

ABSTRACT

HALL, CHARLES WILLIAM. The Economic Context of Undergraduate Retention at Public Universities. (Under the direction of Alyssa N. Bryant.)

This investigation seeks to understand the economic context of undergraduate retention at public universities. Theoretically, “context” is understood as the fiscal environment of the organization. Empirically, the fiscal environment is measured at two distinct levels: the state and the institution. At the state level, the interest lies in how state appropriation for higher education varies as a function of other state appropriations (i.e., state health system and the criminal justice system, respectively) as well as the general economic health of the state (as measured by the annual unemployment rate). In turn, the state level context is examined to determine any effects it may have on matters of institutional finance, specifically, expenditures, tuition pricing, and the availability of financial aid. These state- and institution-level economic contexts are then analyzed to understand how they affect the organizational behavior of the institution, measured by the institutional retention rate.

The results show that, on average, across institutions over time, the institutional retention rate is fairly static. Essentially, the institutional retention rate does not change. Within-year change at an institution is negatively affected by institutional size (small- and medium-sized schools as compared to large), institutional selectivity (low- and medium-selectivity schools as compared to high-selectivity institutions), student services expenditures and grant expenditures. Over time, only instructional expenditures and research expenditures each had any significant effect on the growth in the institutional retention rate, and the magnitude of these individual effects was minimal, at best. No state-level covariate had any effect on the linear growth in institutional retention.

The Economic Context of Undergraduate Retention at Public Universities

by
Charles William Hall

A dissertation submitted to the Graduate Faculty of
North Carolina State University
in partial fulfillment of the
requirements for the Degree of
Doctor of Education

Higher Education Administration

Raleigh, North Carolina

2011

APPROVED BY:

Alyssa N. Bryant, Ph.D.
Chair of Advisory Committee

Duane Akroyd, Ph.D.
Member

Audrey J. Jaeger, Ph.D.
Member

Paul D. Umbach, Ph.D.
Member

DEDICATION

To my first teachers—my parents.

BIOGRAPHY

Charles William Hall was born on June 8, 1975 in Culpeper, Virginia. He graduated from Culpeper County High School in 1993. He completed his undergraduate studies at Virginia Polytechnic Institute & State University (Virginia Tech) in 1998, earning a Bachelor of Arts degree in Foreign Languages and Literatures (Spanish), with a minor in Sociology. He began his graduate career at Virginia Commonwealth University, earning a Master of Science degree in Sociology in August, 2000. He later came to North Carolina State University, formally entering the Higher Education Administration doctoral program in Fall, 2007. His research interests revolve around questions involving longitudinal (panel) and multilevel data.

ACKNOWLEDGEMENTS

As this dissertation concerns in part the finance of public universities, which is partially funded by public tax dollars, and furthermore that I have attended and benefitted exclusively from such institutions, I find it only appropriate to acknowledge first and foremost the taxpayers on whose shoulders the burden of public education is placed. You have my gratitude.

Next, I would like to thank my committee for their diligence and duty.

Paul, your zeal at the opportunity to “geek out” made my tangling with these cumbersome models manageable.

Duane, I very much appreciate your willingness to wear another “hat,” given your administrative responsibilities as DGP, especially during an organizational “realignment.”

AJ, you were my first contact in the HEA program through your Org Theory course, (where I first learned about Pfeffer and Salancik (1978), coincidentally). Yours was, is, and I hope always will be a warm and welcoming presence.

To Alyssa...for your perseverance, your thoughtfulness, your unwavering optimism, your caring; there are not words sufficient nor adequate to fully express and wholly commend the meaning of your station in this final stage of my long and arduous graduate career. So, with utmost admiration and full humility, I hope it fitting to simply say, *I thank you....*

I wish to thank the then-Department of Adult & Higher Education for giving an orphan a home.

Speaking of homes, I would like to thank Michael Ritchey and the wonderful staff at Global Village Organic Coffee over the years for providing a “home away from home,”

“office away from office,” and general *sanctum sanctorum* from the grind of graduate school. Mike, you’ve been there to chit-chat, advise, give the inside scoop, enjoy a pizzelle over a cappuccino, comfort in the sorrows, and, most importantly, rejoice in the successes. You helped make my tenure at NC State that much bearable.

