are small.

With respect to undergraduate tuition and fees, results across the three variables representing the policy treatment suggested that for every \$1000 increase in tuition, an institution saw an increase in STEM degrees by 0.052 ($p < .001$). Placed in context, a 5.3% ($\exp(0.052) = 1.053$) increase in degrees at the average institution in an average year is equivalent to approximately 24 to 25 STEM BA degrees ($464.77 * 1.053$), keeping in mind that there exists wide variation in the number of STEM degrees awarded across institutions ($SD = 536.19$, refer to summary statistics in Table 3). The relationship between tuition and degrees indicates that factors related to institutional characteristics beyond what is captured by the Carnegie classification variables, which already captures differences in tuition levels, may have influenced

STEM degree completions.

Discussion

In an environment of resource scarcity, increased accountability pressures, and a national college completion agenda, performance funding has become a widespread higher education policy aimed at improving student retention and completion at public institutions. Applying the private sector logic of paying for desired results, performance funding utilizes the policy tool of incentives and pays institutions more for graduating more students. Given national emphasis on fostering educational attainment in STEM fields to increase graduates' labor market opportunities and contribute to global economic competitiveness, some states incorporate extra financial incentives or a separate performance metric for STEM degrees to direct institutions' attention to these high demand fields.

This study builds on the growing body of literature on the effectiveness of performance funding incentives targeted at 4-year institutions (Rutherford & Rabovsky, 2014; Tandberg & Hillman, 2014), defined as the degree to which the policy improved targeted outcomes beyond what would have happened in the absence of the policy. I specifically explore the impact of the STEM incentive embedded in 13 states' performance funding policies across years 1995 to 2013. Results from the difference-in-differences analyses consistently indicate that the STEM incentive does not improve degree completion. That is, had institutions *not* been subject to the STEM metric, they still would have produced the same number of STEM bachelors' degrees.

At the same time, null results do not necessarily mean that the STEM performance metric is ineffective. If in the short term the STEM metric does not produce more degrees, there still exists a possibility that it will produce more degrees in the longer term. For instance, Kansas has operated the policy for 9 years and New Mexico for 7 years, but the other 11 states in my dataset

have operated the policy for 5 years or less (includes adoption year, refer to Table 1). Degree increases within these time frames would imply that at institutions subject to the STEM metric, more students who were already declared majors graduated in STEM; undeclared students declared STEM majors and graduated; and/or new incoming students graduated in STEM. My study suggests that within these time frames and up to three years post-policy adoption, institutions on average did not increase STEM undergraduate degree attainment. However, future analyses could examine longer time periods as data becomes available to see if institutions simply require more time to recruit, retain, and graduate new cohorts of STEM students. Another possibility is examining major declarations in STEM as an intermediate measure of growing interest and retention in STEM fields. In the following paragraphs I explore implications of this study, offer tentative policy recommendations, and suggest avenues for future research.

Beyond the short time most STEM incentives have been in place, there are several other possible explanations for the apparent short-term ineffectiveness of performance funding STEM incentives in accomplishing their goal. First, there exists an unclear pathway between performance funding budget allocations and institutional actions. Multiple stakeholders including campus officials and external policymakers can create complexity in how the STEM incentive motivates behaviors among faculty and staff who can contribute to student retention.

Specifically, there exists possible misalignment between the strategies institutions employ to create campus environments that support retention in STEM and annual performance measured by the state funding formula. While the policy draws macro-level attention to degree completion priorities, institutions bear the burden of addressing micro-level conditions. Addressing micro-level barriers within departments, within classrooms, among students, and among faculty require time for implementation, and yield less quantifiable results that the

funding formula does not recognize or reward. One example is commitment from high-level administrators to evaluate potential challenges and discover opportunities in existing STEM programs to support retention (e.g. assessing pedagogical practices, developing new programs to connect undergraduates with faculty research). Another key resource area is staff—expertise and time to track student progress and pinpoint common challenges, such as certain prerequisite courses with high failure rates that discourage students from declaring a STEM major (e.g. more publicization of tutoring is a potential strategy here). Further research is encouraged to examine within-institution incentives for faculty and staff with direct contact with students.

