State Level Funding Policy in Higher Education:
An Evaluation of the Relationship between
Performance-Based Funding and Outcomes in Public Four-Year Institutions

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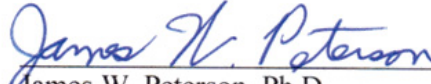

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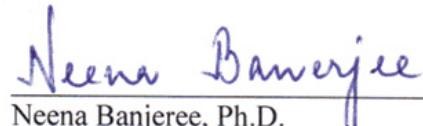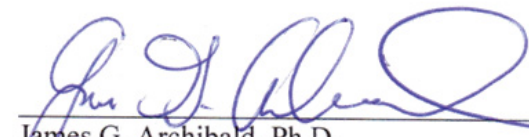
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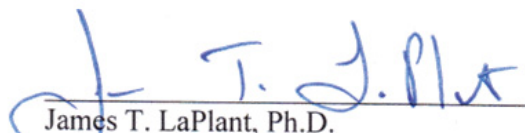Professor of Political Science

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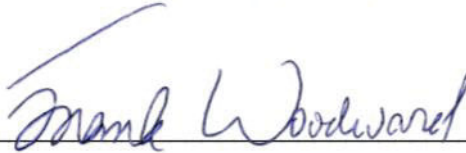
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ABSTRACT

Increasing the effectiveness of higher education institutions has become
increasingly important for states in recent decades. During this time, a wide range of
performance-based higher education funding initiatives has emerged as a means to
improve outcomes in higher education. However, although performance-based funding
initiatives continue to take shape in a number of states, only a few studies have evaluated
the effectiveness of these policies over time. The purpose of this study is to examine the
effectiveness of performance funding implementation in United States (U.S.) public four-
year institutions, by evaluating the relationship between funding amount and program
duration with outcomes represented by completion rates and retention rates.

This study employs hierarchical linear regression (HLM) methods to evaluate
2,452 four-year public institutions in 50 states from 2004 to 2010, using publicly
available data obtained from the Integrated Postsecondary Education Data System
(IPEDS) longitudinal Delta Cost Project Database. Additional institution-level control
variables are also included from IPEDS data, and state-level control variables are
incorporated from the National Conference of State Legislatures [NCSL] (2013), Bureau
of Labor Statistics [BLS] (2013) and Bureau of Economic Analysis [BEA] (2013)
datasets.

The results of this study's analyses reveal that neither funding amount nor
duration was meaningfully associated with completion rate or retention rate from 2004 to
2010. The institution-level variable faculty-student ratio was found to have a moderately
significant association with completion rate, however. An examination of variance at

each level of the model showed that the addition of institution-level factors accounted for the greatest proportion of variance reduction.

This study recommends that further research should be conducted in order to evaluate individual state-level funding models more thoroughly. In addition, state higher education boards and institutional administrators should clarify funding objectives and outcomes measures in order to improve existing models and enhance the alignment between funding formulae and institutional mission. It is also recommended that states should be willing to revise or cease performance-based funding policies when research reveals implementation to be ineffective. Furthermore, the study recommends that institutional administrators, faculty, and staff give greater attention to the implementation and communication of performance funding policies at the institutional level.

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GLOSSARY OF TERMS

Carnegie Classification: Carnegie Foundation categorization of United States higher education colleges and universities for research purposes based on institutional functions and characteristics.

Completion Rate: The ratio of "degrees, certificates, diplomas or other formal awards granted by an institution in a year" (National Center for Education Statistics [NCES] 2013b), divided by the full-time equivalent (FTE) count for the year. Institutions are required to report completions of students who complete a degree within 150 percent of the normal completion time, including three years for a two-year degree, and six years for a four-year degree (2013b). Students who transfer and complete a degree at another institution are not included in this calculation (2013b).

Full-Time Equivalent (FTE) Enrollment: The sum of full-time enrollment plus a calculated portion of part-time enrollment. This calculation is based on factors specific to the "control and level of institution and level of student" (NCES 2013b). These ratios are outlined in Table 3.

Free Application for Federal Student Aid (FAFSA): Application used by the U.S. Department of Education to determine eligibility for federal Pell grant, Work-Study, and federal student loans.

Funding Formula: Method of calculation established for the allocation of state funding at public higher education institutions.

Higher Education Act of 1965: Federal legislation enacted for the purpose of strengthening "the educational resources of our colleges and universities and to provide financial assistance for students in postsecondary and higher education" (P. L. 89-329).

Higher Education Price Index (HEPI): Inflation index developed for the purpose of tracking "the main cost drivers in higher education" (Commonfund Institute 2013). This index "measures the average relative level of prices in a fixed basket of goods and services purchased by colleges and universities throughout the year" (2013).

Integrated Postsecondary Education Data System (IPEDS): A system of surveys conducted by the National Center for Education Statistics (NCES) collecting information on "enrollments, program completions, graduation rates, faculty and staff, finances, institutional prices, and financial aid" (NCES 2013c).

Net Tuition Revenue: Total payments collected by an institution from students less institutional grant aid (NCES 2013b).

Pell Grant: Need-based federal undergraduate student aid. Funds are distributed based on results of the Free Application for Federal Student Aid (FAFSA).

Performance Indicator: Quantifiable outcomes factor used to measure progress toward institutional objectives.

Performance-Based Funding: State-level higher education funding model in which at least a portion of state funding for a given year is allocated based on performance indicator outcomes from the prior year.

Private Institution: A college or university under the authority of an independent governing board rather than state higher education board or council. Private institutions do not receive funding for operations or salaries from state allocations, but funding instead comes from private sources including donors, endowment investments, tuition and fees, and other sources. However, private institutions can receive federal and state grants, and students at private institutions can also receive federal and state financial aid.

Public Institution: A college or university under the authority of a state higher education governing board. Public institutions receive funding for operations and salaries from state allocations.

Retention Rate: The percentage of full-time equivalent (FTE) students enrolled at an institution during a given fall term who re-enrolled the following fall term.

Scholastic Assessment Test (SAT): College admission test of mathematics, reading, and writing ability administered by The College Board.

Title IV: Section of the *Higher Education Act of 1965* (P. L. 89-329) that established programs to increase student assistance including the Federal Work-Study Program, Pell Grants, and student loan programs.

Unemployment Rate: Monthly calculation established by the Bureau of Labor Statistics defined as the percentage of the total U.S. labor force age 16 or older who "do not have a job, have actively looked for work in the prior 4 weeks, and are currently available for work" (Bureau of Labor Statistics [BLS] 2013).

Chapter I

INTRODUCTION

Evaluating the cost and effectiveness of systems of higher education in the United States has proven to be a critical, yet elusive, goal for states throughout the decades. As the cost of delivering public higher education continues to increase (National Center for Public Policy and Higher Education [NCPPHE] 2008, 8-9), states have struggled to provide adequate funding while also achieving the program goals that governing boards and state administrators identify as most important. Traditionally, most states have based higher education funding models on enrollment levels (Adleman and Carey 2008, 13). However, state-level policies built upon performance-based funding have gained popularity in recent years as potential solutions for funding public universities more effectively while improving outcomes (13). At its root, performance funding seeks to "strengthen the linkage between funding and results" (Robinson 2007, 1) by basing funding levels for a given budget year on the outcomes of the previous year (2). One method for creating these linkages at the university level is through the establishment of performance funding formulae, which specify the relative weights of institution-specific factors guiding the distribution of state-level funds for a given year (Burke and Associates 2002, 27; 204). Although performance-based funding policies continue to be promoted and expanded in many states, a full understanding of their significance for institutional outcomes has thus far been lacking.

By implementing policy-level funding initiatives in order to drive improvements in higher education outcomes, states potentially gain the ability to adjust funding strategically to serve the political purpose of control. State funding has historically been tied directly to enrollment levels (Adleman and Carey 2008, 13), and enrollment-based funding policies have served as an important lever used to expand enrollment for many years. However, this study will examine ways in which performance-based funding is associated with outcomes indicators that go well beyond enrollment. In this way, state level higher education boards potentially have a much more direct means of control over public institution, and for this reason the economic and political assumptions underlying policy-level control of the links between funding and outcomes become critically important. For this reason, the goal of this study is to examine and test statistically the assumptions underlying the linkages between performance funding and outcomes, and to draw appropriate conclusions based on the outcomes of this analysis.

This analysis will draw upon a single-state panel data study conducted by this researcher in 2013 that evaluated Tennessee's longitudinal performance funding data between the years 2004 and 2010 (Woodward 2013). That analysis found a statistically significant positive relationship between both state and federal appropriations and completion rates in Tennessee, as well as a statistically significant negative relationship between tuition revenue and completion rate (2013, 28). This study will seek to expand this preliminary analysis in order to gain a more comprehensive understanding of the behavior of amount and duration of performance-funding implementation across 50 states, using a much wider range of factors that will be outlined below.

Conceptually, this study will be driven by the overarching question of effectiveness. In light of higher education's shifting financial landscape, states have acted out of necessity by seeking alternative funding models. However, it is critical to ask whether performance-based funding does in fact offer a means to enhance the connection between funding and outcomes, while still preserving the alignment of these outcomes with institutional and state missions. Evaluating this improvement will be accomplished by assessing the changes in state-level outcomes indicators during the time period under analysis. These specific measures will be discussed further in Chapter 3.

This study's conceptual framework will be built around the goal of understanding the inherently iterative cycle of higher education financial decision-making. Through the careful selection of funding factors and control variables, this study will employ quantitative analysis as a means to evaluate more fully the historic relationship between funding and outcomes. As a review of the literature in Chapter 2 will illustrate, understanding this relationship will offer potentially significant benefits for both institutions and states.

Statement of the Problem

Although performance-based funding policies have been implemented throughout the years using a wide range of models, the primary issue addressed by this study is that a comprehensive understanding of the impact and significance of their relationship to outcome indicators is still lacking. This lack of understanding leads to policy ambiguity with regard to design and implementation, and produces potential inefficiencies in the financial operations of public universities. In fact, as Rabovsky (2012) notes from Gilmour and Lewis (2006) and Moynihan (2008), without a fundamental understanding

of the relationship between higher education funding and outcomes, it is often not even clear "whether poor performance should be met with reduced or increased funding" (Rabovsky 2012, 676). There is clearly an acute gap in higher education policy research, and its implications are potentially critical.

Purpose of the Study

The purpose of this study is to evaluate the underlying relationship between performance funding and outcomes indicators in public higher education over a seven-year period, using fixed effects and hierarchical linear methods. In this way, this study seeks to contribute to a more comprehensive understanding of state-level higher education funding, and to offer clear and practical results that are applicable for state-level policy development and higher education administration.

Research Questions

This study will address the problems outlined above by examining the following research questions:

1. Is the amount of state-level performance funding associated with retention rate as an institutional outcome in four-year public universities in the U.S. over time?

2. Is the duration of state-level performance funding associated with retention rate as an institutional outcome in four-year public universities in the U.S. over time?

3. Is the amount of state-level performance funding associated with completion rate as an institutional outcome in four-year public universities in the U.S. over time?

4. Is the duration of state-level performance funding associated with completion rate as an institutional outcome in four-year public universities in the U.S. over time?

These research questions will be addressed specifically through quantitative

analyses of Integrated Postsecondary Education Data System (IPEDS) longitudinal data

from 2004 to 2010, compiled as part of the National Center for Education Statistics

IPEDS: Delta Cost Project Database (National Center for Education Statistics [NCES],

2013a). The research hypotheses for this study will be presented in Chapter 3.

Summary of Methodology

This section provides an overview of the methodological framework that will be

used to address the research questions presented above. The independent, dependent, and

control variables are presented here in introductory form only. Chapter 3 will present the

selection of variables and determination of analytic strategy in greater detail. This

quantitative analysis will employ both fixed effects and hierarchical linear regression

(HLM) methods to evaluate a 50-state panel dataset representing public bachelors,

masters, and research institutions between the years 2004 and 2010. This study will test

correlation, not causation. The source for the panel data is the publicly available

longitudinal "IPEDS Analytics: Delta Cost Project Database," developed by the

American Institutes for Research through the National Center for Education Statistics

(NCES 2013a).

The independent, dependent, and control variables used in this study are outlined

in Table 6 in Appendix A, and the data sources for these variables will be described in

further detail in Chapter 3. The two dependent variables examined in this study are

student retention rate (*Retention*) and completion rate (*Completion*), two of the most

commonly used performance indicators among states that have implemented performance

funding policies (Shin and Milton 2004, 4). The independent variables examined in this

study are performance-based funding amount measured in HEPI-scaled 2010 dollars per year (*Amount*), and program duration (*Duration*) measured in the number of consecutive years each state policy has been in effect. Because the outcomes indicators for a given fiscal year are based on funding levels appropriated in the prior year, the independent variable *Amount* will be lagged by one year. The selection of *Amount* and *Duration* as independent variables will allow for the creation of comparison groups between the states that implement performance-based funding in a given year, versus those that do not (that is, *Amount* = 0 in years with no performance funding). This model will also allow for states that have implemented performance funding in some years, but which might have decreased or discontinued the funding program in other years.

In addition to these independent variables, a range of institution- and state-level control variables will be added to the panel data. State-level data are drawn from sources including the National Conference of State Legislatures [NCSL] (2013), Bureau of Labor Statistics [BLS] (2013), and Bureau of Economic Analysis [BEA] (2013) datasets. These state-level variables include state unemployment rate (*Unemployment*), average personal income (*Income*), and per-capita tax revenue by state (*Tax*). Institution-level control variables included in this study are derived from the IPEDS: Delta Cost Project Database (NCES 2013a). Institution-level variables include average Pell Grant per FTE student (*Pell*); Carnegie Classification of the institution (*Carnegie_Bachelors*, *Carnegie_Masters,* and *Carnegie_Research*); SAT I Math scores at the 75th percentile (*SATMATH75*), in-state tuition and fees per FTE student (*Tuition*), average number of full-time instructional faculty per FTE student (*Faculty*), and the percentage minority enrollment (*Minority*).

Limitations of the Study

It is important to clarify several limitations with regard to the design and scope of this study. First, data evaluated in this study will be limited to public non-profit institutions and will exclude community colleges, technical colleges, and for-profit institutions. This delimitation is operationalized by the use of Carnegie Classifications 15 through 23 in the IPEDS: Delta Cost Project Database. While state and local performance funding policies certainly impact community and technical college systems, the completion and retention rate indicators used in this study are those most frequently demonstrated in the literature to be used by four-year universities. Because community colleges and technical college systems frequently base outcomes measures on alternative indicators such as transfer rates and certifications (Zarkesh and Beas 2004, 70), their academic missions are measured in significantly different ways. For this reason, *Completion* and *Retention* would not be the most appropriate outcomes indicators for these categories of institutions.

From a policy perspective, states have approached the issue of mission differentiation for four-year public universities in a variety of ways (Bastedo and Gumport 2003, 342-343; Dougherty and Reddy 2013, 60-61). Institutional funding formulae often reflect the inclusion of specific state-level goals that are codified by funding percentage (Burke and Associates 2002, 15-17). While an evaluation of mission differentiation in state-level higher education funding policy is beyond the scope of this study, it will be important to incorporate aspects of measurement indicating institutional mission.

As an example of institutions whose performance-based funding formulae reflect mission-specific factor selections, Table 1 displays the formulae established by the state of Tennessee for the 2010-2011 fiscal year for the University of Tennessee, Knoxville (UTK) and Austin Peay State University. UTK is categorized as a "Research University" with Carnegie Classification 15, and in 2010 the university had a full-time equivalent (FTE) enrollment of 24,219 students (THEC 2013a). Austin Peay State University is categorized as Carnegie Classification 19, "Master's Colleges and Universities," and in 2010 the university had an FTE enrollment of 8,418 students (NCES 2013a). The funding weights displayed here are used by the Tennessee Higher Education Commission to differentiate funding based on mission-based differences within the state university system (THEC 2011):

Table 1: Selected Funding Weights for Two Tennessee Universities

Factors in Funding Formulae	Funding Weight Percentage	
	University of Tennessee, Knoxville (UTK)	Austin Peay State University (APSU)
Bachelors and Associates	15%	25%
Doctoral / Law Degrees	10%	0%
Research and Service	15%	10%
Six-Year Graduation Rate	20%	10%

Note. Adapted from Tennessee Higher Education Commission [THEC]. (2011). "Outcomes Based Formula Narrative". Retrieved from http://www.state.tn.us/thec/Divisions/Fiscal/funding_formula/1-Outcomes Based Formula Narrative - for website.pdf.

While the IPEDS: Delta Cost Project Database offers a rich collection of funding and performance data, the longitudinal scope of the data is limited by the reporting practices of each individual institution over time. Although some IPEDS data were reported by institutions as early as 1987 (NCES 2013a), several variables from the dataset that are used in this study were not reported by institutions prior to 2003. Because of this,

the present study will limit data to the years 2004 to 2010, with the addition of 2003 variable data used for the creation of lagged variables as noted above. As additional years of performance data become available, subsequent studies will be able to evaluate the effects of state-level funding policies more fully.

This study incorporates a number of state-level control variables drawn from a range of data sources in addition to the IPEDS: Delta Cost Project, including the National Conference of State Legislatures, Bureau of Labor Statistics, and Bureau of Economic Analysis. While the addition of data from these sources provides a relatively broad range of additional socioeconomic data for the study's controls, variable selection is limited by the availability of these auxiliary datasets.

In addition, because some states have only recently adopted performance-based funding policies (NCSL 2013), limited meaningful data are available for the independent variable *Duration* in the years following program implementation. Chapter 3 will discuss the construction of the variable *Duration* in further detail, and it will outline the implications of time-related limitations associated with data availability. As noted above, as performance-based funding implementation generates additional years of data, there will be an improved opportunity to evaluate the presence and significance of correlations between funding and outcomes in those states.

Significance of the Study

The story of performance-based higher education funding in the United States has been one of the emerging accountability of institutional responsibility, combined with the ever-increasing political and economic pressures for increased efficiency at the state level. Multiple economic downturns faced by most states since the 1990s have

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engendered a sense of increased urgency among higher education governing boards and state legislatures (Burke and Associates 2002, 6), particularly in light of ever-increasing tuition levels in many university systems. As Burke and Associates note, "[c]riticism of public higher education rises during recessions and recedes with recovery" (7).

As Chapter 2 will explore further, the forces giving rise to performance-based funding initiatives are not rooted merely in economic pressures, but they often represent the convergence of academic, economic, and political forces (Kingdon 1995, 90). For this reason, this study will incorporate a range of variables addressing all three areas. For many states, the passage of funding policies has been closely tied to the political popularity of university accountability (Zumeta 1998, 6-7); however, evidence-based systems of analysis and feedback for these programs have been sorely lacking.

As new waves of performance-based funding initiatives continue to take shape in many states (National Conference of State Legislatures [NCSL] 2013), the need for research grows ever more urgent. In order to address this need, this study will offer several potentially significant benefits in the field of higher education policy research. Long-term analysis of the relationship between funding and outcomes can offer valuable insights for researchers, policy makers, university leaders, and public administrators who seek to improve upon existing state-level funding policy or develop new initiatives. The potential applications are particularly significant from the political standpoint: public budgeting is an inherently political process (Rubin 2009, 2), and Burke and Associates (2002) rightly note that in many cases the political and economic arguments surrounding higher education budgeting have "generated more heat than light" (Burke and Associates 2002, 265). Only in relatively recent years have performance models that can account for

differentiating factors such as institutional mission (2-3) replaced earlier implementations of performance budgeting described by Miao (2012) as an "initial wave of ineffective models" (2). This study will potentially provide a better understanding of the higher education funding landscape for legislators, and the results can lead to progress in crafting more effective long-term budgetary policy at the state level.

Furthermore, this study will employ hierarchical linear regression (HLM) analysis to evaluate the potential significance of relationships at institutional and state levels in the dataset. In this way, insight can potentially be gained into the nature of both institution- and state-level relationships among variable levels. As Chapter 2 will show, while multilevel analysis has become a commonly used tool in higher education research in recent years (Raudenbush and Bryk 2002, *xxiii*), only a few major studies have employed this methodology in the evaluation of performance-based funding policies in higher education. Because funding policies require both effective designs at the state level as well as effective implementation at the institutional level, multilevel analysis can offer valuable insights into the relative effectiveness of each component of the funding process. In this way, this study can offer significant contributions to the field of state-level higher education funding policy.