Almost since my arrival at NCSU, I have been a “regular” at Student Health Services. I am especially grateful to my current care providers, Carolyn Garrett-Piggott, MD, and Sonya Wornom, LPN, who took over for Laura Pratt, MD, (SHS-Ret.) and Mary (Candler) Wahl, RN, CDE (SHS-Ret.). Also, there are the wonderful ladies at the Pharmacy and all the rest of the friendly staff at Student Health Services. Quite literally, they have touched my life, and their efforts have had a direct bearing on the completion of this project.

I would like to thank a few other folks who have also gone through this process, stuck with me through thick and thin, and helped me survive the ordeals and trials of graduate school: Zach Brewster, Matthew Irvin, Christine Mair, Kylie Parrotta, and R.V. Rikard.

I very much appreciate the patience and encouragement everyone “back home” has shown as my path toward this goal meandered and wandered: The Early’s, Los Rodriguez, The Gore’s, The Harpin’s, The Spidle’s, The Dare’s, The Buraker’s, The Clayton’s, Thomas, Thompson, The Carver’s, The Long’s, Bemis, Gwen, Mike B., E.D.H.D., The Payne’s, The Gartner’s, KD4RHP, N8RDR, KD4VML, those Weik’s, and, last but not least, them Williams’.

Finally, I absolutely could not have done this without the endearing support of my family.

TABLE OF CONTENTS

LIST OF TABLES	viii
LIST OF FIGURES	x
Chapter 1, Overview	1
Introduction	1
The Statement of the Problem	4
Theoretical Framework	6
Research Questions	9
Method	9
Significance of the Study	12
Limitations and Delimitations	14
Summary.....	17
Chapter 2, Review of the Literature	19
Introduction	19
Resource Dependence Theory	21
State-Level Economics and Institutional Finance	27
Retention	28
Institutional Selectivity	28
Institutional Size and Scope	29
Tuition as Revenue, Tuition Pricing and Financial Aid	31
Institutional Expenditures	34
Remediation Programs	37
Race and Retention	38
Summary	40
Chapter 3, Data Analysis	44
Introduction	44
Research Design	45
Population and Sample	45
Additional Comments about the Sample	47
Variable Operationalization	47
Data Analysis	54
Data Analytic Issues Specific to HLM	60
Summary	62
Chapter 4, Results	65
Introduction.....	65
Univariate Summary	66
Year-by-Year Descriptives	66
State-Level Covariates	70
HLM Analytics	72
OLS Regression Findings	75
Fully Unconditional Analysis	79
Growth Curve Analysis	80
Institutional Level Analysis of Covariance	83
State Level Analysis of Covariance	86
Combined Model	88

Higher Education Appropriations Model	93
Assessment of Research Questions	94
Summary	95
Chapter 5, Discussion	97
Introduction	97
Summary of Findings	97
Theoretical Implications	112
Policy Implications	116
Limitations of the Current Research	120
Directions for Future Research	124
Summary	127
REFERENCES	130
APPENDIX	141
APPENDIX A: YEAR-TO-YEAR DESCRIPTIVE STATISTICS	142
APPENDIX B: SUMMARY OF STATE-LEVEL COVARIATES	148
APPENDIX C: WITHIN-YEAR OLS REGRESSION MODELS	164
APPENDIX D: PARAMETRIC EQUATIONS	170

LIST OF TABLES

TABLE 1. Variable Specifications	51
TABLE 2. Summary Statistics of Variables Used in HLM Analysis	72
TABLE 3. Fully Unconditional Analysis of Institutional Retention Rate	79
TABLE 4. Linear Growth Model of Institutional Retention Rate	80
TABLE 5. Institutional Level ANCOVA	83
TABLE 6. State-Level ANCOVA	87
TABLE 7. Combined Model	89
TABLE 8. Associations of State-level Covariates with Higher Education Appropriations	93
TABLE A1. Summary Statistics of Variables, Year = 2003	142
TABLE A2. Summary Statistics of Variables, Year = 2004	143
TABLE A3. Summary Statistics of Variables, Year = 2005	144
TABLE A4. Summary Statistics of Variables, Year = 2006	145
TABLE A5. Summary Statistics of Variables, Year = 2007	146
TABLE A6. Summary Statistics of Variables, Year = 2008	147
TABLE B1. Annual Unemployment Rate, by State, 2003-2008	148
TABLE B2. Change in Annual Unemployment Rate, by State, 2003-2008	150
TABLE B3. Annual Higher Education Appropriation, by State, 2003-2008	152
TABLE B4. Change in Annual Higher Education Appropriation, by State, 2003-2008	154
TABLE B5. Annual Medicaid Appropriation, by State, 2003-2008	156
TABLE B6. Change in Annual Medicaid Appropriation, by State, 2003-2008	158
TABLE B7. Annual Criminal Justice System Appropriation, by State, 2003-2008	160