Additionally, resources are necessary to reduce attainment gaps for student subpopulations. Introduced in the literature review, examples include improving campus climates that steer female students away from STEM and that contribute to disparities in attainment (Espinosa, 2011), as well as retaining female faculty who are vital to mentoring undergraduates (Xu, 2008). These goals require faculty, administrators, and staff to recognize and address obstacles, which may necessitate creating a new committee, delivering workshops on diversity to faculty, or pairing students with a faculty mentor. More fundamental changes potentially unconnected to a performance funding STEM incentive or not quantifiable in the funding formula are seemingly necessarily to produce greater STEM degree achievement.

In short, institutions require resources, capacity and time to systematically improve student completion in STEM (Jones et al., 2015)—resources that are not allocated through a performance funding policy until *after* the institution increases completion—which is likely most challenging for lower-resourced institutions that serve more underrepresented students. This policy design component has room for further exploration. Institutions may be better positioned to graduate STEM students if performance funding provided an up-front “start-up” funding

allocation for institutions to identify promising initial strategies for STEM retention. Once institutions begin to reach targeted improvements in year-to-year STEM completion numbers, states could subsequently allocate the remaining funds.

Second, to determine actions with potential to improve STEM completion in the context of performance funding, strategizing and compromises are likely necessarily between faculty and administrators, as well as between administrators and state policymakers. Multiple stakeholders have divergent viewpoints on how state funds can be leveraged to improve STEM completion that contributes to disconnect between what policymakers *believe* campuses are or should be doing, versus what campus stakeholders are *actually* doing and are able to accomplish. In the face of limited resources and public pressures, policymakers may view campuses as spending wastefully and exerting too little effort to improve graduation, whereas campuses may view policymakers as infringing on autonomy and using performance funding as a punitive measure. A recent study by the author found that faculty members in particular perceive that state policymakers and even high-level administrators are not cognizant of what it takes “close to the ground” to help students graduate (Li, 2016). Consistent with existing research on campus perspectives, some faculty see themselves as already committed to student retention regardless of a state performance funding policy (Natow et al., 2014).

Additional research from the quantitative and qualitative traditions is recommended on if and how administrators, faculty, and staff implement feasible practices in direct response to external performance funding goals. This is especially important because more frequent student-faculty interactions have a positive effect on STEM degree completion (Gayles & Ampaw, 2014). Relatedly, barriers faced by students from historically underrepresented groups may continue to persist despite state policymaker actions to allocate extra funding for completions by

underrepresented students (defined in most states as African American, Hispanic/Latino, and or American Indian/Alaska Native). Recruiting and retaining diverse faculty into STEM fields who can teach and mentor future students requires diverse students to earn advanced degrees in STEM—a challenging cycle that needs to be considered when developing a performance funding policy. Policymakers may wish to include performance metrics not just for students but also for faculty diversity in STEM. Examples include the proportion of tenured/tenure-track faculty from underrepresented backgrounds, which also addresses the supply issue by encouraging institutions to attract and retain diverse faculty. Because my study finds that degree completions do not increase within the time period analyzed, another policy design recommendation is to fund student accomplishments on the way to earning a STEM degree and track intermediate steps towards completion (Dougherty & Natow, 2015; Miao, 2012). Examples to consider are first to second-year retention, number of majors in STEM, third to fourth year retention, and rates of successful passage of gatekeeper courses (e.g. calculus, organic chemistry).

A third explanation for why the STEM incentive in performance funding policies has yet to result in more degrees is that institutions are faced with frequently changing and sometimes conflicting demands, external and internal. Institutions must respond to ever-evolving demands from the state, from students and families, as well as internal initiatives such as new “pet projects” when a new president or provost steps in. In addition, institutions may see the STEM incentive as negligible in the context of other initiatives, and other performance metrics rewarded such as total degrees. From the policymakers’ standpoint, whether a governor, system leader, governing or coordinating board leader, using a STEM performance incentive to hold institutions accountable for graduating students in fields with higher job placement rates is a strategic decision, and one that is appealing to voters and elected officials. This rhetoric is attractive to

students and parents who may question the return on investment for a bachelors' degree.