Burke and Associates (2002) point out that beginning in the 1980s, a number of studies revealed major flaws in the identification of student outcomes in higher education, as well as in the ability to measure progress toward those goals (2-5). Even after assessment became the subject of greater focus throughout the 1980s and beyond (4-5), Burke and Associates have observed that institutions have often failed to address underlying issues of accountability (Burke and Associates 2002, 5). This pattern of

failure has produced what Harnisch (2011) describes as "a mixed history of success and instability" (2). By contributing to a greater understanding of the relationship between funding and outcomes, this study can provide university governing boards and institutional administrators with the tools to administer more effective institutional budgets with a greater capacity to achieve institutional goals. In this way, the study will also serve to bring added consistency and confidence to the planning process for institutional decision makers.

Summary of Chapters

Chapter 2 will provide a review of the literature addressing performance funding in higher education, and its role in the context of U.S. higher education funding policy. A brief review of the historical scope of performance funding literature will first be examined, including early programs in Tennessee beginning in the 1970s. Next, studies will be outlined that address policies involving the perspective of multiple states, particularly in light of changing state and federal grant policies throughout the 1980s and beyond. Following this review of the historical context, Chapter 2 will outline primary studies in the research literature and their implications for issues including the political forces driving performance funding; challenges to performance funding policy; the research on performance indicators, including reporting and implementation; evaluations of overall effectiveness in the literature; and gaps in the literature and the present state of interpretation. Finally, the chapter will outline the role of the research questions of this study within the status of current research. Within this context, the conceptual framework of the study will be presented in order to set the stage for the analytic strategy presented in Chapter 3.

Chapter 3 will present a detailed outline of the study's research design and methodology, and it will also convey the specific measures and procedures that will be used to evaluate the null and alternative research hypotheses. This chapter will first present the specific measures obtained through the IPEDS: Delta Cost Project Database and other data sources comprising the study's panel dataset. The validity of these data sources will be outlined (Rudestam and Newton 2007, 95), and the relevance and procedures for the treatment of the specific variables used in this study will then be detailed. The research hypotheses will be tested using both pooled OLS and HLM methods of analyses, and the procedural steps will be presented in detail. The outcomes of these tests will be summarized in preparation for a full analysis of results in Chapter 4, and for interpretation in Chapter 5.

Chapter 4 will present the results of the analytical tests and procedures outlined in Chapter 3. First, descriptive statistics for the variables of interest will be presented along with relevant characteristics of the dataset. The adequacy of each test will be evaluated with regard to central statistical assumptions (Rudestam and Newton 2007, 158), and findings will then be presented for each test. Next, a pooled ordinary least squares (OLS) model will be evaluated for each dependent variable. The results of hierarchical linear analysis of the unconditional model for each dependent variable will be presented along with an evaluation of the Intraclass Correlation (ICC) statistic, in order to determine whether HLM analysis is appropriate for the model. Based on the results of this evaluation, the full HLM models for *Completion* and *Retention* will be evaluated. In addition, the proportions of variance distribution at each level of analysis will be interpreted based on the comparison of random effects components from the

unconditional and full models (Raudenbush and Bryk 2002, 149-152). Substantive

conclusions will be based on the results of the full HLM model, and these findings will

be used to evaluate the null and alternative research presented in Chapter 3.

Using the test results presented above, Chapter 5 will interpret the research

findings and evaluate potential significance within the context of the research literature

(Rudestam and Newton 2007, 195). Because this study's conceptual framework centers

on the overarching question of evaluating effectiveness in higher education performance

funding, Chapter 5 will interpret the meaning of the study's findings within the context of

this framework. In addition, any limitations with regard to the scope and applicability of

the results will be considered, particularly in light of alternative findings and

methodological approaches identified in the literature (196-197). Based on the context of

the primary trends in current and emerging research presented in Chapter 2, the study's

contributions to the field of higher education research will be considered, and directions

for further research will be discussed.

Chapter II

LITERATURE REVIEW

While performance-based initiatives in the public and private sectors have been evaluated to a substantial degree in budgetary and economic literature, relatively few studies have evaluated performance-based funding policies using multi-state data. Although a few studies have included a relatively wide range of performance indicators, substantive analysis of the long-term impact of higher education performance funding remains lacking. This review will explore the primary insights surrounding the role of public policy in higher education budgeting found in the literature, as well as the effect this can have on budgetary decisions based on current practices in data analysis.

This review will be presented in several sections, beginning with a brief historical review of emerging literature since the early 1980s. This historical perspective will offer insight into the early growth in research around state-level performance funding policy adoption, and it will provide context for the conceptual framework of the study. Second, the use of performance indicators in the research literature will be outlined, along with the methodological approaches of studies that examine longitudinal data, including those employing multilevel analysis. This will provide background for the selection of the indicators examined in this study. Following this, the literature addressing the political impact of policy on higher education budgeting will be considered. Finally, critiques and limitations of performance funding policy implementation and research will be summarized.

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The Historical Context

Early state-level studies conducted from the 1980s onward offer an interesting window into the growth of performance-based research. Tennessee's pilot performance-based system in the late 1970s provided one of the first opportunities to examine the relationship between performance funding and outcomes. In 1980, Richard Dumont published a case study examining the impact of Tennessee's state funding policy at Tennessee Technological University. Dumont's analysis identified several primary motivations for the Tennessee project, including "escalating costs," "enrollment decline," and "waning public confidence" (Dumont 1980, 405). Dumont's evaluation also included an interesting observation regarding the particular understanding of performance for the stakeholders in Tennessee's emerging funding policy. Dumont noted that if performance simply means "the evaluation of achievement against some predetermined standard or criterion" (412), then there is the potential for performance funding to become punitive in nature, especially when program administration, data collection, and other components of the program are not optimal (412). Instead, Dumont observed that Tennessee at that time preferred an understanding of performance as a contractual relationship (412-413). By this he emphasized an incentive-based aspect of performance, in which academic freedom can be maximized while still addressing the program indicators that are preferred by the state (413). Furthermore, Dumont observed that focusing on incentives as rewards for performance maximizes the ability to "provide public evidence on performance" (413).

In 1982, E. Grady Bogue and Wayne Brown outlined their own involvement in developing the Tennessee Higher Education Commission's performance-based funding

policies in 1974 (Bogue and Brown 1982, 123). In this analysis, Bogue and Brown noted that focusing on enrollment rather than outcomes in funding policy "…tends to emphasize growth as a measure of achievement—to obtain additional dollars, an institution has to add students…*it displaces an institution's purpose* [emphasis added]" (124). These early Tennessee studies are significant and informative from the historical perspective, and the observations of early participants and researchers such as Bogue and Brown (1982) illuminate the importance of the institutional mission as a critical component of institutional funding. This is a focus that will be examined further in the pages to follow.

In 1986, the National Governors' Association (NGA) released *Time for Results,* a publication that identified an urgent need for increased clarity and specificity in the identification of educational outcomes (Adleman and Carey 2008, 2). This book brought attention to the growing focus on assessment taking place at that time (NGA 1986), and its publication has contributed to a lasting emphasis on efficiency and accountability at the secondary and higher education levels (Burke and Associates 2002, 2-5), as well as an increased understanding of the economic and political pressures in accountability systems.

A Developing Understanding of Higher Education Cost Structure

The emerging scholarship in the area of assessment and outcomes took shape within the context of a simultaneous, growing understanding of higher education markets as multi-dimensional (Cohn, et al. 1989, 284). A number of institution-level analyses of higher education outputs have followed the foundational cost structure work of William Baumol (1982) in this arena, including Cohn, Rhine, and Santos (1989); de Groot et al.

(1991); and Dundar and Lewis (1995). Baumol's influential work throughout the years has addressed issues of price, scale, and productivity analysis, and this work has had a lasting impact on economic analysis in fields such as health care and higher education (Cohn, Rhine, and Santos 1989, 285; Nordhaus 2008). In this regard, Paulsen and Smart (2001) note that most studies have failed to recognize the multi-product nature of higher education's economic output (Paulsen and Smart 2001, 162), with the result that many studies have produced "biased, if not misleading, conclusions regarding costs and economies of scale and scope" (162). They further observe that a persistent challenge for research addressing financial issues in higher education is tied to the fact that "[t]he outputs and outcomes of education are typically not clearly defined and measured" (163).

A further complication of applying standard cost analyses in higher education financial research is that, as Paulsen and Smart (2001) put it, "not only the quantity of outputs [of non-profit universities], but also their qualities are desirable outputs" (163). This issue has a subtle but important effect on the identification of mission-specific goals and outputs in relation to cost. Applying the cost function to higher education outputs and products, especially given the fact that non-profit universities are not necessarily motivated to minimize cost (Brinkman 1990, 110), is addressed in the work of Howard Bowen (1980); Verry (1987); Cohn, Rhine, and Santos (1989); and others. Although these researchers have provided a solid foundation for cost analysis in higher education, significant challenges remain. Drawing on a recent example in the literature, Pantuosco, Ullrich, and Pierce's (2013) consideration of state-level higher education spending reveals that although state-level higher education spending increased substantially from 1997 to 2009, this spending was not significantly correlated with measures of

undergraduate degree attainment during that period (Pantuosco, Ullrich, and Pierce 2013, 163). The research questions addressed by this present study offer insight into one important aspect of this issue, namely the significance of the multi-output funding approaches in state-level performance funding policies.

The National Landscape: Moving Toward Accountability

Throughout the 1990s, state-level performance budgeting continued to grow in popularity as well as sophistication. By the end of the decade, Zumeta observed that "…we may be witnessing the initial phases of a historically sharp increment in the degree of government involvement in academic matters" (Zumeta 1998, 5). Zumeta's examination of the rise of outcomes accountability included an essential challenge to consider the social implications of increasing external accountability demands upon U.S. university systems (6-8). A number of researchers also began to evaluate the expanding state-level policy initiatives taking shape during that time. In particular, Melkers and Willoughby (1998) considered the relative effectiveness among states in holding agencies accountable for budget policy. Their broad state-level policy survey is meaningful both for its understanding of the range of policies that existed among states at that time, as well as for the means of obtaining and using various metrics in policy implementation (Melkers and Willoughby 1998, 68-69). Based on their evaluation of evidence of the gap between policy and implementation through the use of case studies, they concluded that "[t]he future of this effort is unclear" (70).

The growing popularity of performance funding initiatives in the late 1990s led to a number of analyses by higher education commissions in the early 2000s. From 2000 to 2008, the National Center for Public Policy and Higher Education (NCPPHE) published

their annual *Measuring Up* report, which served as a "state-by-state report card" (NCPPHE 2008, 14) of state-level higher education performance. In a similar vein, the Commission on the Future of Higher Education initiated a 2006 study examining the status of information gathering at the state level (Adleman and Carey 2008, 1). *Education Sector* has published similar evaluations, such as their 2008 fifty-state analysis of data collection and usage patterns for state-level data (1).

Noteworthy among the research that was taking shape in the early 2000s is the work of Joseph C. Burke. The work of Burke and Associates (2002) is frequently cited as a foundational resource for higher education researchers and administrators. Using data collected as part of the State Higher Education Financial Officer (SHEFO) surveys (10), Burke and Associates' analysis contributed substantial clarity to an understanding of the primary differences in program implementation, characteristics, challenges (27-30), and levels of connection between performance indicators and financial policies (21-23). Particularly valuable in this collection of studies is Burke's own evaluation of the closure of performance funding systems in Arkansas, Colorado, Kentucky, and Minnesota, in which he observed that for these states, funding models were "easier to start than sustain" (219).

Several recent studies illustrate the growing emphasis on performance funding at the national level. A 2013 study conducted by the National Association of State Budget Officers (NASBO) identified several major trends pointing to the need for greater performance-based funding measures by states. By using the IPEDS: Delta Cost Project's "education and related" per-student metric that measures the "direct per student costs" for students (NASBO 2013, 6), NASBO observed an "unsustainable cost model" (8) in

higher education spending, in which net tuition revenue rises while spending remains flat and per-student appropriations falls over time (NASBO 2013, 7-8). With a 40-plus year downward trend in state per-student appropriations (4), tuition has continued to rise while universities have generally employed a strategy of "cost shifting" rather than cost reduction (9).

Based on these cost model findings, NASBO identified a compelling need for states to develop more effective strategies to achieve "influence over the priorities and outcomes of public higher education institutions" in order to increase efficiency and re-orient the cost model for greater sustainability (NASBO 2013, *vi*). According to the study, this effort must include leveraging the availability of state-level performance data (*vi*); in short, states must "fix the metric" (*vi*). In fact, they argue that "perhaps [performance funding's] greatest benefit at this point is in helping to align public goals with institutional missions" (*vi*).

Performance Indicators in Education Research

Several state-level studies conducted in recent years have evaluated the significance of performance indicators with regard to the effectiveness of funding policy. Contemporary research has so far focused primarily on such issues as the nature of indicator selection, the capacity for data collection (Ewell and Jones 1994), and the relationship of performance indicators to institutional mission (Burke and Associates 2002, 225 et al.). A number of studies have also focused specifically on the political implications of performance indicator selection (Toutkoushian and Hollis 1998; Layzell 1999; Shin 2010; and Crellin et al. 2011), which are of particular importance to the selection of control variables in this study.

As financial research began to address economies of scope in higher education output analysis in the late 1980s, progress in the application of new models of higher education funding analysis began to take shape as well. In addition to the work of Cohn, Rhine, and Santos (1989) and de Groot et al. (1991) cited above, Paulsen and Smart (2001) also note Nelson and Hevert (1992), Lloyd, Morgan, and Williams (1993), and Dundar and Lewis (1995) as key studies addressing the multi-output nature of non-profit higher education cost structures (Paulsen and Smart 2001, 178-179). Although the literature does reveal extensive work in this complex field, much additional research is needed in light of shifting economic and political demands in order to address the challenges of adapting methodologies, indicator selection, and other parameters (179-182). This present study seeks to gain insight into this question through the use of multilevel analysis: by analyzing the behavior of funding policy both within states at the institutional level and between states over time, the results of this study will potentially offer greater insight into whether funding policy solutions are primarily associated with factors at the state level, or whether institutions themselves bear the majority of responsibility for achieving desired outcomes.

The availability of state-level data from both the State Higher Education Finance Officers (SHEFO) and State Higher Education Executive Officers (SHEEO) surveys beginning in the late 1990s provided researchers with much more comprehensive data than were previously available. This has made possible a more substantial consideration of the importance of indicators and metrics for outcome evaluation. In 1999, Daniel Layzell examined state-level policy implementation practices based on those reported in the SHEEO survey. Layzell observed that these responses report "data availability" as a

primary factor in the selection of performance indicators (Layzell 1999, 237). Shin and

Milton (2004), Burke and Associates (2002, 11), and others have offered analyses of

SHEEO and SHEFO survey data as well. Shin and Milton outlined the most commonly

used performance indicators (2004, 4), noting that the 1997 survey results show

graduation rate to be the most frequently cited indicator, a factor in use by thirty-two

states at that time (4).

The literature shows that performance indicator selection has been impacted not

only by higher education's complex cost structure and financial roles, but by equally

complex political roles as well. Barnetson and Cutright's (2000) observation of a gap in

the research with regard to performance indicator studies in higher education led to their

argument that performance research tends to "focus on issues of effectiveness and

efficiency rather than social justice and democracy" (277). This evaluation emphasizes

the inherently political nature of performance indicators: Barnetson and Cutright offer the

premise that performance indicators are not only descriptive but prescriptive as well, with

the potential to become "conceptual technologies that shape *what* issues we think about

and *how* we think about those issues by embedding normative assumptions into the

selection and structure of those indicators" (277).

In 2010, Jung Cheol Shin published an analysis of the impact of policy reform on

institutional performance, as measured by the dependent variables graduation rate and

federal research funding level (Shin 2010, 47). Importantly, Shin's analysis identified no

statistically significant increase in performance (63), and his work raises additional

questions to be addressed in this present study and future research. Shin's research

design, his use of HLM analysis, and selection of covariates (54) all inform this study.

First, Shin's treatment of federal research funding as a dependent variable (Shin 2010, 53), rather than as an input driving institutional outcomes, brings to light an important point about the inherently cyclical nature of university funding in general. Second, Shin's application of HLM analysis methods in his research design is an important reminder of the multilevel nature of education data. Multilevel analysis has been used in a number of other social science contexts (Raudenbush and Bryk 2002) and will be used in this present study. Although progress continues to be made in the use of multilevel analysis in higher education research, the literature reveals a great deal of unrealized opportunity in the analysis of longitudinal education data.

Several budgetary studies including Shugart (2013), Dougherty and Hong (2006), and Crellin et al. (2011) have examined the significance of mission-specific performance factors from the community college perspective. As Zarkesh and Beas (2004) have observed, completion rate is often a much less relevant outcomes indicator for community colleges than for four-year colleges and universities (64). Shugart noted that completions can be tailored to include "graduation or successful transfer" (Shugart 2013, *n.p.*) in order to target the particular mission of two-year institutions more accurately. From this perspective, Crellin et al. (2011) observed that when completions are incorporated into funding formulae, they "are incentivized to care much more for student success than for student quantity" (3). The incentivizing impact of performance indicator selection, and the subsequent effect this can potentially have upon the development of institutional priorities and policy decisions, are topics that offer opportunities for much more extensive research.

In 2006, Dougherty and Hong evaluated the role of performance policies at the community college level using interviews with institutional officials in six states. Their findings are instructive as well as cautionary: while institutions are often treated by the state as inherently able to carry out the policies upon which their funding depends, Dougherty and Hong's results show otherwise (2006, 73-75). Their qualitative study revealed situations for some community colleges in which "lack of technical or other resources..." created challenges for the institutions in simply "trying to keep up with things" (73). Furthermore, their research points to the risk in making the assumption that officials are even aware of the policy standards under which they are being evaluated (66), as they point out with regard to funding policies for community college transfer rates in the state of California (66-67). While these findings are derived specifically from community college analyses, they offer cautionary guidance for the scope of research across all types of public institutions. Certainly, the literature in this area shows the degree to which policy implementation depends on the initiative and compliance of individual institutions. This is an issue that will be addressed further in Chapter 5 in light of this study's results.

While a substantial amount of performance funding research deals with the capacity of policy to move institutions and states toward intended outcomes, Dougherty and Reddy (2013, 71-77) have also identified a number of unintended consequences of performance funding that are presented in the literature. While the research in this regard is limited, a number of state-level studies have revealed the added commitments of both time and money that are often required of institutions for funding compliance (Dougherty and Reddy 2013, 71). They also note the research of Jenkins, Ellwein, and Boswell

(2009) and Bell (2005), which have observed the role of performance funding policy in the "narrowing of institutional missions" (Dougherty and Reddy 2013, 72). Related to this issue is the potential significance of performance funding as a disincentive to remain focused on academic transfer rates or on programs that are not directly rewarded by performance funding policies (72, from Jenkins, Ellwein, and Boswell 2009, 36-37).

Panel Data and Methodology

The use of publicly available panel data in higher education research reveals both expanding opportunities and continued challenges. A number of studies, including Shin and Milton (2004), Shin (2010), and Sav (2011), illustrate varying approaches in the analysis of Integrated Postsecondary Education Data System (IPEDS) panel data (e.g., Sav 2011, 146). The work of Toutkoushian and Hollis (1998) provides an example of the selection of state-level controls in higher education panel data analysis and the impact it can have on interpretation.

The literature shows that the use of multilevel methods in higher education data analysis has increased in frequency in recent years (Raudenbush and Bryk 2002, *xix*), in part due to the availability and processing power of modern statistical software (*xxi*). However, with regard to performance-based funding analysis specifically, Dougherty and Reddy's (2013) review of research designs and indicator selection in performance-funding analysis identifies only a small number of studies employing hierarchical linear models (56).

Thomas Rabovsky's (2012) research methodology is particularly instructive for this present study. Rabovsky's analysis of the significance of higher education performance funding programs on both state budgets and institutional spending priorities

(Rabovsky 2012, 675) is built around an examination of Integrated Postsecondary Education Data Systems (IPEDS) outcomes data (2012, 680). Rabovsky's use of publicly available federal data points to the considerable value of longitudinal datasets in funding research, as well as the importance of selecting an appropriate methodological approach. In particular, Rabovsky's use of IPEDS data has enabled him to go beyond a straightforward evaluation of the relationship between funding and outcomes to construct a regression model that evaluates elements of "institutional behavior" as a component of performance funding analysis (680). This involves modeling the significance of spending priorities such as research spending upon the underlying "causal logic" within the institutions themselves (679).