TABLE B8. Change in Annual Criminal Justice System Appropriation, by State, 2003-2008	162
TABLE C1. OLS Regression of Institutional Retention Rate, 2003	164
TABLE C2. OLS Regression of Institutional Retention Rate, 2004	165
TABLE C3. OLS Regression of Institutional Retention Rate, 2005	166
TABLE C4. OLS Regression of Institutional Retention Rate, 2006	167
TABLE C5. OLS Regression of Institutional Retention Rate, 2007	168
TABLE C6. OLS Regression of Institutional Retention Rate, 2008	169

LIST OF FIGURES

Figure 1. Conceptual Framework	18
--------------------------------------	----

CHAPTER 1

Introduction

The numbers are clear: over the past thirty years or so, the price of student tuition across institutions of higher education continues to rise, often outstripping inflation (NCES, 2008; Paulsen, 2001b; Toutkoushian, 2001). More and more, students are responsible for shouldering the burden of the costs of education. Among public colleges and universities, an oft-noted reason for the decline in institutional support and related availability of financial aid is that the institutions themselves receive less money from their respective states (Weerts & Ronca, 2006; Zumeta, 2004). Part of the reason for diminishing revenues is that, as legislators are quick to note, there exist competing demands for the limited amount of state dollars from multiple sources, for example, public health care systems and the criminal justice system. The various economic demands covered by a state's finite resources are projected to continue to rise, thus fostering increased competition for limited budget dollars (Monk, Dooris, & Erickson, 2009; Schuh, 1993; Toutkoushian, 2001). As a result, legislatures are requiring evidence of the effective use of these funds. An example of such measures includes an institution's rates of retention or graduation, respectively (Alexander, 2000, Lewis & Dundar, 2001). Yet, a conundrum exists in that the students paying the increasing tuition prices also live and work within the larger economic context of the state, the fiscal ebb and flow of which simultaneously drives changes in the availability of funding to the educational institution. Put another way, higher education finance is a strained system where diminishing state-level appropriations for higher education meet increasing costs by the institution (Barr, 2002; Zumeta, 2004). The immediate result of this fiscal shortfall in the institution is an increase in tuition pricing with a simultaneous decrease in the availability of

financial aid (Hossler, 2004). To further complicate the financial picture, institutional budgeting woes and concomitant shifting of the fiscal burden to the individual student all occur in the larger economic cycle of the state, which seeks proof of the efficiency and effectiveness of their higher education institutions (Paulsen, 2001a). The simple relationships among state appropriations, institutional expenditures, tuition price, and institutional outcomes (e.g., retention) may not be so linear after all.

Over the past few decades, the price of education has risen steadily and steeply, often exceeding the rate of inflation. Mumper (1993a; 1993b) points to three specific reasons as to why the price of education grew so much so fast: 1) decreasing state appropriations for higher education, 2) increasing expenditures on the physical plant, education infrastructure (i.e., computer labs), as well as faculty and staff compensation, and 3) increasing need for remedial education. Regarding the first issue, states have been forced to “cut” expenditures for higher education (Zumeta, 2004). That is, the portion of the budget pie reserved for higher education shrank, mostly in the face of increasing funding needs for Medicaid and other programs that support a burgeoning elderly population as well as growing expenditures for criminal justice. States have also been faced with pressure to adequately fund the K-12 system (Paulsen, 2001a). In sum, higher education faces competing demands from an increasing number of equally demanding sources. Regarding the second issue, the simple fact of the matter is that the basic costs of education (paying salaries, keeping the lights and heat on) are increasing, much as they are in any other financial forum (Barr, 2002; Farmer, 2004; Mumper, 2001). Cost of living increases need to be met, and the price of oil certainly affects individual institutions that often serve many thousands of persons. Lastly, as more students enter college who are not adequately prepared to attend the college classroom,

universities are faced with diverting funds to remedial programs to get these trailing students up to speed with their peers (Farmer, 2004). At the institutional level, these multiple, competing demands for increasingly limited resources translates into less money available for aid packages for students, which negatively affects retention (Gansemer-Topf & Schuh, 2006; Titus, 2006c).