Whether or not the financial incentive improves outcomes, the STEM metric is a symbolic policy tool representing a state's commitment to economic competitiveness, graduates' gainful employment, and a highly skilled workforce. For institutions however, meeting demands from multiple external stakeholders in the face of stagnant or diminishing resources necessitates tough decisions that can include cutting academic programs in non-STEM fields in exchange for uncertain gains—a topic worthy of future research.

A broader question raised by the current study and prior studies concerns the future of performance funding as state policymakers continue to adopt the policy when there exists mixed evidence that it improves degree completion at 4-year institutions (Rutherford & Rabovsky, 2014; Tandberg & Hillman, 2014). National focus on STEM retention, the college completion agenda, the attractive simple logic of rewarding performance, and strong interest among policymakers contribute to the continual development of performance funding policies. More time and research is necessary to uncover the longer-term impacts of performance funding STEM incentives on degree completion, which does hold promise, and in the meantime, careful consideration must be paid to institutional strategies and resources available to advance educational attainment in the STEM fields in a pay for performance setup.

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Appendix

[Insert Figure 2]

IN HIGH DEMAND: PERFORMANCE FUNDING POLICY IMPACTS ON STEM DEGREE ATTAINMENT

Insert Tables

Table 1: STEM Metric in State Performance Funding Policy

Year	State
2005	Kansas
2007	New Mexico
2009	Ohio
2010	Pennsylvania
2011	Arkansas, Illinois, Indiana, Mississippi
2012	Arizona, Michigan
2013	Maine, Minnesota, Nevada

Source: Dougherty & Natow (2015); Tandberg & Hillman (2014).

Note. Year is policy adoption year of the STEM metric.

Table 2: Data Sources

Variable	Source
<i>Institution-level</i>	
STEM BA degrees	IPEDS Completions Survey
Enrollment by race, gender, FT/PT, degree level	IPEDS Enrollment Survey
Tuition, Carnegie classification	IPEDS Institutional Characteristics Survey Data
<i>State-level</i>	
Performance funding policy	National Conference of State Legislatures, journal articles, policy reports, legislative statutes
STEM performance funding metric	Same as above
State appropriations	State Higher Education Executive Officers Higher Education Finance (SHEEO SHEF)
Grant aid	National Association of State Student Grant & Aid Programs (NASSGAP)
Income per capita	Bureau of Economic Analysis
Unemployment rate	Bureau of Labor Statistics

Note. IPEDS data from WebCASPAR

Table 3: Summary Statistics

Variable	Mean	Std. Dev.
STEM BA degrees	464.77	537.19
STEM BA degrees (logged)	5.55	1.18
% Underrepresented students ^a	22.51	23.75
% Female	56.00	7.87
% Part-time	21.04	13.60
UG In-state tuition+fees (\$1000s)	5.04	2.56
State grant aid per student (all degree levels, logged)	5.62	1.02
State appropriations per student (all degree levels, \$1000s)	4.69	1.36
Total UG enrollment (logged)	8.92	0.84
Carnegie Classification		
Baccalaureate College	0.14	
Master's Comprehensive	0.55	
Doctoral / Research University	0.13	
Research University (High Research Activity)	0.03	
Research University (Very High Research Activity)	0.15	
State income per capita (\$1000s)	40.72	6.35
State unemployment rate	5.85	1.95

N = 9037 institution-years. % is percent of undergraduates.

^aUnderrepresented students: African American, Hispanic/Latino, American Indian/Alaska Native.