Rabovsky observed that most higher education performance funding studies have evaluated only the direct relationship between funding and outcomes, without appreciating the intermediary "causal logic" that comprises the chain of decisions between funding and outcomes (Rabovsky 2012, 679). This intermediary impact, Rabovsky notes, can include the effect that performance policies can have upon the restructuring of incentives, which in turn produces an "administrative response" that yields a change in outcomes (679). Because most studies have evaluated only the direct relationship between performance indicators and outcomes without considering the intermediary causal steps, an appreciable level of insight into the role of socioeconomic factors and institutional behavior is often lost (697). Rabovsky's analysis did not identify a statistically significant relationship between state-level funding policy and outcomes; however, he noted the need for further research on mission-based differentiation in state funding formulae (Rabovsky 2012, 697).

As the literature makes clear, substantial economic work continues to be done in the arena of higher education funding analysis. However, the literature is much less clear with regard to the basis upon which state-level political decisions are made. Because performance-based funding policies are developed at the state level, the role of political forces and decision-making processes must be carefully understood as a significant component of the funding process. The next section will explore the literature regarding the political nature of higher education performance funding.

Political Forces Driving Performance Funding

A number of recent studies have explored the inherently political nature of higher education funding at the state level, addressing a range of issues including policy development and implementation (Carnevale, Johnson, and Edwards 1998; Dougherty, Natow, Hare, and Vega 2010), as well as the effect and significance of performance funding on outcomes and reporting (Cohen and Kisker 2009; Rabovsky 2012). Zarkesh and Beas (2004) highlighted a key observation about the political context of performance funding research and implementation, noting that state-level budget initiatives are often driven more by the political priorities of policy advocates than by the particular mission-focused needs of the states (Zarkesh and Beas 2004, 63-64).

With regard to the political process, John Kingdon's (1995) examination of the political environment in which ideas arise (and the conditions under which they take root) offers particularly valuable insight here. Kingdon observed that political issues arise within the context of separate "streams," including "problems, solutions, participants, and choice opportunities" (90). Because each stream "has a life of its own" apart from other separate channels (90), many policy theories and potential solutions remain unattached to

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specific political problems (Kingdon 1995, 123). Political motivations for enacting

legislation often arise only when an idea that has been sustained in one political stream

becomes attached, through a window of opportunity, to another stream (123). Burke and

Associates (2002) observed the applicability of Kingdon's theory to the increased

popularity of performance funding in the 1990s (Burke and Associates 2002, *xiv*). As

they observed, "The intersection of problems and politics caused a search for a new

budgeting policy" (*xv*). In particular, financial pressures from the impact of a recession

on state revenues brought both budgetary cuts and increased public scrutiny to what were

becoming viewed as inefficiencies in higher education (*xiv*).

In recent years, the political rhetoric surrounding state performance-based funding

initiatives has revealed both the political passion and empirical uncertainty impacting

these programs. Case studies are presented here from Louisiana and Ohio as illustrations

of this trend. The state of Louisiana has experimented with forms of both performance

funding and performance budgeting since 2001 (Burke and Associates 2002, 24-25);

however, the IPEDS data presented in Table 2 for Louisiana shows that public university

six-year graduation rates have varied widely in the state between 2002 and 2010:

Table 2: Louisiana Public University Six-Year Graduation Rates, 2002-2010

Year	Six-Year Graduation Rate
2002	31.09
2003	29.19
2004	27.23
2005	31.62
2006	26.15
2007	35.54
2008	34.90
2009	35.81
2010	33.01

Source: NCES: Integrated Postsecondary Education Data System (IPEDS) http://nces.ed.gov/ipeds/, January 4, 2014

In 2010, Louisiana Governor Bobby Jindal signed the state's "Granting Resources and Autonomy" (GRAD) Act, which offered an incentive-based variation of its existing performance funding policies. These new incentives included "increased autonomy and flexibility" over factors such as tuition and fee levels when institutions reach performance benchmarks (State of Louisiana 2014). Furthermore, in 2013, Louisiana State Representative Steve Carter spoke to the Louisiana Senate Education Committee in favor of Senate Bill 117, which proposed the creation of an "Outcomes-Based Funding Task Force" (Louisiana State Legislature 2014). As Carter stated, "…something needs to be done. And this may not be the end of all but it is a tremendous start…to ensure that every youngster in this state gets a quality education" (McGaughy 2013). However, as of June 3, 2013, SB117 failed to pass, and this has halted progress toward the creation of this task force (State of Louisiana 2014). Because of these policy changes, additional years of data will be needed to evaluate the significance of Louisiana's performance-based initiatives.

In contrast to the Louisiana model, however, the story of performance-based funding in Ohio highlights a substantially more focused policy initiative. For many years, Ohio had relied on an enrollment-driven funding model that was operated within a highly decentralized state university governance structure (Burke and Associates 2002, 170). However, Ohio's institutions were struggling to achieve successful academic outcomes, and its relatively low tax revenues had driven tuition levels ever higher in order to sustain funding levels (172-173). Because of this, in the mid 1990s public pressures to improve higher education accessibility and performance precipitated a change. Ohio's newly formed Higher Education Funding Commission developed a streamlined performance-funding model focusing on a few key indicators, rather than a more complex funding

formula that would have been difficult to implement (NCSL 2013). From both the political and institutional points of view, this approach proved to be successful. Ohio's performance has continued to improve, and since that time the state has refined its performance-funding model with a greater focus on degree attainment rather than course completions (NCSL 2013).

As the research literature has shown, state-level performance funding policies continue to be shaped by a complex range of political factors, and the political nature of performance funding impacts the efforts of both policy makers and the institutions being evaluated. As Moynihan (2008) stated, "we should put aside notions that performance data is neutral, scientific, or definitive, but assume that it represents the interests of an advocate seeking to persuade" (193). Moynihan argued that performance information might be better viewed as "an interactive dialogue between interested actors" (195). Taken together, the work of Kingdon and Moynihan both offer valuable reminders that the politically-charged motivations of entrenched interests can emerge in almost every component of performance funding, including the selection, implementation, and interpretation of funding formula components and outcomes metrics, as well as institutional reporting.

Qualitative studies and interviews also reveal the effect that the implementation of performance funding policies can have on multiple levels of faculty and administration within a given institution. Lorber (2001) interviewed eighteen Tennessee Technological University faculty members and administrators in his qualitative study of performance funding impact between 1979 and 1999. Although the majority of university officials identified a perceived association between performance funding and improved outcomes

(Lorber 2001, 67), few indicated an awareness of any direct policy changes, curricular

changes, or other academic or accreditation-related policy implementations that were a

direct result of performance funding (67). Lorber's study highlights the potential

breakdown that can occur in an institution within its internal policy communication and

implementation procedures.

Furthermore, Cohen and Kisker (2009) observe that the pressure felt by

institution-level actors in performance funding implementation can potentially lead to a

shift in motivations, which can result in questionable and even deceptive behavior. As

they note, "…in states where performance-based funding has been tried, some

institutional managers have been tempted to be less than forthright about the data they

submit" (Cohen and Kisker 2009, 522). In fact, Rabovsky noted several studies that

observe the implications for research when institutions are tempted to "game the system"

in their reporting, including the manipulation of outcomes data in order to maximize

short-term funding at the expense of long-term strategic initiatives (Rabovsky 2012, 677).

Gaining insight into the complexity of the relationship between performance

funding and accountability is a central focus of this study, and its significance for both

the interpretation of research and the future direction of state-level policy is considerable.

In this regard, a review of the literature reveals that only a few state-level systems have

been in existence long enough to provide meaningful data for analysis of policy change.

Dougherty, Natow, Hare, and Vega (2010) highlighted the need for future research in

their evaluation of Tennessee and Florida data as examples of "long-lasting state

performance funding systems" (1). As they put it, because "the operation of political

forces is not exhausted by the passage of legislation" (1), their analysis points toward an

important direction for future research as more states produce meaningful data. Their research offers particularly meaningful insight regarding the political and social sources of change in funding factors (Dougherty, Natow, Hare, and Vega 2010, 2-4). As an example, they described the Tennessee Higher Education Commission's addition of transfer rates into the Tennessee funding formula, which was enacted after concerns about transfer issues by parents and students had reached the Tennessee legislature (3). Without the benefit of additional research in the relatively small number of states with sufficient longitudinal performance funding data, policy decisions such as these risk unintended consequences in their educational outcomes.

From a policy standpoint, Dougherty, Natow, Hare, and Vega (2010) also point to significant reasons that performance funding has not spread more fully across the nation. Their qualitative research draws on interviews and existing research literature in order to evaluate several shared "circumstances" or factors among the six states that they identified as having encouraged the rise of performance funding models, including "a revenue/cost squeeze on elected government officials, business demand for greater government efficiency and lower costs, and a rising Republican presence in state legislatures" (Dougherty, Natow, Hare, and Vega 2010, 1). Interestingly, their study found that among the six states studied, public pressure was not generally a significant factor in the development of higher education policy (2). This finding, while beyond the scope of the present study, points to an important area for further research.

Challenges to Performance Funding Policy

Several studies have offered important critiques and limitations of the implementation, assumptions, and analysis of performance funding. In particular,

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Dougherty and Hong (2006) observed several obstacles to reaching the stated goals of performance systems in the six states they observed, including the significant issue of "funding instability" (72). Harnisch (2011) noted the inconsistent track record of performance funding over time, observing that out of the 26 states that adopted performance-based funding models between 1979 and 2007 (3), many programs were eliminated due to such factors as state-level cuts, misalignment of measurements and campus missions (3), and "lack of sustained support from political and campus leaders" (3). Harnisch also observed that performance funding could reduce incentives for institutions to address issues of access, especially for low-income students (8). Some critics argue that by rewarding a focus upon a limited subset of outcomes, performance funding fundamentally distorts the missions of universities, potentially encouraging a move away from equally valuable, if less quantifiable, benefits of higher education (8).

The failure of the Arkansas performance-based funding model in the late 1990s is an interesting example of the consequences of poor alignment between funding and mission. Burke and Associates (2002) observe that one factor leading to the dismantling of the Arkansas performance funding program in the 1990s was a failure to differentiate between mission-based institutional differences, and even between two-year and four-year institutional categories (225). Their "monolithic model that covered all institutions, whatever their differences in sector or mission" (225) yielded frustration and infighting among the institutions that suffered from the poorly implemented distribution model (225).

As mentioned above, the literature points to the critical nature of implementation as a function of policy communication, and in this light Burke and Minassians (2003)

observed what they consider to be "a common and fatal flaw" (Burke and Minassians 2003, 20) in funding policy implementation. Their analysis is based on 2003 State Higher Education Finance Officers (SHEFO) survey data. At the institutional level, they noted that performance-based funding as an overall strategy often does not translate down to the internal decision-making structure of the university. In their analysis, they observe that unless internal departments are held to the same standards of implementation that university systems themselves are, performance-based systems are "unlikely to improve substantially the performance of colleges and universities" (Burke and Minassians 2003, 20).

Interestingly, in this regard the rhetoric of concern surrounding performance funding has often magnified what is for many states a relatively small budgetary impact (Burke and Associates 2002, 266-267). Since many state policies currently reserve only a minimal percentage of total funding to performance measures (National Conference of State Legislatures [NCSL] 2013), Burke and Associates are correct in noting that "[p]erformance funding really represents more of a conceptual than a funding shift" (Burke and Associates 2002, 267). The potential policy implications of this observation will be addressed further in Chapter 5, with specific regard to the results of this study.

While considerable progress has been made since the 1980s in the examination of performance funding's association with institutional outcomes, Rabovsky observed that as of 2012, "serious gaps" still remained in the understanding of performance funding's significance for both the institutional and state levels in higher education (Rabovsky 2012, 676). The research literature repeatedly points to the significance of the mediating role of state-level political and economic factors. Clearly, performance-based funding

policies do not exist in a vacuum, and they are rarely implemented apart from the complex interplay of outside political issues. The literature reveals the need to focus carefully on mediating economic factors, duration, and degree of implementation as variables in quantitative analysis (Shin 2010, et al.), and for this reason, this study will incorporate a wide range of socioeconomic control variables.

Summary

As the literature shows, within a span of less than 50 years performance funding has emerged as a major component of higher education budget policies in many states. During this same time period, these funding initiatives have in some cases retracted as initial programs began to fail in many states, and then re-emerged again in recent years as economic and political forces placed additional pressures on state funding policy. While a limited number of studies have examined the role of specific performance-funding policies implemented on individual state levels, the research in general has not found significant evidence of any meaningful association of performance-based higher education funding with higher education outcomes measures through the analysis of longitudinal data (Dougherty and Reddy 2013, 79-80). A clear need exists for a much more thorough understanding of the behavior, significance, and limitations of performance indicators in higher education funding, and this current study is designed to address these gaps in the research literature.

In essence, the literature surrounding performance-based funding continues to wrestle with the underlying question of impact. As states continue to develop and promote performance-based initiatives that are often based on politically motivated goals, the need for further research regarding the most frequently selected performance

outcomes factors remains critical. It is the intent of this study to address the needs

identified in the literature by evaluating the research hypotheses presented in Chapter 3.

The following section will outline in detail the methodology and procedures that will be

used in this analysis.

Chapter III

METHODOLOGY

This chapter will present a detailed outline of the study's research design and

methodology, including the specific measures and procedures that will be used to

evaluate the research hypotheses presented below. First, the data sources for the study

including the IPEDS: Delta Cost Project Database and other sources will be discussed,

and the reliability and limitations of these data sources will be addressed. Next, the

dependent, independent, and control variables that comprise this study's longitudinal

dataset will be presented. Based on the nature of the dataset, research questions, and

conceptual framework, the selection of the methodological approach that will be used in

this study will then be outlined, and the specific procedural steps that will be followed in

order to evaluate the research hypotheses will be detailed.

Research Questions

This study will examine the following research questions:

1. Is the *amount* of state-level performance funding associated with *completion rate* as an

institutional outcome in four-year public universities in the U.S. over time?

2. Is the *duration* of state-level performance funding associated with *completion rate* as

an institutional outcome in four-year public universities in the U.S. over time?

3. Is the *amount* of state-level performance funding associated with *retention rate* as an

institutional outcome in four-year public universities in the U.S. over time?

4. Is the *duration* of state-level performance funding associated with *retention rate* as an institutional outcome in four-year public universities in the U.S. over time?

These research questions will be evaluated through an examination of the following null and alternative hypotheses for each pair of dependent and independent variables:

I. Research Hypotheses for *Amount* and *Completion*

Null Hypothesis (H_0): *Amount* of performance funding at the state level is not associated with *completion rate* among U.S. four-year public universities.

Alternative Hypothesis (H_1): *Amount* of performance funding at the state level has a positive, statistically significant association with *completion rate* among U.S. four-year public universities.

II. Research Hypotheses for *Duration* and *Completion*

Null Hypothesis (H_0): *Duration* of performance funding at the state level is not associated with *completion rate* among U.S. four-year public universities.

Alternative Hypothesis (H_1): *Duration* of performance funding at the state level has a positive, statistically significant association with *completion rate* among U.S. four-year public universities.

III. Research Hypotheses for *Amount* and *Retention*

Null Hypothesis (H_0): *Amount* of performance funding at the state level is not associated with *retention rate* among U.S. four-year public universities.

Alternative Hypothesis (H_1): *Amount* of performance funding at the state level has a positive, statistically significant association with *retention rate* among U.S. four-year public universities.

IV. Research Hypotheses for *Duration* and *Retention*

Null Hypothesis (H_0): *Duration* of performance funding at the state level is not associated with *retention rate* among U.S. four-year public universities.

Alternative Hypothesis (H_1): *Duration* of performance funding at the state level has a positive, statistically significant association with *retention rate* among U.S. four-year public universities.

Description of the Dataset

The research hypotheses will be evaluated through the quantitative analysis of a 50-state panel dataset, representing the population of all institutions from the IPEDS: Delta Cost Project Database matching the Carnegie classifications "Public Bachelors," "Public Masters," and "Public Research" (NCES 2013a), during the years 2004 to 2010. The unit of observation in this study will be examined on three levels: level one is the individual observation (institution-year); level two is the institution level; and level three is the state level. The dataset contains 3,372 individual observations, which will provide the first level of the hierarchical analysis. These individual observations are grouped into 482 institution-level units based on the IPEDS variable *unitid*, which will provide the second level of analysis. The institution-level units are then organized into 50 state-level groupings across seven years, ranging from 2004 to 2010.

In addition to this seven-year longitudinal panel, 482 observations from the year 2003 will be added in order to create initial values for the lagged independent variable *Amount*. The size of the panel will allow for evaluation using pooled Ordinary Least Squares (OLS) analysis as well as hierarchical linear regression (HLM) modeling, which will enable the evaluation of multilevel variation among institutions, states, and levels of performance-based funding implementation over time (Raudenbush and Bryk 2002, 4).

In this dataset, the following 14 states are represented by at least one year of performance funding implementation during the 2004-2010 period: Colorado, Florida, Georgia, Illinois, Indiana, Kansas, Kentucky, Louisiana, New Mexico, Ohio, Oklahoma, Pennsylvania, South Dakota, and Tennessee (NCES 2013a). During the years 2004 to 2010, 200 institutions within these 14 states were impacted by performance funding for at

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least one year. Each of these states has a *Duration* value greater than zero for at least one year during the years 2004 to 2010, as illustrated in Table 7 in Appendix A. There are 421 institutions in 36 states that did not implement performance funding during this period, and these states therefore have *Duration* values of zero for each year in the dataset.

In addition to the institution-level data obtained through IPEDS, state-level control variables will be added to the panel data from sources including the National Conference of State Legislatures [NCSL] (2013), Bureau of Labor Statistics [BLS] (2013), and Bureau of Economic Analysis [BEA] (2013) datasets. These data sources and the control variables added from these sources are outlined in detail below.

All dollar values in the data including tuition, tax revenue, and state-level appropriations will be scaled to 2010 dollars using the Higher Education Price Index (HEPI) (Lenihan 2012, 3) for consistent comparison across years and sectors (Gillen and Robe 2011, 4). The Commonfund Institute maintains the HEPI, and beginning with 2002 data, Commonfund rescaled this index to reflect a more accurate comparison between the HEPI and Consumer Price Index (CPI) (Commonfund Institute 2013). These rescaled index values for each year are used by the IPEDS: Delta Cost Project Database, and they are reflected in the 2004 to 2010 panel data evaluated in this study. As Gillen and Robe point out, "[t]he main use of price indices is to allow for valid comparisons of values from different years and also to allow for comparisons across sectors" (Gillen and Robe 2011, 4). However, they also note that the Higher Education Price Index must be carefully applied in economic arguments, to avoid out-of-context comparisons such as a false sense of equivalency among economic sources (for instance, potentially conflating a

description of "what happened" with "an argument for why it happened") (Gillen and Robe 2011, 4). The application of these issues with regard to the interpretation of this study's results will be addressed in Chapter 5.

Sample Size and Reliability of Data Sources

There are 3,372 individual observations represented in the panel dataset for the criteria selected for this study. However, institutions have in some cases not reported all data points for each year, and for this reason these observations form an unbalanced panel. The maximum sample for which all variable data are present is represented by 2,452 observations. For this reason, in order to obtain a balanced panel dataset, this study's analysis will employ a sample of 2,452 observations representing 482 institutions within 50 states.

The IPEDS: Delta Cost Project Database is a publicly available, longitudinal dataset developed by the American Institutes for Research and currently maintained by the National Center for Education Statistics (Lenihan 2012, 1). This dataset was developed with the goal of "mak[ing] data from the Integrated Postsecondary Education Data System (IPEDS) more readily usable for longitudinal analysis" (1). The IPEDS survey is a mandatory reporting requirement for all educational institutions that receive federal Title IV funds ("Higher Education Opportunity Act", P. L. 110-315), and as a result, the IPEDS: Delta Cost Project Database represents all institutions in this population. In addition to IPEDS data, limited amounts of data obtained through the Financial Institution Shared Assessment Program (FISAP) are also incorporated into the dataset (NCES 2011, 3).

Since the results of the first IPEDS reporting year became available in 1987 (Fuller 2011, 6), many changes have taken place including the expansion of scope of the IPEDS survey (6), as well as changes to institutions and state university systems. Also, federal reporting requirements have continued to evolve, including those mandated through the 1998 amendments to the Higher Education Act of 1965, which served to expand the amount of "'consumer information' that NCES is required to provide" (Fuller 2011, 8). Because of this, the IPEDS: Delta Cost Project has attempted to maximize the consistency and reliability of IPEDS data across the 1987-2010 time period by harmonizing annual reporting results (NCES 2011, 4), creating consistent primary key identifiers, and developing "matched sets" wherever possible for institutional data in order to maximize the amount of complete information across the full dataset's span of years (Fuller 2011, 2).

Where single-year gaps in data exist, the IPEDS: Delta Cost Project Database presents imputed values (NCES 2011, 10-11), unless those values arise at either the first or last position in the longitudinal series (11). Where gaps of two or more years exist, no data are imputed (11). The standards for IPEDS reporting continue to be guided by the U.S. Department of Education through the National Center for Education Statistics (Fuller 2011, 1), and as a whole, the IPEDS: Delta Cost Project Database represents a very high quality, reliable source of higher education data.

The preparation of data for this study will also involve the incorporation of publicly available state-level financial information from three additional data sources. First, the Bureau of Census conducts the Current Population Survey (CPS) monthly for the U.S. Department of Labor, Bureau of Labor Statistics (BLS 2013). This survey's

published results include average annual unemployment rates by state. These rates will be added as the control variable *Unemployment* by state for each institution in the IPEDS: Delta Cost Project Database from 2004 to 2010.

In addition, the U.S. Department of Commerce publishes quarterly National Income and Product Accounts (NIPA) estimates through the Bureau of Economic Analysis (BEA 2012). These estimates outline a broad range of economic output measures designed to "serve as primary indicators of the current condition of the U.S. economy" (BEA 2012, 3). State-level personal income is published as a component of these reports each year, and these values will be added as the control variable *Income* in this study for each institution in the IPEDS: Delta Cost Project Database from 2004 to 2010. Because the NIPA estimates are a component of the System of National Accounts (SNA), they serve as a primary source of major economic drivers and economic modeling for the federal government (5). As such, the accuracy and reliability of these systems are watched closely, and the revision models and other aspects of the NIPA estimates are addressed in detail in the literature (Mayerhauser and Pack 2013).

The Urban Institute-Brookings Institution Tax Policy Center has compiled data from the U.S. Census Bureau's *Annual Survey of State and Local Government Finance* (Tax Policy Center 2013). These data include per-capita tax revenue collected by each state for selected years, including the years 2004 to 2010 that will be evaluated in this study. These values will be used to construct the state-level control variable *Tax* for each institution in the IPEDS: Delta Cost Project Database.

Description of Measures

This section outlines the dependent, independent, and control variables that will be examined in this study. A detailed description of variables and descriptive statistics is presented in Tables 6 and 10 in Appendix A. All descriptive statistics presented in this section are produced using the Stata/IC 13.1 software package running on Mac OS X 10.9.1. Final selection of the variables used in the regression analyses will depend on a full interpretation of the descriptive statistics, tests, and measures of fit reviewed in this section. These results and the full regression models will be presented in Chapter 4.

Some of the variables in this study are based on per-student ratios derived from the IPEDS full-time equivalent (FTE) calculation of enrollment at each institution. These FTE values are calculated using the following formulae, based on the type of institution:

Table 3: Full-Time Equivalent (FTE) Calculations Based on Student Classification

Undergraduate enrollment at public four-year institutions	FTE = full-time count + part-time count*0.403543
Undergraduate enrollment at all other institutions	FTE = full-time count + part-time count*0.397058
Enrollment in programs classified as First-Professional	FTE = full-time count + part-time count*0.6
Graduate enrollment	FTE = full-time count + part-time count*0.361702

Source: National Center for Education Statistics (http://nces.ed.gov/ipeds/glossary/index.asp)

<u>Dependent Variables</u>. The dependent variables *Completion* and *Retention* represent the most frequently used indicators of institutional success for four-year colleges and universities (Burke and Associates 2002, 46). The dependent variable *Completion* represents the student completion rate per institution per year, which is measured as the ratio of total student completions at each institution, divided by total full-time-equivalent (FTE) enrollment per year. These values will be calculated using the IPEDS variable *totalcompletions*, defined as "Number of total degrees, awards and certificates granted,"

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and the IPEDS variable *fte_count*, defined as "Total fall FTE student enrollment" (NCES 2013b).

$$Completion = \frac{totalcompletions}{fte\_count}$$

The dependent variable *Retention* represents the percentage of FTE enrolled students who returned the following year at each institution. Full-time retention rate has consistently been one of the most commonly used performance indicators for four-year institutions in the research literature (Burke and Associates 2002, 69-71; Rabovsky 2012, 680). The IPEDS: Delta Cost Project Database variable *ftretention_rate,* defined as "Full-time retention rate" (NCES 2013b), was incorporated as a data point in the IPEDS surveys in 2003 (Rabovsky 2012, 681), and *Retention* will be produced using this variable in the present study.

Independent Variables. The following independent variables represent direct financial measures of state-level performance funding policy. By incorporating funding *Duration* as an independent variable in addition to total appropriation amount, this study addresses the research hypotheses by exploring a dimension of performance funding not frequently studied in the literature (Rabovsky 2012, 676; Shin 2010).

The independent variable *Amount* represents the dollar amount of state-level appropriations per FTE student, measured in 2010 HEPI-adjusted dollars and lagged by one year. This variable represents the direct measure of performance funding for each institution (NCES 2013b). These values will be produced using the following IPEDS variables: *state03* ("Revenue from state appropriations") which is lagged by one year; *fte_count* ("Total fall FTE student enrollment"), which is lagged by one year; and *hepi_scalar2010* (Higher Education Price Index (HEPI) 2010 scalar) (NCES 2013b).

$$Amount = \frac{\left[\frac{state03}{fte\_count}\right]}{hepi\_scalar2010}$$

Because states allocate performance-based funds for a given year based on the previous

year's outcomes, both *state03* and *fte_count* are lagged by one year in the calculation

above.

The dependent variable *Duration* represents the cumulative number of years that

each state's performance funding policy has been implemented as of each year, for each

institution. Table 7 in Appendix A presents the *Duration* values for each state in the

dataset. The variable *Duration* was constructed using data compiled by the National

Conference of State Legislatures (NCSL 2013). For example, if an institution's state had

first implemented its performance funding policy in 2002, the variable *Duration* would

subsequently have a value of 2 for the year 2004. If a state discontinued its performance

funding policy in a given year, *Duration* would then have a value of 0 beginning in the

year the policy was discontinued. The addition of *Duration* as an independent variable

will offer potential insight into the long-term behavior of performance funding in a way

that has not yet been comprehensively examined in the literature.

Institution-Level Control Variables. By accounting for the behavior of state and

institution-level control variables in this study's regression models, the additional effects

of the independent variables can be more clearly understood in comparison to the

unconditional model. A careful selection of control variables in this study is based on the

review of the literature, availability of data, and potential relevance to the research

questions listed above. These variables represent several characteristics of individual

institutions in the dataset, which can exhibit variability across institutions in a given year,

and within individual institutions from year to year. Control variable selection makes use of the extensive range of information available through the IPEDS: Delta Cost Project Database in order to control for a number of factors that are potentially associated with performance at the institutional level.

The institution-level control variable *Pell* represents the average federal Pell grant award per FTE student. The federal Pell grant is awarded to individual students based on their qualifications as determined through the Free Application for Federal Student Aid (FAFSA) (Federal Student Aid [FSA] 2014). These values are adjusted to 2010 dollars using the HEPI index. These values will be calculated using the following IPEDS variables: *grant01* ("Pell Grants"); *fte_count* ("Total fall FTE student enrollment"); and *hepi_scalar2010* ("Higher Education Price Index (HEPI) 2010 scalar") (NCES 2013b).

$$Pell = \frac{\left[\frac{grant01}{fte\_count}\right]}{hepi\_scalar2010}$$

Institution-level Carnegie Classification data are based on values of *carnegie2005* ("Carnegie Classification 2005") in the IPEDS: Delta Cost Project Database (NCES 2013b). The Carnegie Foundation developed a categorization for colleges and universities in the 1970s, and these classifications have become a standard method of controlling for institutional mission in higher education research (McCormick et al. 2009, 145). Carnegie Classification categories have been revised several times since the 1970s, and the 2005 revisions incorporated a range of new factors that expanded their applicability and utility for higher education research (146). The Carnegie Classifications selected for analysis in this study include the values 15 to 23. This range of values

encompasses the groups of institutions for which the performance outcomes variables *Completion* and *Retention* represent the most relevant measures.

In the Carnegie 2005 Classification, values 15-17 represent research universities. As mentioned in Chapter 1, an example of an institution with this classification is the University of Tennessee, whose flagship campus is in Knoxville, Tennessee. In 2010, this university system had an enrollment of 43,905 full-time equivalent students, a mean completion rate of 22.55 percent, and a mean retention rate of 84.0 percent (NCES 2013b). In addition, Carnegie Classification values 18-20 represent master's degree granting colleges and universities. An example of this category is Indiana State University in Indianapolis, Indiana. In 2010, this institution had a full-time equivalent enrollment of 9,044 students, a mean completion rate of 22.9 percent, and a mean retention rate of 64.0 percent (NCES 2013b). Values 21-23 in the IPEDS data represent bachelor's degree-granting colleges and universities using Carnegie Classifications. An example of an institution in this category is Wright State University in Dayton, Ohio. In 2010, this institution had a full-time equivalent enrollment of 16,195 students, a mean completion rate of 22.67 percent, and a mean retention rate of 70.0 percent (NCES 2013b).

Using the IPEDS dataset variable *carnegie2005* in this study's analysis, these Carnegie Classification values have been recoded in order to create three dummy variables: *Carnegie_Research, Carnegie_Masters,* and *Carnegie_Bachelors*. Values 15 through 17 have been coded *Carnegie_Research* = 1, values 18 through 20 have been coded *Carnegie_Masters* = 1, and values 21 through 23 have been coded

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Carnegie_Bachelors = 1. Table 8 in Appendix A displays the distribution of institutions represented by each Carnegie 2005 Classification.

The institution-level control variable *SATMATH75* represents the College Board Scholastic Assessment Test (SAT) Math I scores at the 75th percentile. College entrance exam scores, including SAT and ACT test scores, are among the most commonly used measure of aptitude in higher education research. For instance, Grove, Wasserman, and Grodner (2006) observed that 70 percent of economics studies use college entrance scores as a proxy for aptitude (132). The values for *SATMATH75* are calculated using the value *satmt75* from the IPEDS: Delta Cost Project Database (NCES 2013b). In addition to the SAT I Math scores used in this study, SAT I Verbal scores at the 75th percentile are also available in the IPEDS dataset; however, a preliminary examination of variance inflation factors (VIF) reveals a relatively high degree of collinearity between SAT Math and Verbal scores. For this reason, only the IPEDS value *SATMATH75* will be included in the study.

The institution-level control variable *Tuition* represents the in-state tuition and fees established for each institution per year. The IPEDS: Delta Cost Project Database reports several levels of tuition per institution that are based on student classifications and other categories. However, for the purposes of this study, the IPEDS variable *tuitionfee02_tf* representing "in-state tuition and fees per student" will be used as a standard of comparison (NCES 2013b). These values are adjusted to 2010 dollars using the HEPI index. These values will be produced using the following IPEDS variables: *tuitionfee02_tf* ("In-state tuition and fees for full-time undergraduates (Sticker price)") and *hepi_scalar2010* (Higher Education Price Index (HEPI) 2010 scalar) (NCES 2013b).

$$Tuition = \frac{tuitionfee02\_tf}{hepi\_scalar2010}$$

The institution-level control variable *Faculty* represents the average number of full-time instructional faculty employed at each institution per full-time equivalent (FTE) student, as reported by the institution. This ratio is commonly used in the research literature as a proxy for class size (Monks and Schmidt 2011, 1). These values will be calculated using the following IPEDS variables: *faculty_instr_headcount* ("Total number of full-time instructional faculty") and *fte_count* ("Total fall FTE student enrollment") (NCES 2013b).

$$Faculty = \frac{faculty\_instr\_headcount}{fte\_count}$$

The institution-level control variable *Minority* represents the percentage of non-white students enrolled at each institution per year. Ross and Kena (2012) reported considerable disparity in the percentage of students enrolled in college compared by racial category (Ross and Kena 2012, 162-163). While the importance of controlling for factors such as minority enrollment is well demonstrated in the research literature (Reardon and Robinson 2008, 497), methods for codifying and evaluating minority enrollment vary greatly (Martin et al. 2013, 641-642). Sirin's (2005) meta-analysis of studies from 1990 to 2000 examined the relationship between socioeconomic status and academic achievement, showing that minority status had a moderating effect (417; 435). In this study, these values will be calculated using the following IPEDS variables: *total_enrollment* ("Total Enrollment") and *total_enrollment_white_tot* ("Total Enrollment (White)") (NCES 2013b).

$$Minority = \frac{total\_enrollment - total\_enrollment\_white\_tot}{total\_enrollment}$$

State-Level Control Variables. The following variables represent characteristics of state-level groupings. The additional economic data from the sources outlined below provide a much wider range of control variables than is available through IPEDS data alone. This study follows the approach of hierarchical studies in performance funding such as Shin and Milton (2004), Shin (2010), and Rabovsky (2012) in the incorporation of state-level control variables, as discussed in Chapter 2. The variable *Statenum* translates the *State* text string name from the IPEDS: Delta Cost Project data into a corresponding integer value ranging from one to fifty, in order to provide a state-level grouping for hierarchical analysis.

Because performance-based funding is developed and implemented at the state level, researchers including Dougherty and Reddy (2013) and Shin (2010, 54) have noted the importance of incorporating state-level variables to control for the impact of economic factors demonstrated in the literature (Shin and Milton 2004; Heller 1997). This can enhance the analytical potential of the state-level grouping in the hierarchical model. State-level control variables exhibit no variability for institutions within the same state for a given year. However, they do exhibit variability for institutions across different states within a given year, and across the longitudinal years of the dataset.

A large number of studies have examined the significance of socioeconomic (SES) factors for student academic achievement, and a number of studies have drawn on Bureau of Labor Statistics longitudinal data such as the National Longitudinal Survey of Youth 1979 to examine these relationships (Jaeger 2012, 904-905). Three economic variables will be incorporated into the IPEDS dataset for this study. First, the state-level control variable *Unemployment* represents the unemployment rate reported by the U.S.

Department of Labor, Bureau of Labor Statistics for each state from 2004 to 2010.

Individuals are classified as unemployed if they meet the following criteria: "Persons are

classified as unemployed if they do not have a job, have actively looked for work in the

prior 4 weeks, and are currently available for work" (BLS 2013).

Next, the variable *Income* represents the average personal income reported by the

U.S. Department of Commerce, Bureau of Economic Analysis for each state from 2004

to 2010. These values are adjusted to 2010 dollars using the HEPI index, as described

above. While studies have demonstrated a positive relationship between average earnings

and such factors as educational enrollment (Braunstein, McGrath, and Pescatrice 1999),

the wide range of analytical approaches in the research literature for factors such as

family income reveals the complexity of evaluating and controlling for SES factors

(Cameron and Taber 2004, 137). In this study, the state-level control variable *Tax*

represents the average state and local tax revenue as reported by the Brookings

Institution's Tax Policy Center for each state from 2004 to 2010. These values are also

adjusted to 2010 dollars using the HEPI index.

Collinearity Analysis

Final selection of variables for the HLM analysis depends on an examination of

collinearity among potential regressors. Variance inflation factor analysis will provide the

basis for rejecting any potential regressors for the HLM model that demonstrate a high

level of collinearity (Chatterjee and Hadi 2012, 250). The selection of variables for the

regression models in this study will be evaluated based on the results of this analysis.

Table 9 in Appendix A presents the results of collinearity analysis, displaying the

variance inflation factor (VIF) for each independent variable. A VIF statistic of 10 or

greater is an indication of collinearity among variables (Chatterjee and Hadi 2012, 250). In the results presented in Table 9, *SATMATH75* and *SATVERBAL75* exhibited a relatively high degree of collinearity, and for this reason *SATVERBAL75* was not included in the final model. In addition, the variable *Carnegie_Bachelors* was removed from the analysis in order to avoid the presence of collinearity with the other two dummy variables, *Carnegie_Research* and *Carnegie_Masters*. All other independent variables fell within the recommended tolerance (250).

Analytic Strategy

This section will outline the specific steps that will be taken in order to build each level of the hierarchical model. The methodological approach selected for this study is based on a number of factors including the structure of the dataset itself (Luke 2004, 23), which is composed of institution-level observations nested within state-level groups, across a longitudinal dimension with repeated annual observations (NCES 2013a). As noted in Chapter 2, this study's conceptual framework is based on the overarching issue of policy effectiveness in higher education performance-based funding. As the literature review makes clear, understanding policy effectiveness in performance funding requires an examination of policy implementation on multiple levels. Because of this, the research design and methodology outlined in this chapter have been selected with this conceptual framework in mind. The methodological approach for this study will involve the following steps:

1. Evaluation of Descriptive Statistics. First, regressors will be selected based on an evaluation of descriptive statistics and collinearity analysis, and the preliminary evaluation of correlations among variables. Evaluation of descriptive statistics will

provide an understanding of central tendency and spread, and consideration of these factors will be instructive in determining the final selection of regressors for analysis. This preliminary exploration of the variables of interest will include examinations of means, standard deviations for each variable, and other descriptive statistics (Frees 2004, 25). Correlation matrices and VIF statistics will also be evaluated to determine the significance of relationships, and the potential multicollinearity among covariates (Remler and Van Ryzin 2011, 297). This analysis will provide an initial evaluation of significant relationships among variables. Based on an evaluation of the descriptive statistics and measures of variance, an initial outline of significant relationships among variables will be developed.

2. Pooled OLS Analysis. Next, pooled OLS will be performed on the unconditional models for *Completion* and *Retention*. This analysis will yield preliminary indications of statistically significant relationships. However, pooled OLS will not provide a sufficient basis upon which to make determinations about relationships within and between variables among the levels of analysis (Raudenbush and Bryk 2002, 86-87).

3. Unconditional HLM Model. The next step in this analysis will be the evaluation of the unconditional HLM model, which will provide information about variability within and among observations (Raudenbush and Bryk 2002, 69). The appropriateness of HLM analysis will be determined through an evaluation of Intraclass Correlation (ICC) for each unconditional model (Hox 2010, 33-36). Because performance-based funding policies are implemented at the state level and carried out by individual institutions on an annual budgetary timeframe, the variables of interest in the IPEDS data correspond naturally to a three-level hierarchical framework. For this reason, hierarchical linear regression (HLM)

analysis is well suited as a methodological approach for this study (Raudenbush and Bryk 2002, 4). This approach has been demonstrated in the literature to serve as an effective tool in higher education research. Variance components will be partitioned at each level of analysis in order to provide a baseline of comparison for the full model (Hox 2010, 69-70). The ability to segment variability into groupings by level (Raudenbush and Bryk 2002, 230) is a key advantage of multilevel analysis and will be discussed further in the interpretation of results in Chapter 4.

4. Full HLM Model. At this point the full hierarchical model will be constructed, and the nested, multilevel models for both *Completion* and *Retention* will then be regressed using Stata software. The slopes and standard error components for the full model will be interpreted, and the significance of each level's control variables will be evaluated by comparing the unconditional and full models (Hox 2010, 16; 77). Statistical significance of coefficients will be considered, and the research hypotheses will then be evaluated in light of these results for each level of the hierarchical model. Based on the results of this analysis, a full interpretation of results will follow in Chapter 5.

The following section describes a generalized form of the hierarchical models that will be evaluated at each level of analysis. This three-level outline closely follows the model of Raudenbush and Bryk (2002, 229-234). The flexibility of the HLM model allows for the treatment of the longitudinal time-specific measure as level one, which in this case will represent each year of the institutional observations. At level one, the unconditional models for each dependent variable can be expressed as follows:

Level One: Observation-level. The level one unconditional model for *Completion* is expressed as follows:

$$Completion_{ijk} = \pi_{ijk} + e_{ijk}$$

in which $Completion_{ijk}$ = completion rate for observation i, institution j, state k (Raudenbush and Bryk 2002, 229). In this model, π_{ijk} = the average completion rate of institution j, state k, and e_{ijk} = the random effect component (the deviation of an observation ijk's completion rate from the mean institution) (229). Adding coefficients to this unconditional model yields the following:

$$Completion_{ijk} = \pi_{0jk} + \pi_{1jk}Duration_{ijk} + \pi_{2jk}Amount_{ijk} + e_{ijk}.$$

The level one model for *Retention* will be constructed following the same structural pattern.