Table 4: Impact of STEM Policy (Binary Variable) on Logged STEM BA Degrees

	Comparison Group 1 No STEM	Comparison Group 2 PF with no STEM
STEM Policy	0.008 (0.030)	0.006 (0.031)
% Underrepresented students ^a	-0.001 (0.001)	-0.001 (0.002)
% Female	-0.017*** (0.004)	-0.023*** (0.005)
% Part-time	-0.006*** (0.002)	-0.004* (0.002)
UG In-state tuition+fees (\$1000s)	0.052*** (0.012)	0.051** (0.017)
State grant aid per student (logged)	0.025** (0.009)	0.006 (0.009)
State appropriations per student (\$1000s)	0.002 (0.012)	0.011 (0.016)
Total UG enrollment (logged)	0.974*** (0.043)	0.927*** (0.057)
Master's Comprehensive	0.240** (0.078)	0.358*** (0.093)
Doctoral / Research University	0.481*** (0.110)	0.581*** (0.117)
Research University (High Research Activity)	0.507*** (0.125)	0.579*** (0.156)
Research University (Very High Research Activity)	0.590*** (0.109)	0.676*** (0.140)
State income per capita (\$1000s)	-0.006 (0.005)	-0.006 (0.007)
State unemployment rate	-0.022** (0.007)	-0.011 (0.009)
R squared	0.85	0.86
N (institution-years)	9037	4984

Note. Robust standard errors in parentheses.

^aUnderrepresented students: African American, Hispanic/Latino, American Indian/Alaska Native.

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 5: Impact of STEM Policy*Year Interaction on Logged STEM BA Degrees

	(1) Log STEM BAs	(2) Log STEM BAs
STEM Policy*Year ^a	0.004 (0.008)	0.004 (0.008)
% Underrepresented students ^b	-0.001 (0.001)	-0.001 (0.002)
% Female	-0.017*** (0.004)	-0.023*** (0.005)
% Part-time	-0.006*** (0.002)	-0.004* (0.002)
UG In-state tuition+fees (\$1000s)	0.052*** (0.012)	0.051** (0.017)
State grant aid per student (logged)	0.026** (0.009)	0.006 (0.009)
State appropriations per student (\$1000s)	0.002 (0.012)	0.011 (0.015)
Total UG enrollment (logged)	0.974*** (0.043)	0.927*** (0.057)
Master's Comprehensive	0.240** (0.078)	0.358*** (0.093)
Doctoral / Research University	0.481*** (0.110)	0.581*** (0.117)
Research University (High Research Activity)	0.507*** (0.125)	0.579*** (0.156)
Research University (Very High Research Activity)	0.590*** (0.109)	0.676*** (0.140)
State income per capita (\$1000s)	-0.006 (0.005)	-0.006 (0.007)
State unemployment rate	-0.022** (0.007)	-0.011 (0.009)
R squared	0.85	0.86
N (college-years)	9037	4984

Note. Robust standard errors in parentheses.

^a Year 1 is the policy adoption year.

^b Underrepresented students: African American, Hispanic/Latino, American Indian/Alaska Native.

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 6: Impact of STEM Policy (Each Year of Policy) on Logged STEM BA Degrees

	(1) Comparison Group 1 No Policy	(2) Comparison Group 2 General Policy w/o STEM
Year 1 ^a	-0.017 (0.033)	-0.017 (0.034)
Year 2	0.005 (0.027)	-0.002 (0.030)
Year 3	0.045 (0.037)	0.041 (0.039)
Year 4	0.015 (0.041)	0.010 (0.044)
Year 5	0.036 (0.057)	0.035 (0.060)
Year 6	-0.019 (0.062)	-0.005 (0.066)
Year 7	0.028 (0.076)	0.033 (0.079)
Year 8	-0.009 (0.062)	-0.003 (0.065)
Year 9	-0.020 (0.078)	-0.010 (0.082)
R squared	0.85	0.86
N (college-years)	9037	4984

Note. Robust standard errors in parentheses.

^a Year 1 is the policy adoption year.