Level Two: Institution-level. Extending this model to level two for each observation-level mean value of π_{ijk} above, Raudenbush and Bryk (2002) describe the institution-level model that be expressed as follows (229):

$$\pi_{0jk} = \beta_{00k} + r_{0jk}$$

In this expression, β_{00k}= the mean completion rate for state k, and r_{0jk}= the random effect for institution j. When the regressors from level two are added to this unconditional model, each observation-level coefficient from π_{1jk} to π_{pjk} will have the corresponding regression expression as follows:

$$\pi_{pjk} =$$
$$\beta_{p0k} + \beta_{p1k}Pell + \beta_{p2k}Carnegie\_Research_{pjk} + \beta_{p3k}Carnegie\_Masters_{pjk} + \beta_{p4k}SATMATH75_{pjk} + \beta_{p5k}Tuition_{pjk} + \beta_{p6k}Faculty_{pjk} + \beta_{p7k}Minority_{pjk} + r_{pjk}.$$

The level two regression equations for the dependent variable *Retention* will be constructed following the same pattern for each observation-level coefficient from π_{1jk} to π_{pjk} (Raudenbush and Bryk 2002, 229-230).

Level Three: State-level. At the state level, each coefficient from the institution-level expression will be represented as a function of level three (state-level) predictors (Luke 2004, 10):

$$\beta_{00k} = \gamma_{000} + u_{00k}$$

In this expression, γ_{000} = the grand mean for *Completion*, and u_{00k} = the random effect component for state (Raudenbush and Bryk 2002, 230). The state-level variables at this level of analysis are *Unemployment, Income*, and *Tax*, and for each coefficient in the range β_{p1k} to β_{pqk} the following full model can be expressed as follows:

$$\beta_{pqk} = \gamma_{pq0} + \gamma_{pq1}Unemployment + \gamma_{pq2}Income + \gamma_{pq3}Tax + u_{pqk}.$$

The level three regression equations for the dependent variable *Retention* will be constructed following the same pattern for each observation-level coefficient $\beta_{p1k} \ldots \beta_{pqk}$.

Combining each level of analysis above yields the following, full model for *Completion*:

Completion = B$_0$ + B$_1$*Amount* + B$_2$*Minority + B$_3$*Pell + B$_4$*SATMATH75 + B$_5$*Tuition
+B$_6$*Faculty + B$_7$*Duration + B$_8$*Tax + B$_9$*Income + B$_{10}$*Unemployment +
B$_{11}$**Carnegie_Research* + B$_{12}$*Carnegie_Masters

In a similar way, the following full model is constructed for *Retention*:

Retention = B$_0$ + B$_1$*Amount* + B$_2$*Minority + B$_3$*Pell + B$_4$*SATMATH75 + B$_5$*Tuition
+B$_6$*Faculty + B$_7$*Duration + B$_8$*Tax + B$_9$*Income + B$_{10}$*Unemployment +
B$_{11}$**Carnegie_Research* + B$_{12}$*Carnegie_Masters

Methodological Limitations of the Study

This study contains several limitations in design and scope, and the nature of the data also yields certain delimitations that will be outlined here. While the IPEDS: Delta Cost Project Database contains a wide range of institution-level and state-level factors, this study will be limited to those primary indicators of student outcomes and primary funding components of state-level performance policies identified in the literature (Shin and Milton 2004, 4). As noted above, although the IPEDS: Delta Cost Project Database contains values representing institutions of all Carnegie 2005 Classifications, this study will be limited to those institutions for which *Retention* and *Completion* are the most accurate measures of institutional outcomes, namely those institutions with Carnegie Classification having values 15 to 23 in the IPEDS data (NCES 2013a). This limitation has a precedent in the literature with the Carnegie Classification selections used in the research design of Shin (2003). This selection of Carnegie values therefore excludes community and technical colleges, for-profit institutions, and other specialty institutions from the study (Zarkesh and Beas 2004, 70).

An additional delimitation is the time period evaluated in this study, which will be restricted to the years 2004 to 2010. Although the National Center for Education Statistics began to collect a limited amount of data through the IPEDS survey beginning in 1987 (Fuller 2011, 5-6), the full range of variables evaluated in this study is not fully available prior to 2003. The time period selected for this study will allow for the analysis of a balanced panel dataset.

Chapter 4 will present the test results for the analytical procedures outlined above. The results of each statistical test will be outlined, and statistical significance and other

appropriate measures will be presented for each analytical step (Rudestam and Newton

2007, 121). Based on these findings, regression coefficients will be determined for the

hierarchical models at each level for each dependent variable *Completion* and *Retention*.

Based on these test results, an evaluation of the research hypotheses will then be

presented.

Chapter IV

FINDINGS

By implementing the methodology outlined in Chapter 3, this study has sought to

evaluate the association of performance-based funding policy *Amount* and *Duration* with

the two most frequently-used measures of educational outcomes in U.S. public colleges

and universities, which are *Completion* and *Retention* rates. The analytical strategy for

this study has involved the following steps: first, descriptive statistics for the dependent

and independent variables were analyzed, and variance inflation factor statistics were

evaluated in order to determine the degree of collinearity among independent variables.

Based on this preliminary analysis, the final selection of regressors was determined.

Next, a pooled OLS model was evaluated without regard for the longitudinal and nested

structure of the dataset, in order to gain preliminary insight into relationships between the

dependent and independent variables.

Following the evaluation of the pooled OLS model, an unconditional Hierarchical

Linear Regression (HLM) model (also known as a multilevel model) for each dependent

variable was evaluated, and the Intraclass Correlation (ICC) statistics for these models

were calculated in order to assess the need for HLM. Finally, full HLM models for

Completion and *Retention* were evaluated in order to determine slopes, standard errors,

and the statistical significance of relationships at each level. Substantive conclusions are

based on the analyses of the full multilevel models, and these results are presented in this

chapter. These findings will be used to evaluate this study's research hypotheses.

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Descriptive Statistics and Correlation Analysis

First, descriptive statistics for the variables examined in this study are presented in Tables 10 through 12 in Appendix A. Table 12 shows that across all observations in the IPEDS dataset, public four-year colleges and universities from the years 2004 to 2010 saw *Completion* rates increase at an average of .36 percent each year over the seven-year period, ranging from 22.84 percent in 2004 to 23.42 percent in 2010. Both performance funding states and non-performance states increased their mean *Completion* rates across the seven-year period; however, performance-based funding states increased *Completion* rates at a higher annual average rate than did non-performance funding states. In addition, performance-based funding states increased these average annual rates more often (in six out of seven years) than non-performance funding states did.

The examination of descriptive statistics for the dependent variable *Retention* shows that while both performance-based funding states and non-performance funding states exhibited increases in *Retention* rates between 2004 and 2010, the rates for performance-based funding states increased at a higher average annual rate (.77 percentage points per year) than non-performance funding states did (.56 percentage points per year). While this pattern seems to imply that performance-based funding policies have been successful in driving *Retention* rates, further analysis in the sections to follow will show that the relationship between funding policy implementation and *Retention* is statistically more complex. Understanding the scope of this relationship will depend on a full examination using multilevel analysis.

An evaluation of the independent variables *Duration* and *Amount* reveals that, although the number of states and institutions that received performance-based funding

dollars did increase between the years 2004 and 2010, in general the average funding

levels in those states changed minimally throughout that period. Specifically, in the

IPEDS dataset sample for the year 2004, a total of 92 institutions among 9 states had

received performance-based funding dollars for at least one year. In 2010, this number

increased to 126 institutions in 12 states. Furthermore, among the states that received

performance funding each year, the mean values for *Amount* stayed nearly unchanged,

increasing from $7,040.93 in 2004 (in HEPI-scaled 2010 dollars) to $7,074.56 in 2010.

However, it should be noted that although the mean values in the panel data for these

years remained almost constant, funding levels in individual states in some cases changed

substantially. The results of multilevel analysis will provide further insight into the

significance of both the institution-level and state-level changes with regard to the

dependent variables.

These descriptive statistics paint a highly mixed picture of performance-based

funding trends from 2004 to 2010. While growth trends in policy adoption at the state

level are evident, the results of correlation analysis presented in Table 11 in Appendix A

show that little correlation exists among the dependent variables *Retention* and

Completion and the independent variables *Amount* and *Duration* in the pooled data.

Furthermore, certain patterns that are apparent at the institutional level vary markedly

from those observed at the state level. Based merely on these preliminary patterns, it is

therefore tempting to conclude that these dependent and independent variables have no

statistically significant relationships. However, due to the multilevel structure of the

IPEDS data, these initial patterns and the results of correlation analysis alone do not

provide a sufficient basis for this conclusion (Raudenbush and Bryk 2002, 86-87).

Because of this, a pooled OLS regression model for each dependent variable was constructed, and the next section presents the results of the pooled OLS regression analysis.

Pooled OLS Models

At this stage of analysis, a full ordinary least squares (OLS) regression model was evaluated for each dependent variable using the regressors described in Tables 13 and 14 in Appendix A. The results of this analysis were used to consider initial relationships among variables in the pooled IPEDS: Delta Cost Project dataset, without regard to the longitudinal and nested structure of the data. Tables 13 and 14 outline the results of this regression analysis. The adjusted R^2 values for these models indicate that the regression model for *Completion* described approximately 33.08 percent of the relationship, and the regression model for *Retention* described approximately 55.04 percent of the relationship.

The results of the OLS analysis for the *Completion* model indicate that a statistically significant relationship between *Completion* and the independent variable *Amount* does exist. However, given the range of values for *Amount* in the IPEDS dataset, this relationship represents only a very small practical range of effect. Further examination of the relationship between *Completion* and *Amount* will be discussed in the analysis of full HLM results below. In addition, no statistically significant relationship was identified between *Completion* and the independent variable *Duration*.

Furthermore, the results of OLS analysis for the Retention model show no significant relationship between the dependent variable *Retention* and the independent variables *Amount* and *Duration*. These initial findings from the pooled OLS analysis for

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both dependent variables point to the need for further investigation using HLM methods, taking into account the longitudinal and nested structure of the data.

However, several other statistically significant control variable relationships were demonstrated in the pooled OLS model, including *Pell*, *Carnegie_Research*, *Carnegie_Masters*, *SATMATH75*, *Tuition*, *Faculty*, *Unemployment*, and *Income*. While statistical significance is observed for these control variables, substantively the results are of only limited value. However, the relationship and significance of the control variable *Faculty* with *Completion* is in fact meaningful. Since the variables *Faculty* and *Completion* are both measured in percentage rates, the results show that with all other factors held constant, each percentage point increase in full-time faculty per FTE student is associated with a .30 percentage point increase in *Completion* rate.

The practical significance of this result can be seen by considering the range of values for *Faculty*: since values within two standard deviations of the mean for *Faculty* range from 1.97 percent to 7.17 percent, the range of values for *Faculty* could produce between a .30 and 1.55 percentage point increase for approximately 95.45 percent of the values of *Completion*. Although this result does not directly impact the research hypotheses addressed by this study, this preliminary finding represents a potentially important direction for further research. Because of this, the relationship between *Faculty* and *Completion* will be examined further in the HLM analysis below, so that these institution-level effects can be further investigated.

In summary, the results from the pooled OLS regression have provided initial insight into the behavior of the independent and dependent variables without regard to the longitudinal and hierarchical nature of the dataset. The next step in this study's analytical

strategy was to determine whether *Completion* and *Retention* exhibited variance among groups, taking into consideration the hierarchical structure of the data. Based on an evaluation of the appropriateness of this strategy using the results of the ICC statistic in the unconditional model, the full three-level hierarchical model was evaluated. An interpretation of the results of this analysis is presented below.

Three-Level Hierarchical Linear Regression Model

This section presents the results of the evaluation of HLM models for both *Completion* and *Retention*. Prior to evaluating the HLM models, it was necessary to determine whether variability exists among regressors at each level of the hierarchical model (Shin 2003, 102). Evaluating the unconditional model serves two primary purposes in this regard: first, it allows for the decomposition of level-specific variance components (Hox 2010, 15), providing insight into the proportion of variation accounted for by each grouping level. Second, as Hox states, evaluating the unconditional model "serves as a benchmark with which other models are compared" (16). This provided a basis for comparison of the full HLM model, in order to account for the relative improvement of the addition of independent and control variables. The following sections establish this benchmark through the analysis of intercept-only models for *Completion* and *Retention*.

Intraclass Correlation (ICC). Calculating the likelihood ratio (LR) statistic for the unconditional HLM model provided a means to test the null hypothesis that there is no variance among groups (Hox 2010, 47). If there were no basis to reject this null hypothesis, then the use of HLM analysis would not be warranted. However, in this case the p-value of the test statistic was 0, so the null hypothesis was in fact rejected. As a

result, this analysis indicates that there is intraclass variance among groups, and for this reason the full HLM model will be evaluated. Table 4 outlines the ICC analysis results for the unconditional model for *Completion*, which is used in order to estimate relative levels of correlation within each level of analysis (Hox 2010, 14).

Table 4: Unconditional Model Intraclass Correlation (ICC) for *Completion*

Level	ICC (Std. Error)
State Level	.12 (.04)
Institution Level	.84 (.01)

Table 4 reveals a key insight into the distribution of variance among levels in the IPEDS data for *Completion*. Specifically, the correlation of institutions within states (level two) is high, at .84. This is interpreted to mean that approximately 84 percent of variance of *Completion* is explained at level two, by the grouping of institutions within states (Hox 2010, 15-17). Furthermore, the variance of *Completion* at the state level (level three) is much lower, at approximately 12 percent. Identifying the partitioned variance at each level is a key benefit of HLM analysis, and the potential implications of this variance distribution will be discussed further in Chapter 5 in the interpretation of results.

As with the unconditional *Completion* model above, the results of the likelihood ratio test for *Retention* rejected the null hypothesis that there is no variance among groups. Therefore, the full HLM model for *Retention* will be evaluated. An evaluation of the ICC components for the unconditional *Retention* model produced the following results shown in Table 5:

Table 5: Unconditional Model Intraclass Correlation (ICC) for *Retention*

Level	ICC (Std. Error)
State Level	.18 (.04)
Institution Level	.78 (.01)

Based on the ICC level-specific components in Table 5, the correlation of institutions within states (level two) is high, at .78. That is, approximately 78 percent of the variance of *Retention* among institutions can be explained by their grouping within states (Hox 2010, 15). The intraclass correlation among states at level three is much lower, at .18, so approximately 18 percent of the variance can be explained at the state level. Considering the results of both the *Completion* and *Retention* ICC analysis together allows a picture of the relative significance of institution-level factors as a whole to become much clearer: these results show that for the two most commonly used measures of performance funding outcomes in colleges and universities from 2004 to 2010, institution-level factors accounted for over *three-quarters* of the partitioned variance.

In summary, an analysis of pooled OLS models for the dependent variables *Completion* and *Retention* do not reveal meaningful relationships between the independent and dependent variables. Furthermore, an evaluation of the ICC components for *Completion* and *Retention* indicates that multilevel analysis is an appropriate means of gaining further insight into level-specific relationships, due to the distribution of variance between the group means at each level. In the following section, the results of the full HLM analyses for each dependent variable are presented.

Results for the Full HLM Model for *Completion*

The results of the preliminary analyses presented above show the significant range of variance distribution among the levels in the full model. At this point, the full hierarchical linear model for the dependent variable *Completion* was conducted. Table 15 in Appendix A displays the slopes and standard error results of the full HLM analysis for

the dependent variable *Completion*. The statistically significant results of this analysis are presented in this section.

First, a very small, yet statistically significant, relationship between the variables *Completion* and *Amount* was exhibited in the results of the HLM analysis. Specifically, for each dollar increase in *Amount,* a resulting .00000108 percent change in *Completion* rate was observed, with all other factors held constant. Although this result is statistically significant, because of the effective upper limits of institutional funding levels found in the data, such a small change in *Completion* rate has no meaningful effect. Nevertheless, this finding is in fact highly significant with regard to its implications for policy legislation. Since state-level performance-based funding initiatives are implicitly built on the assumption that funding amounts do in fact impact outcomes, the fact that this study finds no meaningful statistical relationship among those factors certainly brings the underlying policy assumptions into question. The implications of this finding will be discussed further in Chapter 5.

Next, a number of institution-level variables were found to have statistically significant relationships with the dependent variables. The following statistically significant institution-level relationships were observed: with all other factors held constant, each percent increase in *SATMATH75* produced only a .00004 percent increase in *Completion.* As with the independent variable *Amount*, the effective relationship of *SATMATH75* on *Completion* is not meaningful within the range of data under evaluation. However, the findings with regard to the dependent variable *Faculty* do represent a meaningful relationship with the dependent variable: for each percent increase in *Faculty*, a resulting 1.58 percent increase in *Completion* is observed. While this result is not

directly related to the research hypotheses, it does represent a potentially significant direction for further research.

The following statistically significant relationships at the state level were observed: with all other factors held constant, each dollar increase in *Income* yields a .00000124 percent increase in *Completion*. Also, each percent increase in *Minority* resulted in a -.03 percent decrease in *Completion*. It is important to understand the controlling effects of socioeconomic factors such as these, and in particular the fact that neither *Income* nor *Minority* exhibited more than a slight association with *Completion* is a significant finding. Understanding the role of state-level socioeconomic factors is particularly important in light of the fact that, as discussed above, only 11.8 percent of the variance was explained at the state level for the HLM *Completion* model. These results point clearly to the fact that institution-level factors describe a much more substantial portion of the model than state-level factors. The additional insight gained by an evaluation of the state-level socioeconomic factors *Income* and *Minority* will provide context for an interpretation of these results in Chapter 5.

In addition to these institutional and state-level factors, the results of analysis for the dummy variables comprising the Carnegie Classification categories (shown in Table 8 in Appendix A) reveal that for institutions categorized as *Carnegie_Research*, completion rates were .05 percent higher than for the reference category *Carnegie_Bachelors*. Also, for institutions categorized as *Carnegie_Masters,* completion rates were .04 percent higher than for *Carnegie_Bachelors* with all other factors held constant. While these factors exhibit moderate statistical significance, as with many other

factors in the full HLM model they demonstrate only very limited practical significance for the model as a whole.

Proportion Reduction of Variance for the HLM *Completion* Model. Finally, in the HLM analysis for the dependent variable *Completion*, the addition of the control variables listed in Tables 15 and 16 in Appendix A produced a considerable reduction of variance in within-group means at each level. This was determined by comparing the random effects parameters of the unconditional model with the full model (Shin 2003, 128). Specifically, a 61.05 percent reduction in variance was produced at the observation level, a 70.54 percent reduction at the institutional level, and a 27.95 percent reduction at the state level. As Shin (2003) notes, one benefit of HLM analysis is "to improve the precision in parameter estimation" at each level of analysis (128). The substantial reduction in variance explained by the addition of control variables in this model illustrates the level of adequacy for the model as a whole.

Results for the Full HLM Model for *Retention*. Table 16 in Appendix A presents the slopes and standard errors for the full HLM model for *Retention*. Based on the coefficients of the regressors selected for the full model, the following statistically significant institution-level relationships were observed: with all other factors held constant, for each dollar increase in *Pell,* a resulting .00002 percent decrease in *Retention* was observed. For each unit increase in *SATMATH75*, a resulting .0006 percent increase in *Retention* was observed. For each dollar increase in *Tuition*, a .00000044 percent increase in *Retention* was observed. While these results are statistically significant, because of the very small coefficient size of the regressors, the maximum range of

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association with the dependent variable is extremely limited. In realistic terms, these factors can be said to have no practical significance for the dependent variable *Retention*.

In addition to the institution-level relationships, the following statistically significant state-level relationships were observed: with other factors held constant, for each dollar increase in *Income*, a .0000033 percent increase in *Retention* was observed, with all other factors held constant. As discussed in the results of the *Completion* model above, identifying such a small level of practical significance from the controlling effect of *Income* at the state level is in fact a valuable insight that will help to provide a better understanding of the landscape of institution-level and state-level factors as a whole. These issues, and their implications for performance-based funding policy implementation, will be discussed in Chapter 5 below.

The results of analysis for the Carnegie Classification category dummy variables in the *Retention* model reveal that for institutions categorized as *Carnegie_Research*, retention rates were .005 percent higher than for the reference category *Carnegie_Bachelors*. Also, retention rates for institutions categorized as *Carnegie_Masters* were .06 percent higher than for the reference category *Carnegie_Bachelors,* with all other factors held constant. This has an extremely small effect on the *Retention* model as a whole.

Proportion Reduction of Variance for the HLM *Retention* Model. The significance of adding institution-level and state-level control variables at each level of the full HLM model for *Retention* was measured by determining the percent change of total variance between the unconditional and full models. As was observed for the dependent variable *Completion* above, a substantial reduction in variance was also observed at each level for

the *Retention* model, including an 11.64 percent reduction at the observation level, a 76.67 percent reduction at the institution level, and a 65.53 percent reduction at the state level.

Evaluation of Hypotheses

The preceding section has presented the results of HLM analysis for the full models of both the *Completion* and *Retention* dependent variables. Regressors were selected based on an analysis of variance and ICC components, and slopes and standard error components were evaluated to determine the statistical significance of each variable in the full model at each level, with all other factors held constant. In addition, the proportion reduction of total variance was compared between the unconditional and full models at each level in order to determine the significance of incorporating institution-level and state-level variables.

Based on the results presented above, a determination can now be made for the evaluation of the null and alternative hypotheses for each pair of dependent and independent variables.

I. Evaluation of Research Hypotheses for *Amount* and *Completion*

Null Hypothesis (H_0): *Amount* of performance funding at the state level is not associated with *completion rate* among U.S. four-year public universities.

Alternative Hypothesis (H_1): *Amount* of performance funding at the state level has a positive, statistically significant association with *completion rate* among U.S. four-year public universities.

Although the evaluation of the relationship between *Amount* and *Completion* yields marginally significant results, because of the actual dollar limit of values for *Amount* in the IPEDS dataset, such a small change in *Completion* in fact has no meaningful significance. As Gelman and Stern (2006) observe, in some cases "statistical

significance is not the same as practical importance" (328). Thus, based on these findings the null hypothesis for *Amount* and *Completion* cannot be rejected.

II. Evaluation of Research Hypotheses for *Duration* and *Completion*

Null Hypothesis (H_0): *Duration* of performance funding at the state level is not associated with *completion rate* among U.S. four-year public universities.

Alternative Hypothesis (H_1): *Duration* of performance funding at the state level has a positive, statistically significant association with *completion rate* among U.S. four-year public universities.

Because *Duration* does not exhibit a statistically significant relationship with

Completion in the full model, the null hypothesis for *Duration* and *Completion* cannot be

rejected.

III. Evaluation of Research Hypotheses for *Amount* and *Retention*

Null Hypothesis (H_0): *Amount* of performance funding at the state level is not associated with *retention rate* among U.S. four-year public universities.

Alternative Hypothesis (H_1): *Amount* of performance funding at the state level has a positive, statistically significant association with *retention rate* among U.S. four-year public universities.

The independent variable *Amount* did not exhibit a statistically significant

relationship with *Retention* in the full model. Therefore, on this basis the null hypothesis

for *Amount* and *Retention* cannot be rejected.

IV. *Duration* and *Retention*

Null Hypothesis (H_0): *Duration* of performance funding at the state level is not associated with *retention rate* among U.S. four-year public universities.

Alternative Hypothesis (H_1): *Duration* of performance funding at the state level has a positive, statistically significant association with *retention rate* among U.S. four-year public universities.

Duration did not exhibit a statistically significant relationship with *Retention* in the full model, and on this basis the null hypothesis for *Duration* and *Completion* cannot be rejected.

In summary, no practical statistical significance was found between the two independent variables *Amount* or *Duration* and the two primary measures of performance outcomes in higher education, *Completion* and *Retention*. Because of this, these findings fail to reject the null hypotheses evaluated in this study. The results of the analysis of completion rate corroborate the findings of other primary studies conducted to date: Shin (2010) concludes that based on the factors of his study, "state characteristics …account for very little institutional performance" (63). Furthermore, based on the partitioning of variance presented in Chapter 4, this study agrees with the findings of Shin (2010, 63) and other studies suggesting that institution-level factors influence performance-based funding outcomes to a substantially greater degree than state-level factors.

The findings of this study with regard to the independent variable *Duration* represent an original contribution to the literature, and they offer potentially significant insights into the behavior of performance-based higher education policy. As discussed in Chapter 2, studies such as Burke and Associates (2002), Dougherty and Hong (2006), and Harnisch (2011) have reviewed the number of years that various state performance funding policies have been in effect. In addition, Shin's (2003) study of performance addresses policy duration by evaluating states with three or more years of sustained performance funding policy implementation, compared with those having less than three years. However, no other published study using longitudinal data in the research literature has evaluated performance-based funding using incremental years of policy duration as a

factor in state higher education effectiveness. Furthermore, in some studies such as Dougherty (2013, 62), the implicit assumption that funding duration contributes to outcomes increases has been made without adequate evidence or analysis. This study offers a corrective to this assumption in both research and policy implementation, as will be discussed further in Chapter 5.

Table 7 in Appendix A illustrates the fact that relatively few states have experienced long-term duration of performance funding implementation. Approximately 76 percent of the observations in the IPEDS: Delta Cost Project data had a *Duration* value of 0 years, and approximately 16 percent had a *Duration* value of one to ten years. Less than five percent of states had performance funding policies in effect for more than ten consecutive years at any time between 2004 and 2010. As states move into longer-term periods in funding duration, the evaluation of additional data would contribute substantially to a better understanding of performance funding effectiveness.

Although not directly related to the research hypotheses, several other institution-level and state-level control variables in this study were found to be meaningfully associated with higher education outcomes measures, and these results can offer additional insight into the overall relationship between performance funding and outcomes. In particular, the highest level of statistical significance found among the variables considered in this study is the institution-level relationship between *Faculty* and *Completion*, representing full-time faculty per FTE student and completion rate. The results of HLM analysis show that each percentage increase in *Faculty* is associated with a 1.58 percent increase in *Completion*, with all other factors held constant. Based on the range of values for these variables in the IPEDS data between the years 2004 and 2010,

two standard deviations around the mean of *Faculty* (4.57 percent ± 1.30 percent) would yield a ± 4.11 percent change in *Completion*. This represents a potentially significant relationship with completion rates for public colleges and universities, and it points to the growing evidence in this study's results that it was the inclusion of institution-level factors, to a much greater degree than state-level factors, that was associated with increases in completion and retention rates at public colleges and universities from 2004 to 2010.

An evaluation of the random effects components of the multilevel analyses in this study reinforces this finding: while variance at each level of analysis decreased significantly with the addition of institution-level and state-level control variables for both *Completion* and *Retention*, it was the addition of control variables at the institution level for each model that explained the greatest proportion of variance reduction. This finding points clearly to the fact that while performance funding initiatives across the U.S. have focused on rewarding state-level factors, colleges and universities would potentially benefit if funding policies focused more specifically on institution-level factors.

These results point to the critical need for researchers to understand much more comprehensively the role and significance of institutional factors in performance-based higher education funding. For instance, the findings presented above illustrate the fact that full-time faculty per-student ratios were significantly associated with completion rates between 2004 and 2010. Interpreting this single finding from the perspective of state funding legislation necessitates a much more thorough understanding of the ways in which state funding currently impacts faculty hiring and retention, as well as the current

relationship between funding levels and enrollment. These insights point to meaningful

directions for future research, with regard to both the formulation of policy at the

legislative level and the implementation of these policies at the institutional level. These

potential implications will be explored in further detail in Chapter 5.

Chapter V

DISCUSSION

This study has evaluated the relationship of performance-based funding amount and program duration with the institution-level and state-level outcomes of four-year public colleges and universities between 2004 and 2010. The findings presented in Chapter 4 identified only a small amount of statistically meaningful association between the independent variables *Amount* and *Duration* and the performance funding outcomes indicators measured by the dependent variables *Completion* and *Retention*. Based on these results, it was concluded that state level performance-based higher education funding has not exhibited a meaningful association with completion rates or retention rates in U.S. public colleges and universities.

This chapter will interpret these results with specific attention to their implications for state-level and institution-level policy stakeholders, including higher education boards and university administrators. The findings presented in Chapter 4 address a significant gap in the existing literature with regard to performance funding research in higher education. These findings can potentially be used in order to address current political trends in funding policy implementation among states nationwide, in addition to a range of other factors impacting policy implementation at the institutional level. Furthermore, the interpretation of these findings could serve as a resource to guide state legislators, as well as administrators in higher education institutions across the country.

Taken as a whole, this study's findings contribute to the existing research literature in a way that helps to clarify the status of performance-based higher education funding in the United States. This research shows that current performance funding policies are not achieving desired results. However, there are indications of potential directions for greater policy effectiveness. These potential ways forward have critical implications both for policy development in states and for policy implementation in higher education institutions. Recommendations will be outlined for policymakers and institutional administrators based on these findings. In addition, several limitations with regard to the applicability of these results will be discussed, and directions for further research will be proposed.

Applying the Results of Analysis: The Political Context

For decades, a nationwide interest in improving student performance has driven the development of policies seeking to achieve more efficient, cost effective higher education delivery at the state level (Burke and Associates 2002, 2-5). Because higher education policy is a function of the states, progress toward these goals has taken shape in many different ways, and the specific forms that higher education delivery and funding have taken in the states have often been highly contested in the political arena. Because of this, opportunities for political action have often depended on politically expedient moments in which "streams" of political opportunity (Kingdon 1995, 123) have arisen in state legislatures. For this reason, factors such as the use of performance data, selection of outcomes indicators, and resulting funding policies have emerged not merely as neutral representations of student achievement, but as issues that are frequently wrapped in the rhetoric of political actors within states (Moynihan 2008, 193-195).

With this political backdrop in mind, an increasingly complex relationship between funding and higher education accountability has developed throughout the decades, and the continued process of research and debate has taken shape within the context of issues including performance accountability and academic freedom (Dumont 1980, 412-413); accountability and program efficiency (Burke and Associates 2002, 2-5); cost structure, price and productivity analysis (Cohn, et al. 1989, 284); and the multi-product character of higher education output (Paulsen and Smart 2001, 162). The research literature shows that these trends have often had quite significant implications for the development of higher education policy. For instance, because economic drivers play a primary role in the development of education policy, the high degree of emphasis in recent decades upon program efficiency has resulted in the reinterpretation of academic outcomes using "economic vocabularies" (Barnetson and Cutright 2000, 288-290). This has often resulted in the misalignment of state goals with institution-level mission. As mentioned in Chapter 2, Harnisch (2011) addresses the fact that economic incentives inherently distort institutional motivations, encouraging or facilitating certain behaviors while dissuading others (2011, 7-8). Because of the impact this can have on the methods by which policy is evaluated and implemented, it is important to interpret this study's findings with regard to *Completion* and *Retention* in this light.

Implications of Independent Variable Analysis

Although performance-based funding policies in many states have been developed with the intent to preserve institution-specific missions by translating them into elaborate funding formulae, these efforts often risk further distorting these goals as academic missions are viewed through political and economic lenses (Harnisch 2011, 7-

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8). Ultimately, the research literature shows that the structure of performance-based funding policies depends on the characteristics of the linkages between funding and outcomes. The fact that funding amount was not found to have a meaningful association with completion rate or retention rate means that either additional linkages must be incorporated into the existing state-level funding polices, or else alternative funding strategies must be established. These implications have significance for state legislators, higher education governing boards, and institutional administrators, and they will be explored in detail in this chapter.

As Burke and Minassians (2003) have observed, the success of funding policy not only depends on the establishment of legislation at the state level, but also on the ability of an institution to communicate policy expectations to its stakeholders within the organization. In addition to this, successful implementation requires the institution to convey the purpose of the policy and to set standards for internal completion and accountability for the execution of policy (Burke and Minassians 2003, 20). As Shin and Milton's (2004) findings make clear, because institutions depend on complex, interconnected systems of accountability, effective performance funding depends on successful communication and implementation at every level (Shin and Milton 2004, 16-17).

This study's findings with regard to faculty-student ratio are particularly significant in this light. The implications of the *Retention* outcomes of this study are indicative of the issues of mission and resource misalignment at the institutional level. No significant association was found between performance funding amount and retention rate, nor between program duration and retention rate. Interpreting this finding requires a

careful understanding of the extensive student retention research literature, and it certainly opens the door for a host of further research questions related to the role of institutional factors.

The work of Tinto (2006) is instructive in this regard. Tinto describes the progress made in retention research throughout the years, noting that in past decades, student persistence was first attributed primarily to individual traits such as motivation and individual academic skills (Tinto 2006, 2). However, subsequent studies revealed that in addition to these primarily "psychological" factors (4), the roles of academic and social environments were highly associated with persistence in the pre-college years and, in particular, in the critical first-year college experience (2-3). While all these factors were important, Tinto also notes that retention studies throughout the 1980s and 1990s offered further insight, identifying the role of faculty involvement in student retention (3-5).

Clearly, a wide range of influences makes a difference in student retention, and key insights can be drawn from the historic pattern of retention research in the interpretation of this study's results. While performance-based policy makes funding available for institutions based on outcomes that are linked to institutional objectives, this process clearly depends on the institution's individual capacity to allocate and administer those funds based on its own highly specific institution-level context. The results of this study imply that colleges and universities are not accomplishing the work of directing funding effectively toward the institution-specific areas that make a difference for student retention.

The implications of this study's findings with regard to performance funding duration are equally significant. The results of HLM analysis revealed that the

independent variable *Duration* had no statistically significant associations with the two most commonly held outcomes measures of public university systems. That is, in states that implemented performance funding policies, even when the initiatives were given longer periods of sustained implementation, no increased significance for college completion rate or retention rate was observed. These findings have potentially significant implications for researchers and policymakers, in particular because they corroborate the relatively small number of studies in the research literature that have addressed the role of policy duration in higher education funding research. Specifically, they confirm the research of Shin (2010), whose HLM analysis evaluated graduation rates and research funding levels as dependent variables. Shin concluded that the duration of performance funding program made no difference in graduation rate (59).

The findings with regard to funding duration have particularly significant implications for higher education policy, precisely because state-level performance funding initiatives have historically been built upon the assumption that policy duration *does* impact outcomes. In fact, the literature suggests that even in studies in which these initiatives were determined not to exhibit a statistically significant association with outcomes, the role of sustained program duration is still often presumed to be a meaningful factor in increasing funding effectiveness. For instance, although Shin and Milton (2004) concluded that graduation rates were not associated with the presence of performance-based funding between 1997 and 2001 in four-year institutions in the United States, their project summary included the recommendation that "[p]olicy-makers are advised to sustain [performance-based funding] programs long enough until such programs bear their fruits or are proven ineffective" (Shin and Milton 2004, 1-2).

Additionally, Dougherty and Hong (2006) observed the general presence of "funding instability" (72) as an obstacle to achieving the objectives of performance funding in the six states they studied, implying that a more stable, sustained duration could have promoted outcomes achievement. Dougherty and Reddy (2013) also make the following claim: "Many performance funding programs do not last for many years, thus undercutting their capacity to produce effects" (62).

Clearly, this study's findings challenge the underlying assumption that additional years of performance funding can add to a "capacity to produce effects" (Dougherty and Reddy 2013, 62), at least with performance funding policies as they are currently implemented. However, it should be noted that because many states have recently launched performance-based funding policies, additional years of data are in fact needed to evaluate fully the significance of these programs. As shown in Table 7 in Appendix A, less than five percent of states have had more than ten consecutive years of higher education performance funding policies in effect at any time in the IPEDS data between 2004 and 2010, and in many cases, states are only in the first or second years of program implementation. Therefore, it is the recommendation of this study that additional longitudinal years of data should be evaluated in a follow-up study, in order to evaluate new state programs after additional values for *Duration* are added.

In addition to the implications outlined for the independent variables, some statistically significant relationships among institution-level and state-level control variables were identified as well. However, the results of the full HLM model show that these control variables generally contributed to the model only minimally. In fact, the only institution-level factor found to have a meaningful association with completion rate

was faculty-student ratio. The implications of this finding will be discussed further below. While other institution-level and state-level variables were found to be statistically significant, their practical significance given the range of values found in the data was not found to be meaningful.

Implications of Control Variable Analysis

What can be learned from the very limited relationship that was identified between funding and institutional outcomes? In general, these findings are consistent with recent research literature that has addressed factors associated with student retention rate, as outlined from Tinto (2006) above. The trends exhibited in retention rate research throughout the years are particularly instructive in the context of this study's findings. As Tinto (2006) makes clear, many student achievement outcomes that were once thought to be attributable to factors outside the institution have subsequently been found, through the examination of longitudinal data, to be more closely related to institution-level factors within the university's administrative structure (2-5). This pattern of refining research trends by examining institutional factors more closely corroborates the findings of this study. Clearly, state-level goals ultimately require more effective institution-level implementation.

Furthermore, although this study has incorporated a relatively wide range of socioeconomic factors that were selected based on a review of the research literature, it is the case that incorporating additional factors could offer further insights. In fact, the primary implication of this study's evaluation of socioeconomic controls is to clarify what does *not* make a significant difference in performance funding. Because such factors such as average salary, minority percentage, average state tax revenue, and

unemployment rate are not associated with funding success, further research is needed

that focuses on identifying additional factors that can potentially lead to the development

of more effective funding policies.

In addition to the insights that have been gained from an evaluation of the

independent and control variables in the multilevel model, the partitioned variance levels

presented in Chapter 4 further demonstrate the importance of institution-level

characteristics, as compared to the less significant role of state-level factors. This study

found that for both the *Completion* and *Retention* models, the incorporation of institution-

level factors in the full HLM models accounted for the greatest amount of variance

reduction: approximately 70.54 percent in the *Completion* model, and 76.67 percent in

the *Retention* model. Even though a number of institution-level factors did not

demonstrate meaningful relationships with student outcomes, the proportion of variance

distribution at the institution-level reinforces the relative significance of these factors in

the hierarchical model.

The importance of the individual institution in performance funding success is

brought into particular focus through this study's findings with regard to faculty-student

ratio. Interestingly, the research literature addressing the significance of faculty-student

ratio and class sizes upon student outcomes is surprisingly mixed. For instance, Kennedy

and Siegfried (1997) found that class size was not associated with student achievement

on the Test of Achievement in College Economics (TUCE) (Kennedy and Siegfried

1997, 390-392). However, Johnson (2010) noted that research results throughout the past

several decades have depended greatly on the type of data and methodological approach

that was used. Johnson's HLM analysis of students in 2,200 undergraduate sections

(Johnson 2010, 705) identifies the significance of faculty-student ratio for final grades, controlling for "student characteristics, class level, and random effects" (721). Johnson found that increases in faculty-student ratio at the class level were associated most strongly with grade increases for small classes. These increases were much less closely related in already-large classes (721-722). Johnson's research is consistent with the findings of this study, which revealed a relatively significant, positive relationship between faculty-student ratio and completion rate, with all other factors held constant. Although this finding does not directly address this study's research hypotheses, it certainly reinforces the larger implications of this study with regard to the overarching importance of factors at the institution level. Clearly, the role of university faculty in the overall success of students is critically important, and the degree of faculty interaction also has a significant effect on overall institutional measures of success (Johnson 2010, 721-722). This insight should inform the development of funding policy by emphasizing the importance of such issues as faculty hiring, salaries, course size management, and a host of other issues at the institutional level. The specific implications of this finding will be discussed further below.

The use of HLM analysis in this study has provided key insights into the importance of factors at the institutional level, and this has led to the identification of potential improvements that can be made as funding policy aligns more closely with meaningful factors on this level. It is clear that in the current landscape of state funding policy, states have not implemented policies that can make a difference for higher education outcomes. Because of this, not only are taxpayer resources going to waste, but students are failing to achieve their potential due to factors that could include both

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ineffective allocation of funds at the state level and ineffective administration of these funds at the university level. Higher education budget policy must become more strategic and better focused on the institution, and it must build upon continued advances made in funding policy research as additional research takes place.

At this point, the two primary trends that are clearly exhibited throughout the sections above can be summarized as follows: first, performance-based funding policies in four-year public institutions across the U.S. from 2004 to 2010 have not proven to be effective in improving university completion rates or retention rates. Second, evaluating the multilevel structure of the IPEDS data reveals that on a proportional basis, institution-level factors are associated with a much higher percentage of outcomes increases than state-level factors. Based on these results, the implications are clear: performance-based funding cannot continue in its current form. Because of this, based on the findings presented in this study and the trends identified in the literature, several specific actions are recommended around the critical areas of research and implementation. These recommendations will be outlined in the section to follow.

Recommendations

Accomplishing state-level goals in higher education must involve a commitment to clarify objectives, measure and assess progress, and make decisions to preserve, modify, or remove policies based on the evidence obtained through research. In this light, this study offers several specific recommendations for state legislatures, higher education boards, and institutional administrators. Each recommendation outlines one or more specific actions to be addressed by a particular constituency, based on the findings of this study. These recommendations require stakeholders above all to be committed to engage

in the pursuit of a more comprehensive understanding of the data associated with higher education outcomes, as well as a much greater level of communication with institutions in order to strengthen the meaningful linkages between policy and implementation. This study's results make clear that it is the institutional level at which these linkages have the greatest potential significance, and these recommendations are focused in detail on that level.