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Figure 1. STEM BA Degrees by State

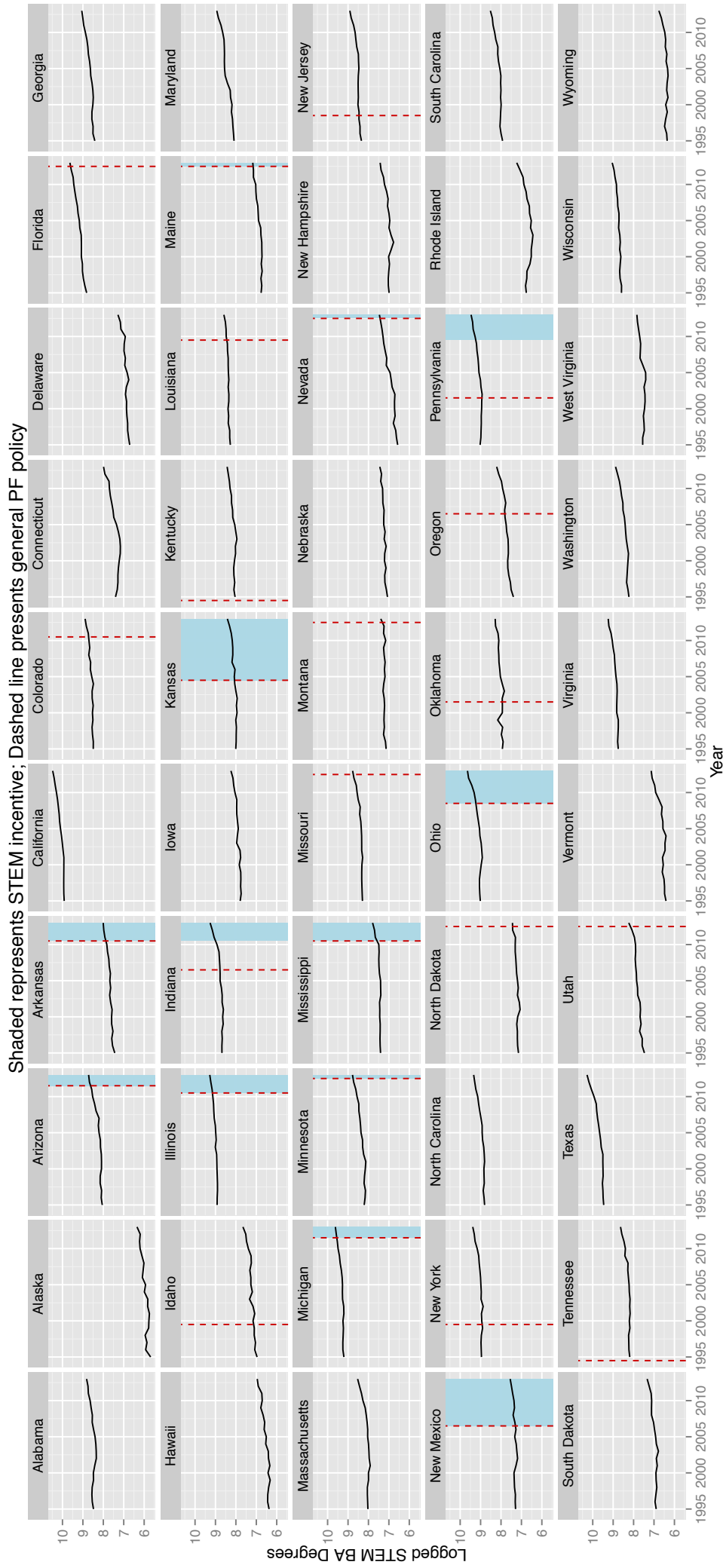
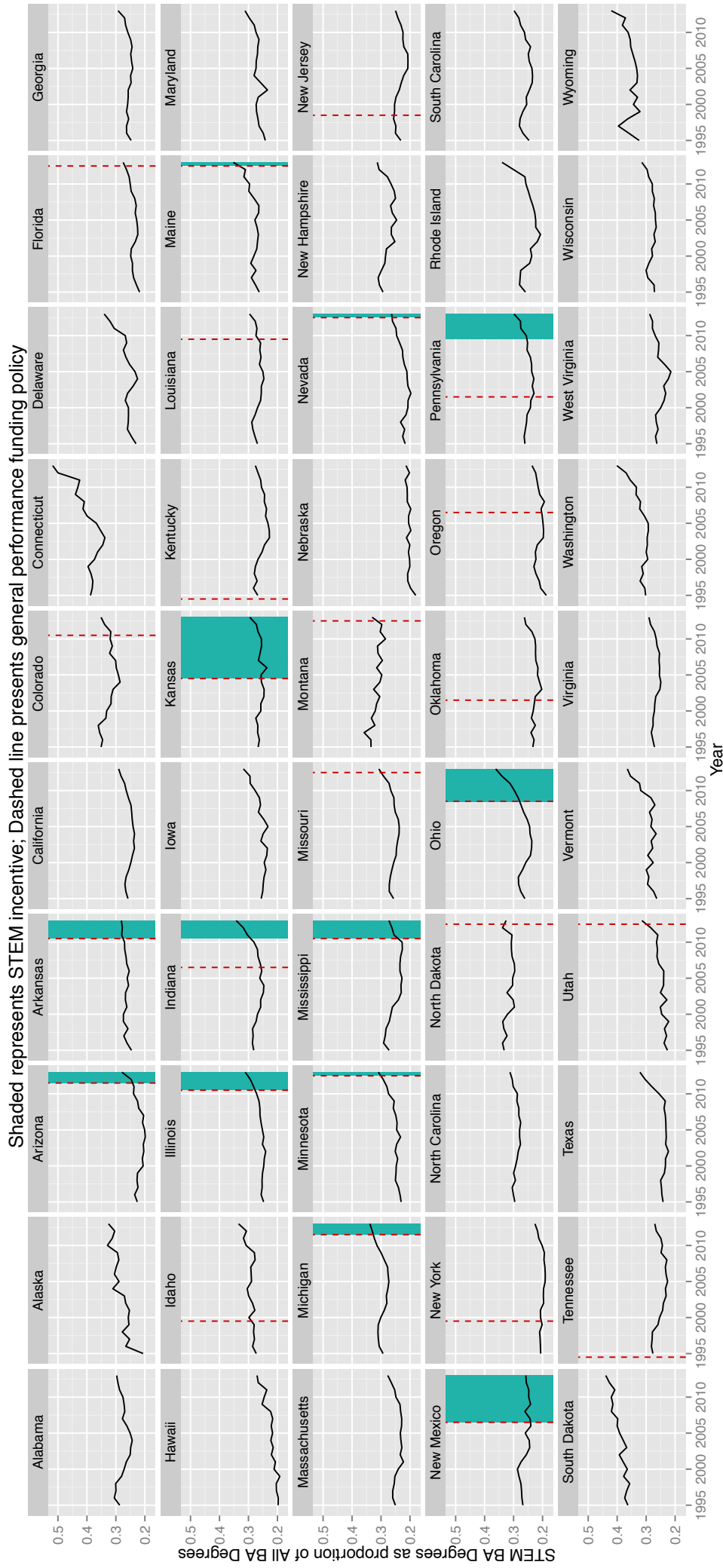