1. Further Research is Necessary to Enhance State-Level Funding Models. Current studies in performance-based funding have generally evaluated a selected set of factors representing the most frequently used institutional outcomes measures (Shin and Milton 2004, 4). Although HLM analysis has offered additional insights into level-specific behavior, few studies have explored individual state-level funding models in detail. If progress is to be made in evaluating the long-term sustainability of individual state-level programs, states must first develop more effective ways to understand the behavior and effectiveness of their own funding models.

In this light, this study's findings build on the results that were found with faculty-student ratio, which exhibited a significant relationship with completion rate in states that implemented performance-based funding between 2004 and 2010. State higher education boards must leverage insights such as these as a starting point for further research. As mentioned above, the research literature shows that faculty-student ratio and class have been shown to be associated with higher education student outcomes (Johnson 2010, 721); however, findings are mixed with regard to the scope of impact, and results have depended in part on analytic strategy and data sources used (705). For this reason, it

is critically important that additional research must be conducted, in order to shed additional light on the relative importance of institution-level factors such as these.

The following specific actions are recommended for higher education governing boards in states that currently implement performance-based funding initiatives. First, boards must develop a meaningful benchmark of analysis, beginning with a workable means of assessing whether adequate data currently exist. In some cases, as quantifiable objectives are clarified in the process of developing mission-based funding goals, it could become clear that sufficient data are not being collected for adequate measurement. In those cases, higher education boards must obtain sufficient evaluative data either through outside data sources, or through the creation of additional data collection instruments (Adleman and Carey 2008, 27). Long-term evaluation of performance-funding effectiveness depends on consistent and effective measurement, and it also depends on the commitment of state boards to give the time and attention necessary for the selection of the most appropriate outcomes indicators.

This study also recommends that state higher education boards task subcommittees at the state level, as well as research faculty at the institutional level, in order to develop strategies for examining the significance of these factors in much greater detail. Because publicly available data are already collected through IPEDS and other surveys, state higher education boards could readily leverage these existing data in order to assist colleges and universities in aligning institutional mission with the factors selected for funding formulae. Where necessary, studies should be commissioned or incorporated into the existing priorities of higher education boards. Using these and other

means, states must develop more comprehensive evaluation tools to refine factor selection on a regular basis.

Initiatives designed to improve funding research could take different forms depending on the structure of higher education boards and outcomes measurement in each state. As an example, the Tennessee Higher Education Commission currently maintains an Academic Affairs Division that is tasked with the administration of Tennessee's performance-based funding programs (THEC 2014). In addition to the state-level reporting and research the Division currently produces, it could also sponsor institution-level research through the development of publication opportunities, mini-grant programs, or other means. This research would not only potentially enhance the state's ability to refine funding formulae and budget decisions, but it would also help to equip universities in Tennessee with additional information that could assist in better aligning funding with institutional missions.

2. Restructure Performance Funding Policies Where Appropriate. When states facilitate the processes that are necessary to evaluate funding policies more thoroughly, the resulting research will potentially uncover other institution-specific factors that can be incorporated into institutional funding formulae as well. However, based on the results of their analyses, states must be equally prepared to take the necessary steps to restructure and revise policies that have been shown to be ineffective. As discussed in Chapter 2, it was this initial commitment to improving the link between funding and outcomes that led to the development of the first performance-based programs. As Bogue and Brown (1982) observed in their early study of the Tennessee funding system, it had become increasingly clear that rewards based only on enrollment were inherently misaligned with

an institution's purpose (Bogue and Brown 1982, 124). This commitment to evidence-based funding policy decisions must remain the focus of each state. Once a clearer picture of successful factors in each state has been developed, states will be better equipped to make rational policy decisions about the long-term future of their programs. Based on the results of this and other studies, it is likely that many states should make significant modifications to the existing performance-based funding policies. The overarching issue in this regard is that policy decisions must be based on evidence gained from research, rather than merely upon political popularity or expediency.

This recommendation is of particular significance for state legislators and higher education boards. As discussed in Chapter 2, legislative efforts behind performance-based funding initiatives have often been driven by political motivations. Because of this, an evaluation of policy effectiveness risks being swayed by a motivation to maintain political popularity. In the long term, however, neither legislators nor institutions benefit from the failure to evaluate policy effectiveness honestly and carefully. If, after comprehensive analysis, state-level funding policies are not shown to improve performance, legislators and higher education governing boards must exhibit the confidence and courage to modify or, when necessary, cease such initiatives. Above all, such decisions must be made based on a thorough analysis of the data.

State higher education governing boards can take guidance from the state of Ohio in this light. In the mid 1990s, recommendations from the newly-appointed Higher Education Funding Commission in Ohio (Burke and Associates 2002, 172) led to the development of an initial five-prong "performance challenge" program (172-173). Although this performance-based system initially suffered both from underfunding and

an overly complex design, Ohio was able to respond to design challenges by reframing and restructuring their approach (Burke and Associates 2002, 174). Success for Ohio's funding programs has proven to be mixed, but additional restructuring has taken place in recent years with new initiatives beginning in 2014 (NCSL 2014). Throughout the years, Ohio has demonstrated a long-term commitment to the improvement and revision of funding programs based on the continual evaluation of data, and in this regard Ohio serves as a valuable example for other performance-based funding states.

3. Improve Institutional Implementation Processes. Once institution-specific funding factors are selected and a process for policy refinement is ongoing, the results of this study imply that not only should the funding factors be carefully evaluated, but the underlying framework of policy implementation must also change. Specifically, institutions must work to improve their own internal administrative implementation and communication strategies at the institution level. As Rabovsky (2012) observes, the means by which funds are applied and managed at the institutional level have been addressed by only a few studies, and these have generally examined performance funding in higher education by focusing only on the direct association between funding and outcomes (679). Much less attention has been given in the literature to the "causal logic" that connects policy and implementation (679); however, it is clear that this intermediary level is critical.

Rabovsky's insight hinges on what he calls the "administrative response" (Rabovsky 2012, 679), and his analysis highlights the considerable amount of work still needed in order to understand the linkages between policy and outcomes in university funding formulae and other implementations of performance funding. Not only is the

relationship between performance funding levels and higher education outcomes limited, but in his words, in fact "we have very limited systematic analysis that can tell us why (or why not)" (Rabovsky 2012, 679). It is clearly this intermediary "administrative response" (679) that Rabovsky sees as the critical component of the internal response of the state university system.

Rabovsky's study also points to the need for a great deal of additional research with regard to missional differentiation (Rabovsky 2012, 697), administrative policy communication structures, and a number of other factors not addressed in this present study. In fact, Rabovsky brings up significant implications of the research of Crellin et al. (2011) and others, who observe the role of incentive and motivation when funding policies are changed in higher education. Crellin et al. note that when completions serve as a component of funding policy, institutional priorities are naturally shaped around serving this desired outcome (Crellin et al. 2011, 3). These issues of motivation and incentive offer insight into the ways in which states can potentially increase the effectiveness of program implementation. While this study considers a number of control variables addressing a relatively wide range of institutional level factors, much more extensive research is needed in order to understand the broader relationship of internal communication and administration of performance policy.

This recommendation speaks directly to university presidents, administrators, and institutional governing boards. In 2003, Burke and Minassians noted that the "common and fatal flaw" of performance-based systems is "the failure to apply these programs to the internal academic units on campus…" (20). The findings of this study relate directly to their evaluation of policy application at the institutional level. Burke and Minassians'

characterization of the effectiveness of performance-based systems based on their

analysis of the Seventh SHEFO Survey is particularly telling:

> The anomaly of all three accountability programs—funding, budgeting, and reporting—is that they hold states, systems, and colleges and universities responsible for performance, but campus leaders do not apply that same responsibility to the internal divisions that are largely responsible for producing institutional results" (Burke and Minassians 2003, 20).

This breakdown between the structure of accountability and the implementation of policy

is a critical factor in higher education performance-based funding, and university

presidents and other leaders should carefully consider the institutional assumptions that

can influence the success of funding policy implementation. The work of Barnetson and

Cutright offers further insight in this regard: when state higher education boards

implement performance-based funding policies based only on end-level outcomes

measures, they are in effect relying on the faulty logic that university systems are

rationally-bounded operations that respond to clear cause-and-effect mechanisms

(Barnetson and Cutright 2000, 288-290). However, quite the contrary is in fact true. The

literature shows that too often, institutional administrators and stakeholders are ill

equipped to implement effectively the practices mandated by legislators and governing

boards, or to communicate effectively the purposes for which these policies are in effect.

It is imperative that presidents and administrators commit the time and effort

needed to examine how effectively funding policies are being communicated within the

administrative levels of their institutions. This could include such efforts as "town hall"

sessions among institutional faculty and staff, the specific incorporation of performance

funding expectations into job descriptions and human resource training sessions, and

incorporation of performance funding goals into the written institutional missions and

outcomes documents. Then, institutional stakeholders must take steps to develop more

adequate procedures for implementation of these policies. One important strategy in this

regard is the incorporation of department-level goals and outcomes factors. For instance,

if the institutional funding formula includes specific completion rate goals, then

individual academic departments should develop plans for measuring and maintaining

appropriate department-level completion rates as well.

Hillman, Kelchen, and Goldrick-Rab (2013) point out the importance of

developing clear mission-specific factors for performance funding implementation

strategies. In their recommendations for funding policy implementation in the state of

Wisconsin, they note that an individual institution's funding structure must connect

meaningfully with the "unique missions and markets" served by the institution (10), in

order to maximize opportunities for success in implementation. When these highly

relevant outcomes indicators are operationalized and incorporated into funding formulae,

the "linkages" between funding and outcomes are strengthened. In this way, not only

does the funding policy link appropriately with the most relevant performance outcomes

measures, but the individual faculty, staff, and other stakeholders at the institutional level

are themselves most closely aligned with the goals and objectives they are being asked to

fulfill.

Not only does the implementation of funding policy at the institution level involve

successfully transmitting policy requirements and outcomes measures, but it must also

involve a clear understanding at every administrative level of the alignment of outcomes

measures with institutional mission. As Barnetson and Cutright (2000) have shown, this

involves developing a consistent vocabulary of academic outcomes measurement across

institutional units. Barnetson and Cutright's research shows that in some cases, the application of performance-based funding policies at the institution level applies the template of an economic vocabulary to academic outcomes (288-290). This has significant implications for institutions: in short, by quantifying the measurement of progress toward the academic mission, performance-based funding policy potentially changes the framework around which the mission is embodied at the institution level (Barnetson and Cutright 2000, 280). If the academic vocabulary of an institution's mission is seemingly at odds with the economic vocabulary through which its objectives are translated, the result is a short-circuiting of the potential effectiveness of the funding policy. This iterative process of communication and implementation must be carefully implemented if funding policies are to achieve success.

4. Redirect the Political Rhetoric. Burke and Associates (2002) observe that performance funding's role for many states is often conceptual or rhetorical, rather than simply financial (267). The political rhetoric that is geared toward legislators, voters, and administrators regarding the effectiveness of performance funding policy must be carefully examined in light of this study. Whenever possible, legislators should make efforts to reclaim education issues from the partisan, rhetorical layers that often distort them. To achieve this, states must commit to focusing more closely on the evidence associated with outcomes measurement and evaluation in their individual state, rather than allow higher education issues to be determined merely by political expediency.

State legislators can look to the state of Florida as an instructive example of the need to redirect higher education funding issues away from what often amounts to a contest of "political will" (Burke and Associates 2002, 158). Prior to 1998, Florida's

State Board of Education had "little influence on higher education funding policies and outcomes" (Burke and Associates 2002, 139-140). Although a number of higher education accountability requirements and performance initiatives had been attempted in Florida prior to this time, including the Government Performance and Accountability Act in 1994 (141), Burke and Associates noted that it was in part "[t]he divided nature of state government and academic governance in Florida" that hampered the implementation of this initiative (142). Political compromise in 1996 (146), followed by a structural change in state legislative authority in 1998 (139), opened the way for higher education priorities to escape the cycle of political struggle.

As Barnetson and Cutright (2000) observe, although funding policy is inherently political, it is often implemented based on the misplaced assumption that outcomes indicators are neutral and objective in their definition and content. In fact, their research refutes prevailing assumptions that performance indicators can serve as objective standards at all. On the contrary, they argue that the implicit assumptions embedded in the application of performance indicators (particularly those that are tied to incentives) (286-287) often act as "conceptual technologies" (280) that shape both the content and approach of policy (277; 280). Barnetson and Cutright illustrate their argument by noting that performance outcomes indicators are, by definition, "policy instruments (i.e., tools that propel institutions and/or individuals to act when otherwise they could not or would not") (Barnetson and Cutright 2000, 279).

Because in many cases the "agenda" (Barnetson and Cutright 2000, 279-280) of performance indicators is perceived as an external tool of manipulation driven primarily by financial incentives, an inherent disconnect is too often created between institutional

administrators and the academic community upon which policies are implemented (Barnetson and Cutright 2000, 280-281). Even though many states claim to have created performance-based funding policies that incorporate institutional mission, the work of Barnetson and Cutright shows how implementing performance-based policies can potentially "confus[e] accountability with regulation" (289). For this reason, institutional administrators must work to identify situations in which this disconnect might be derailing the potential for implementing funding initiatives, and when possible overcome these situations by developing clearer lines of communication with policy stakeholders.

Fundamentally, all four recommendations presented above are based on the mounting evidence in the literature and in this study that what institutions *do* with funding is more important than the amount of funds themselves. A primary question at the policy level, therefore, is how best to structure the funding programs at the state level so that institutions are equipped for success based on proven institution-level outcomes drivers, while also maintaining autonomy in fund management and mission-directed focus. Translating performance-based funding from simply external economic mandates into policies that are clearly connected with the goals of the academic community will improve the shared mission of institutions and states. In order to accomplish this, a greater strategic use of financial and political capital should be directed toward institution-level communication, training, and assistance with policy implementation.

As this study has shown, the failure of many performance-based funding policies to produce effective change in institutional outcomes clearly demands a substantive response. States implementing performance-based funding polices must first clarify the factors that are not associated with outcomes increases, as shown in this study and in the

research literature. Second, states must be ready to refocus and reshape ineffective funding policies based on the results of the growing research in this field including this and other studies. Third, for states that continue to implement performance-based funding policy based on this additional research, it is critically important that university administrators, faculty, and other stakeholders become engaged in a more effective framework of communication and implementation. The specific shape of these communicative frameworks will of course depend heavily upon the missions of each individual institution. Based on the institution-level results of this study, it is recommended that the institutional mission should be the overriding focus of the communicative framework.

Limitations of Applicability and Directions for Further Research

As mentioned in the introductory comments, the conceptual framework for this study has been built around the question of effectiveness. The review of the literature in Chapter 2 makes clear that, despite the implementation of a wide range of funding approaches in many states throughout the years, research has so far shown no meaningful state-level association between performance funding policy and the most common higher education outcomes measures. State higher education funding policies are still plagued by policy ambiguity, and policy effectiveness is hampered by a number of factors including continued inefficiencies, unintended impact upon the financial and human resources of institutions (Dougherty and Reddy 2013, 71-77), and lack of public transparency in the financial operations of public universities.

While this study addressed the overarching issue of policy effectiveness at the institution and state levels, the applicability of this study's results is limited in a number

of ways. This study evaluated the significance of performance-based funding policy as measured by dollar amount per year (*Amount*) and consecutive years of implementation (*Duration*). As such, while this study specifically addresses research questions that evaluate the presence of state-level performance funding policy, it did not differentiate among the variety of ways in which both states and institutions implement policies.

As an example, this study did not differentiate between funding policies that incorporate percentage-based increases into institution-level funding formulas, and polices that allocate funding as a separate bonus (Dougherty and Reddy 2013, 80-81). While both forms of performance funding allocate dollars based on the achievement of outcomes criteria, many important differences exist between the two models, and these could impact decision-making processes at the institutional level. For instance, if funding dollars are allocated to institutions as a bonus, institutional budget managers might be more likely to plan expenditures around the predicted baseline allocation, and reserve bonus funding for special projects or contingency spending. Because this study only identifies the presence of performance funding policy (but not its specific characteristics), further research is needed in this area.

Furthermore, as discussed in Chapter 2, higher education performance funding policy takes shape within complex political landscapes. This study did not incorporate political data into its analysis; however, these issues are important areas for further research, and readily available data from a number of publicly available sources could be incorporated into future studies. For example, although this study does not control for the distribution of state legislators or governors by political party, historical data for state legislative political membership are available through the U.S. Census Bureau's

Statistical Abstract of the United States (U.S. Census Bureau 2012). These data could be incorporated into existing longitudinal datasets including the IPEDS: Delta Cost Project Database. In addition, Burke and Associates (2002) note that state gubernatorial elections can often result in new political priorities emerging in the midst of funding implementation (179; 197). Furthermore, structural political factors such as state legislative arrangement, type of budget approval process, and many others are potentially significant for the development of funding policy, and these should be carefully considered as well.

Just as the wide variation in state-level policy limits the applicability of this study, the range of institutional implementation models further limits the direct application of these results as well. Dougherty and Reddy (2013) have cited limited research to-date showing evidence that funding policy is likely to demonstrate a significant association with an institution's organizational structure, capacity for research, and other characteristics of the institution as it responds to external outcomes incentives (Dougherty and Reddy 2013, 41-43, from Kastner 2000, 31; 35). Because the specific forms of institution-level policy implementation are widely varied, the applicability of this study's results is limited as a result. Clearly, further institution-level research is needed with regard to factors including policy awareness, buy-in, clear communication of objectives and incentives, reliable measurement of objectives, reliable data reporting, and many others.

In addition, this study was limited to the years 2004 to 2010 due to the availability of IPEDS: Delta Cost Project data. As discussed in Chapter 1, a number of variables evaluated in this study were not available in IPEDS reporting prior to 2003 (NCES

2013a). Also, since additional data were incorporated from a number of sources including the Bureau of Labor Statistics and Bureau of Economic Analysis, the longitudinal scope of this combined dataset was limited by the availability of historical data from these sources. In particular, state-level program duration data were obtained through the National Conference of State Legislatures (NCSL 2013), which compiles policy initiatives reported by individual states. For many states in this data source, availability of historic funding policy data was limited.

A number of new performance-based initiatives have been implemented at the state level since 2010, and an evaluation of these recent projects is beyond the scope of this study. Because limited outcomes data are available for these initiatives at this point, additional analysis will be needed as new data become available (Dougherty and Reddy 2013, 80-81). In addition, while this study evaluates a wide range of socioeconomic control variables, a much greater diversity of state-level policy detail and implementation exists. Further research that examines individual state-level policies with specific attention to each state's individual economic policy factors could offer much greater insights in this regard. In Chapter 2, the research literature that addresses the political context of state-level performance funding policy was discussed briefly. However, a comprehensive examination of political factors was beyond the scope of this research. Although this study controls for economic factors such as tax revenue, personal income, and unemployment rate, it does not control for any other state-level economic policies, incentives, or financial burdens that might also be associated with institutional outcomes at the same time that performance-funding policies are in effect (Dougherty and Reddy 2013, 81). Depending on the nature of these policies, their effects could potentially either

amplify or negate the significance of performance-based funding. As such, the applicability of this study's results is limited in this regard, and further research in this area is needed.

Summary

In "Opportunity Adrift: Flagship Universities are Straying from Their Public Mission" (Haycock, Lynch, and Engle 2010), the Education Trust's analysis of spending patterns among flagship public universities shows that financial aid is being allocated in a manner that has increasingly steered away from the "historic mission" of public education (2-4). Because the immense growth of public higher education has taken shape within the complex fiscal landscape of state budget policy, university systems unfortunately depend on funding policies that are not always well aligned with academic mission (Harnisch 2011, 8; Barnetson and Cutright 2000, 288-290). In some cases, state legislators have championed funding policies for reasons of political opportunity or expediency (Kingdon 1995, 90; 123), and too often, institutional and state policy priorities become further misaligned when funding policies serve merely to justify political aims or prioritize fiscal savings (Haycock, Lynch, and Engle 2010, 5-6). Even when funding policies do align with university missions, in many cases the successful implementation of these policies at the institutional level remains lacking (Burke and Minassians 2003, 20). The increasingly complex relationship between institutions and state policy initiatives has, as Rhoten and Calhoun (2009) point out, made it ever more challenging for universities to "provide a clear account of their purposes—to themselves as well as to others" (26).

Within this complex funding landscape, performance-based funding initiatives have emerged in recent decades as a way to achieve increased accountability and efficiency in reaching outcomes, while also offering the potential to increase accountability and financial transparency. Although performance-based funding initiatives have many advocates at the federal and state levels, the complex relationship between institutional priorities and state policy has so far led to mixed success. This study has sought to contribute to the research literature by evaluating the association of funding amount and program duration with completion rates and retention rates from 2004 to 2010. Although public university outcomes were not found to be significantly associated with performance funding policy amount and duration, some implications for institution-level factors do point to a way forward. In particular, multilevel analysis has revealed that potential opportunities exist at the institution level where factors such as faculty-student ratio can be leveraged. Ongoing research in this field must address these issues carefully, and with greater attention to the institution-level factors that can be emphasized in the refinement of funding policies.

At root, these results highlight the continued importance of the individual institution both in identifying factors relating most clearly to institutional mission, and in shaping its academic and administrative structures in a way that can best communicate policy effectiveness. Whatever form funding policies take in individual states—whether performance-based or otherwise—their formation and implementation must depend on a clear evaluation of the evidence. Policymakers and institutional stakeholders must always remain open to adapting and refining these policies as new factors and missions grow and change. In the end, these funding initiatives must remain focused above all on the goal of

identifying the most fiscally responsible and effective means to promote the achievement of outcomes, while also preserving academic integrity and free inquiry (Calhoun 2009, 902-905). This will truly mean the difference in our ability to serve those students who represent the next generation of thinkers and leaders.

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APPENDIX A

Table 6: Definitions and Descriptions of Dependent, Independent, and Control Variables

	Description
Dependent Variables	
Retention	Percentage of FTE enrolled students who returned the following year (NCES 2013a)
Completion	Ratio of total student completions at each institution, divided by total full-time-equivalent (FTE) enrollment per year (NCES 2013a)
Independent Variables	
Amount	Dollar amount of state-level appropriations per FTE student, measured in 2010 HEPI-adjusted dollars
Duration[1]	Duration of performance funding implementation, measured in years
Institution-Level Control Variables	
Pell	Average Pell Grant per FTE Student
Carnegie_Research	Dummy Variable = 1 if Carnegie 2005 Classification value is 15, 16 or 17
Carnegie_Masters	Dummy Variables = 1 if Carnegie 2005 Classification value is 18, 19, or 20
Carnegie_Bachelors	Dummy Variable = 1 if Carnegie 2005 Classification value is 21, 22, or 23
SATMATH75	Student SAT I Math scores at the 75th percentile
Tuition	In-state tuition and fees per FTE student
Faculty	Average number of full-time instructional faculty per FTE student
Minority	Percent student body minority enrollment based on IPEDS data
State-Level Control Variables	
Unemployment[2]	Unemployment rate by state, per year
Income[3]	Average personal income by state, per year
Tax[4]	Per capita tax revenue by state, per year
Statenum	State number (integer value)

Note. Values are derived from the IPEDS: Delta Cost Project Database (NCES 2013a) unless otherwise indicated.

[1]Source: National Conference of State Legislatures (NCSL, "State Activity", February 2013)
[2]Source: U.S. Department of Labor, Bureau of Labor Statistics (BLS 2013).
[3]Source: U.S. Department of Commerce, Bureau of Economic Analysis (BEA 2013).
[4]Source: Urban Institute-Brookings Institution (Tax Policy Center 2013).

Table 7: Number of Consecutive Years of Funding *Duration* per State, per Year in the IPEDS: Delta Cost Project Database, 2004-2010

	2004	2005	2006	2007	2008	2009	2010
Alabama	0	0	0	0	0	0	0
Alaska	0	0	0	0	0	0	0
Arizona	0	0	0	0	0	0	0
Arkansas	0	0	0	0	0	0	0
California	0	0	0	0	0	0	0
Colorado	1	0	0	0	0	0	0
Connecticut	0	0	0	0	0	0	0
Delaware	0	0	0	0	0	0	0
Florida	10	11	12	13	14	15	16
Georgia	0	0	1	2	3	0	0
Hawaii	0	0	0	0	0	0	0
Idaho	0	0	0	0	0	0	0
Illinois	0	0	0	0	0	1	2
Indiana	0	0	0	1	2	3	4
Iowa	0	0	0	0	0	0	0
Kansas	5	6	7	8	9	10	11
Kentucky	0	0	0	0	1	2	3
Louisiana	0	0	0	0	1	2	3
Maine	0	0	0	0	0	0	0
Maryland	0	0	0	0	0	0	0
Massachusetts	0	0	0	0	0	0	0
Michigan	0	0	0	0	0	0	0
Minnesota	0	0	0	0	0	0	0
Mississippi	0	0	0	0	0	0	0
Missouri	0	0	0	0	0	0	0
Montana	0	0	0	0	0	0	0
Nebraska	0	0	0	0	0	0	0
Nevada	0	0	0	0	0	0	0
New Hampshire	0	0	0	0	0	0	0
New Jersey	0	0	0	0	0	0	0
New Mexico	2	3	4	5	6	7	8
New York	0	0	0	0	0	0	0
N. Carolina	0	0	0	0	0	0	0
N. Dakota	0	0	0	0	0	0	0
Ohio	6	7	8	9	10	11	12
Oklahoma	2	3	4	5	6	7	8

Oregon	0	0	0	0	0	0	0
Pennsylvania	2	3	4	5	6	7	8
Rhode Island	0	0	0	0	0	0	0
S. Carolina	0	0	0	0	0	0	0
S. Dakota	1	2	3	4	5	6	7
Tennessee	25	26	27	28	29	30	31
Texas	0	0	0	0	0	0	0
Utah	0	0	0	0	0	0	0
Vermont	0	0	0	0	0	0	0
Virginia	0	0	0	0	0	0	0
Washington	0	0	0	0	0	0	0
West Virginia	0	0	0	0	0	0	0
Wisconsin	0	0	0	0	0	0	0
Wyoming	0	0	0	0	0	0	0

Source: National Conference of State Legislatures (NCSL, "State Activity", February 2013).

Table 8: Categorization of Carnegie Classification Dummy Variables with Descriptions
and Percentages

Variable	Description	Percent
Carnegie_Research	Carnegie = 15, 16 and 17	152 out of 482 (31.5%)
Carnegie_Masters	Carnegie = 18, 19 and 20	234 out of 482 (48.5%)
Carnegie_Bachelors	Carnegie = 21, 22 and 23	96 out of 482 (20.0%)

Table 9: Collinearity Among Dependent, Independent, and Control Variables

	Sq. Rt. (VIF)	VIF	Tolerance	R-Squared
Completion	1.49	1.22	.067	0.33
Retention	2.22	1.49	0.45	0.55
Amount	1.09	1.05	0.91	0.09
Duration	1.07	1.03	0.94	0.06
Tax	3.25	1.80	0.31	0.70
Income	4.10	2.02	0.24	0.76
Unemployment	1.36	1.17	0.74	0.26
Minority	2.08	1.44	0.48	0.52
Carnegie_Research	3.37	1.84	0.30	0.70
Carnegie_Masters	2.52	1.59	0.40	0.60
SATMATH75	8.60	2.93	0.12	0.88
SATVERBAL75	8.49	2.91	0.12	0.88
Tuition	1.29	1.14	0.77	0.23
Faculty	1.15	1.07	0.87	0.13

Table 10: Means and Standard Deviations of Dependent, Independent, and Control Variables

	Mean	Standard Deviation
Dependent Variables		
Retention	0.73	0.12
Completion	0.23	0.07
Independent Variables		
Amount	1603.58	971.74
Duration[1]	1.67	4.36
Institution-Level Control Variables		
Pell	1074.95	600.74
Carnegie_Research	0.32	0.46
Carnegie_Masters	0.49	0.50
Carnegie_Bachelors	0.20	0.40
SATMATH75	583.62	60.75
Tuition	5707.03	2199.58
Faculty	0.05	0.01
Minority	0.34	0.23
State-Level Control Variables		
Unemployment[2]	6.15	2.24
Income[3]	40294.77	5862.99
Tax	4223.04	1046.36

1 Source: National Conference of State Legislatures (NCSL, "State Activity", February 2013).
2 Source: U.S. Department of Labor, Bureau of Labor Statistics (BLS 2013).
3 Source: U.S. Department of Commerce, Bureau of Economic Analysis (BEA 2013).

Table 11: Correlation Among Independent and Dependent Variables

	Completion	*Retention*	*Amount*	*Duration*
Completion	1.00			
Retention	0.32 (.000)***	1.00		
Amount	-0.03 (.10)	-0.02 (.31)	1.00	
Duration	-0.004 (.04)*	-0.01 (.44)	0.01 (.50)	1.00

Note. N = 2,452 observations
***$p \leq .001$; **$p \leq .01$; *$p \leq .05$

Table 12: Comparison of Average *Completion* and *Retention* Rates in Performance Funding States vs. Non-Performance Funding States from 2004 to 2010

Part I: Average *Completion* Rates in Percent per Year

	2004	2005	2006	2007	2008	2009	2010	Avg. Change per Year
States with Performance Funding	21.79	22.58	21.09	21.92	22.38	23.03	29.34	4.95%
States without Performance Funding	23.09	23.48	23.91	24.07	24.45	24.01	23.79	0.43%
All States	22.84	23.26	23.55	23.69	23.81	23.74	23.42	0.36%

Part II: Average *Retention* Rates in Percent per Year

	2004	2005	2006	2007	2008	2009	2010	Avg. Change per Year
States with Performance Funding	68.05	70.53	70.50	72.25	69.56	68.94	71.71	0.77%
States without Performance Funding	72.31	73.56	73.56	73.74	73.83	74.40	75.13	0.56%
All States	70.63	72.96	72.85	72.93	72.90	73.43	74.22	0.73%

Note. Values are derived from the IPEDS: Delta Cost Project Database (NCES 2013a).

Table 13: Pooled OLS Regression Results for Dependent Variable *Completion*

	Coefficient (Std. Error)
Intercept	0.03 (0.01)*
Independent Variables	
Amount	0.0000034 (0.0000007)***
Duration	-0.0003 (0.0002)
Institution-Level Control Variables	
Pell	-0.00001 (0.0000022)***
Carnegie_Research	0.04 (0.003)***
Carnegie_Masters	0.03 (0.002)***
SATMATH75	0.0002 (0.00002)***
Tuition	-0.000002 (0.0000004)***
Faculty	0.30 (0.07)***
Minority	-0.006 (0.005)
State-Level Control Variables	
Unemployment	0.003 (0.0004)***
Income	0.000001 (0.0000002)***
Tax	0.000002 (0.00005)

Note. N = 2,452 observations
***$p \leq .001$; **$p \leq .01$; *$p \leq .05$
Adjusted $R^2 = 0.33$

Table 14: Pooled OLS Regression Results for Dependent Variable *Retention*

	Coefficient (Std. Error)
Intercept	0.03 (0.03)
Independent Variables	
Amount	0.0000009 (0.0000015)
Duration	-0.00002 (0.0003)
Institution-Level Control Variables	
Pell	-0.00005 (0.0000046)***
Carnegie_Research	0.003 (0.005)***
Carnegie_Masters	0.03 (0.004)***
SATMATH75	0.0009 (0.00004)***
Tuition	0.000002 (0.0000008)**
Faculty	0.36 (0.14)**
Minority	0.10 (0.009)***
State-Level Control Variables	
Unemployment	0.007 (0.0007)***
Income	0.000002 (0.0000005)***
Tax	0.000007 (0.000002)**

Note. N = 2,452 observations
***$p \le .001$; **$p \le .01$; *$p \le .05$
Adjusted R^2 = 0.55

Table 15: Full Model HLM Analysis for Dependent Variable *Completion*: Slopes and Standard Errors

	Coefficient (Std. Error)
Intercept	.04 (.02)
Independent Variables	
Amount	0.000001 (0.0000006)*
Duration	0.0001 (0.0006)
Institution-Level Control Variables	
Pell	-0.000004 (0.000003)
Carnegie_Research	0.05 (0.007)***
Carnegie_Masters	0.04 (0.006)***
SATMATH75	0.00004 (0.00002)*
Tuition	0.000002 (0.000001)
Faculty	1.58 (0.25)***
Minority	-0.03 (0.01)*
State-Level Control Variables	
Unemployment	0.0008 (0.0005)
Income	0.000001 (0.0000004)**
Tax	-0.0000008 (0.000002)

Note. N = 2,452 observations; 482 institutions; 50 states

***$p \leq .001$; **$p \leq .01$; *$p \leq .05$

Table 16: Full Model HLM Analysis for Dependent Variable *Retention*: Slopes and Standard Errors

	Coefficient (Std. Error)
Intercept	.15 (.07)
Independent Variables	
Amount	-0.0000019 (0.0000015)
Duration	.0006 (.001)
Institution-Level Variables	
Pell	-.00002 (0.000008)*
Carnegie_Research	.06 (.01)***
Carnegie_Masters	.03 (.01)**
SATMATH75	.0006 (.0001)***
Tuition	0.000004 (0.000002)*
Faculty	.10 (.37)
Minority	.02 (.02)
State-Level Variables	
Unemployment	.005 (.001)***
Income	0.000003 (0.0000009)***
Tax	0.0000015 (0.000004)

Note. N = 2,452 observations; 482 institutions; 50 states

***p ≤ .001; **p ≤ .01; *p ≤ .05

APPENDIX B

Figures 1-2

Figure 1: Comparison of Average *Completion* Rates in Percent Per Year in Performance Funding vs. Non-Performance Funding States
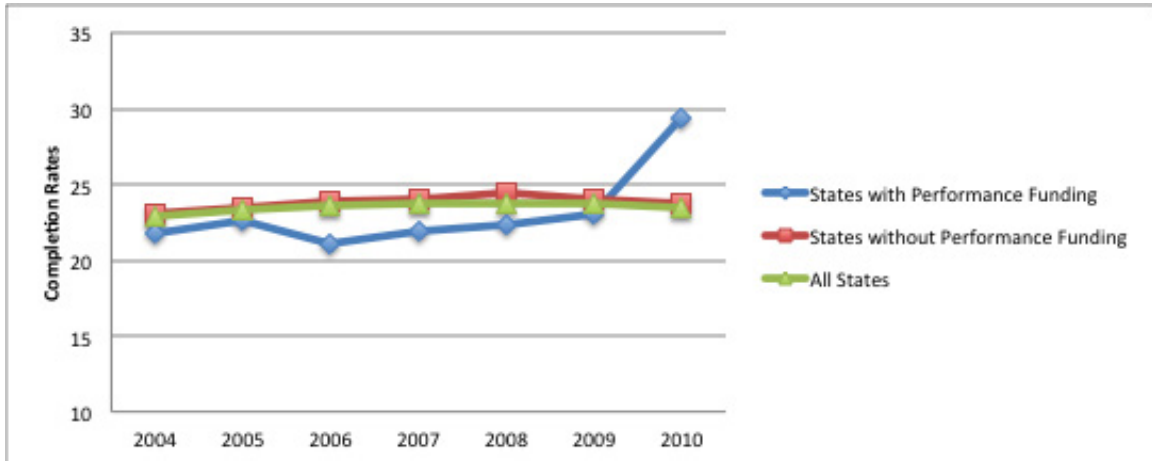
Note. Data compiled from IPEDS: Delta Cost Project Database (NCES 2013a).

Figure 2: Comparison of Average *Retention* Rates in Percent Per Year in Performance Funding vs. Non-Performance Funding States
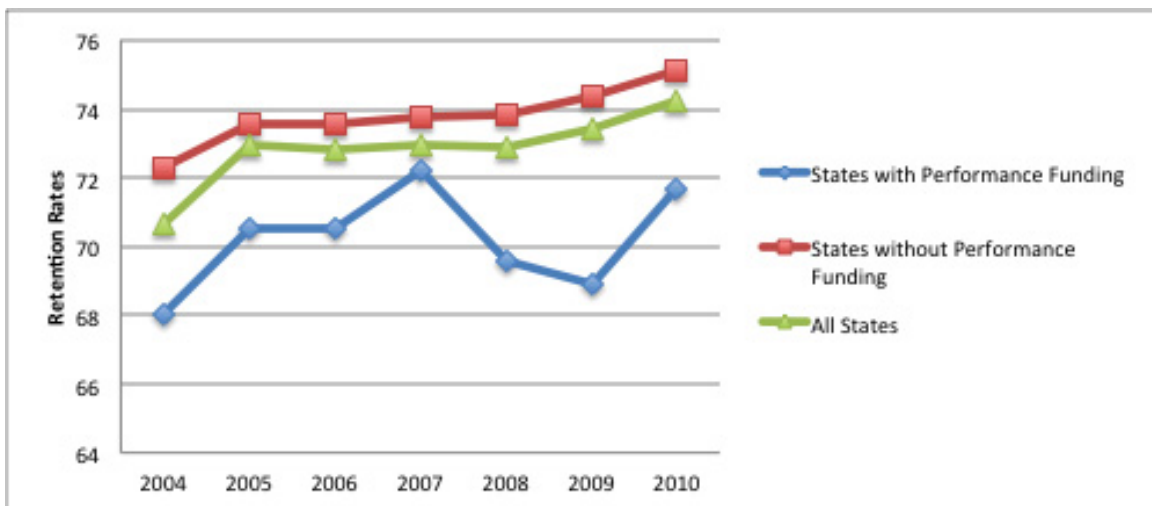
Note. Data compiled from IPEDS: Delta Cost Project Database (NCES 2013a).

APPENDIX C

APPENDIX C:

Institutional Review Board Exemption Form

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VALDOSTA STATE UNIVERSITY
GRADUATE SCHOOL

Valdosta State University Graduate School

Institutional Review Board Oversight Screening Form
for Graduate Student Research

Project Title: State Level Funding Policy in Higher Education: An Evaluation of the Long-Term Impact of Performance Funding

Name: Frank W. Woodward

Faculty Advisor: Dr. James Peterson

Department: Political Science (DPA Program)

E-mail: fwwoodward@valdosta.edu

Telephone: 865-803-0248

Please indicate the academic purpose of the proposed research:
- ☒ Doctoral Dissertation
- ☐ Master's Thesis
- ☐ Other

1. ☐ YES ☒ NO **Will you utilize *existing identifiable private* information about living individuals?** "Existing" information is data that were previously collected for some other purpose, either by the researcher or, more commonly, by another party. "Identifiable" means that the identities of the individuals can be ascertained by the researcher by name, code number, pattern of answers, or in some other way, regardless of whether or not the researcher needs to know the identities of the individuals for the proposed research project. "Private" information includes information about behavior that occurs in a context in which an individual can reasonably expect that no observation or recording is taking place or information provided for specific purposes that the individual can reasonably expect will not be made public (e.g., a medical record or student record).

   Note: If you are using data that: (1) are publicly available; (2) were collected from individuals anonymously (i.e., no identifying information was included when the data were first collected); (3) will be de identified before being given to the researcher, (i.e., the owner of the data will strip identifying information so that the researcher cannot ascertain the identities of individuals); or (4) do not include any private information about the individuals, regardless of whether or not the identities of the individuals can be ascertained, your response to Question 1 should be NO

2. ☐ YES ☒ NO **Will you *interact* with individuals to obtain data?** "Interaction" includes communication or interpersonal contact between the researcher and the research participant, such as testing, surveying, interviewing, or conducting a focus group. It does not include observation of public behavior when the researcher does not participate in the activities being observed.

3. ☐ YES ☒ NO **Will you *intervene* with individuals to obtain data?** "Intervention" includes manipulation of the individual or his/her environment for research purposes, as well as using physical procedures (e.g., measuring body composition, using a medical device, collecting a specimen) to gather data for research purposes.

If you answered YES to ANY of the above questions, your research is subject to Institutional Review Board oversight. Please discard this form and complete and submit an IRB application. Do not begin your research until your application has been reviewed by the IRB and you are informed of the outcome of the review.

• • • • • • • • • • • •

If you answered NO to ALL of the above questions, your research is not subject to Institutional Review Board oversight. Stop here, sign below, secure your faculty advisor's signature, and submit this form to the Graduate School. Please remember that, even though your project is not subject to IRB oversight, you should still observe ethical principles in the conduct of your research.

STUDENT CERTIFICATION: I certify that my responses to the above questions accurately describe my proposed research.

Student's Signature: _Frank C. Woodward_   Date: _0-2-2013_

FACULTY ADVISOR CERTIFICATION: I have reviewed the student's proposed research and concur that it is not subject to Institutional Review Board oversight.

Faculty Advisor's Signature: _James X. Peterson_   Date: _10/22/13_

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