Figure 2. STEM BA Degrees as a proportion of All BA Degrees by State



Conclusion

In my dissertation, titled “The Renaissance of Performance Funding for Higher Education: Policy Adoption, Implementation, and Impacts”, I investigated three interrelated policy stages of performance funding. Results from the first study suggested that rather than following the lead of bordering states that adopted performance funding 2.0 policies, policymakers seemed to prefer to wait and see the longer-term impacts of such policies before applying them to their own state colleges and universities. While external entities such as philanthropic foundations contributed to the rise of performance funding, which may signal lesser influence from campuses, the second study of my dissertation suggested that campus input was taken into account with respect to policy developments in two select states, Pennsylvania and Ohio, that are prominent in the performance funding realm.

Specifically in the second study, I discovered that policymaker actions in Pennsylvania to better align state performance goals with institutional strategic plans were generally viewed positively by campuses and may contribute to the future longevity of the performance funding policy. Among colleges in both Pennsylvania and Ohio, within-unit incentives created by deans and department chairs were necessary to motivate faculty to incorporate new strategies for student retention. In both states, campuses responded in part to performance funding by incorporating or planning to incorporate more sophisticated data analytics to track student progress, particularly for underrepresented student populations. Other states developing or redesigning their performance funding formulas may benefit from carefully observing the policy implementation experiences in Pennsylvania and Ohio, regardless of whether these states border the two focal states examined. Considering the results from the first study, policymakers’ delay in adopting the policy allows time for this type of policy learning to occur.

Lastly in the third study, I discovered that despite a special STEM incentive in multiple states' performance funding policies, STEM degree awards at colleges subject to the incentive have not increased as a result. While the second paper revealed that a STEM metric in Pennsylvania's and Ohio's policies drew greater commitment among mid-level administrators and faculty towards supporting STEM activities, these impacts are not apparent in my national, quasi-experimental analysis presented in the third paper. Performance funding operates in different state environments, targets campuses with a multitude of student populations served and institutional resources available, has been in place in some states for only a few years, and also varies in the proportion of funding allocated to outcomes, among other policy design differences. Therefore, not all states have likely observed positive implementation strategies on campuses for a long enough time period that would manifest themselves in measurable improvements when analyzed nationally. Consistent with earlier studies on degree completions across disciplines in aggregate, a special focus on STEM did not accomplish goals for more students to obtain degrees in these specific fields. These results suggest that at least in the short time period that STEM incentives have been in place in many states, performance funding does not produce more graduates in what are considered highly marketable, highly skilled fields that ultimately enhance state and national economic competitiveness.

The results from my dissertation advance the knowledge on performance funding policies for higher education by highlighting that despite clear increases in campus-related activities aimed at better retention and completion, quantifiable impacts are less likely to emerge when diverse policies are analyzed across states. Policymakers seeking direction from nearby states may be taking heed of these mixed results on performance funding's effectiveness by delaying adoption of such policies until a better understanding of consequences is exposed in nearby

states. The target metric for STEM has yet to yield any measurable impacts, a finding that raises further questions about whether similar target metrics for underrepresented student retention will improve completion rates for these student subgroups. These findings are informative considering that more campuses are incorporating designated metrics for underrepresented student populations and for the STEM fields. My dissertation indicates that perhaps the differences in states' environments, demonstrated by the variety of economic and political contexts that higher education operates within, introduced in the first study, and the variety of campus perspectives towards their state's specific performance funding policy contribute to the, thus far, null impacts when measured across all states.

From a policymaking perspective, it does not appear that the somewhat mixed evidence from the field about the impacts of performance funding have yet led states to discontinue the policy either. While not part of the research question in my first study, I did find in my data collection that since the 2000s decade, no performance funding 2.0 policies were discontinued. As noted, performance funding also remains popular among nationally visible higher education organizations and philanthropic foundations. Therefore, policymakers may wish to take heed of results on the benefits of campus input in policy redesigns from Pennsylvania and Ohio in order to better align the goals of state policies with campus strategic goals. In practice, my results on the campus responses to performance funding are illuminating and encouraging for the future of collaborative opportunities between campuses and states.

From a practical and theoretical standpoint, campus responses to external accountability pressures, which manifest themselves in state performance funding policies, are complex. In this dissertation, I frame the financial incentives in performance funding as applying private sector practices to public higher education. Yet, multifaceted organizations such as colleges may not

respond well to such inevitably limited mechanisms because the benefits and success of higher education are not fully captured by the selected performance funding metrics, which warrants further exploration. The fundamental logic behind and future success of performance funding is an intriguing topic and one that my dissertation advances through multiple angles directed at different stages of the policy. Ultimately, my dissertation contributes new, valuable insights on the various facets of performance funding for higher education, which will continue to stay relevant in future years to come.