With an understanding of what is driving the increasing price of education at the institutional level, we can now examine differential pricing for the individual student. Essentially, the rising price of tuition is a reflection that state legislators are expecting the institution (and hence the individual student) to shoulder more of the financial burden (Thelin, 2004; Trammell, 2004; Zumeta, 2004). However, with high tuition often comes fairly substantial economic aid, often referred to as the “high tuition/high aid” approach (Mumper, 1993a; 1993b; 2001). To offset the high price of attending college, many universities are offering fairly lucrative aid packages to students, primarily in the form of merit- or need-based aid (Baum, 2001). Merit-based aid, such as scholarships, is designed to offset price by providing subsidies to those students who have demonstrated outstanding academic achievement (Hossler, 2004). The purpose here is twofold, however. The merit-based aid does help those high-achieving students pay for college, but having such aid available and students attend one’s university is seen as building prestige for the institution (Hossler, 2004; Lewis & Dunder, 2001).

Examining need-based aid, the institution offers discounted tuition for those students who would be unable to pay the high price of tuition. This discounting often takes the form of grants and loans (Baum, 2001; Hearn & Holdsworth, 2004). However, discounting, especially in the form of loans, still places the burden of funding higher education on the

shoulders of the individual (Mumper, 2001). Additionally, while need-based aid is widely available, there have been some changes here as well. For one, while individual institutions do provide some grants and loans, the Federal government is increasingly looked toward for providing such aid (Hearn, 2001; Hearn & Holdsworth, 2004; Thelin, 2004). Related, during the period of time this study investigates (2003-2008), the Federal government was scaling back the Pell Grant program, the rationale being that Stafford loans will be easier to apply for and obtain.

While it may be true that loans are becoming easier to obtain, students from low-SES backgrounds often do not find loans an appealing form of pricing subsidy, because the loan is something that must be repaid, with interest (St. John & Asker, 2001; Titus, 2006b). Another criticism of the high tuition/high aid approach is also class-based, especially with regard to merit-based aid, because, more often than not, students receiving this type of aid were at an economically-based educational advantage compared with peers from less affluent post-secondary school systems (Mumper, 2001; Titus, 2006b). In terms of retention, some research (St. John, Paulsen, & Carter, 2005; Titus, 2006c) clearly indicates that being able to afford tuition most directly affects student retention more so than any other factor.

The Statement of the Problem

Clearly, the economic puzzle of higher educational finance is both multi-faceted and multi-dimensional. Despite the complex nature of the finance puzzle, however, particular aspects delineated above have been investigated. For example, Okunade (2004) examined factors affecting the extent of appropriations for four-year public colleges and universities for all fifty U.S. states. Of particular interest, he found that the most significant predictor of a particular state's appropriation for higher education was the level of outstanding debt,

followed by competing expenditures on Medicaid and the criminal justice system.

Additionally, Okunade (2004) found that there may be some interplay between tuition pricing and state appropriations for higher education. That is, increases in the price of tuition appear to be a function of changes in appropriations for higher education by the state. This finding suggests that colleges and universities raise tuition prices in anticipation of reduced funding from the state. However, as Okunade (2004) only had one lagged year to control for tuition pricing changes as well as institutional support, this effect remains to be replicated empirically. Somewhat similar to Okunade (2004), Weerts and Ronca (2006) examined the differences between states in their funding of Research I institutions. The authors found that the level of financial support for the institution generally varied by three factors (p. 952): “(a) campus commitment to public service and outreach; (b) strength of the higher education governance system; and (c) extent of gubernatorial and legislative support.” Weerts and Ronca (2006) observed that campus commitment to public service and outreach allows the higher education institution to appear less self-serving and thus more positive in the eyes of the legislators.

Despite a lack of research examining the state-level context of higher education finance on retention, recent studies have examined the institutional financial context on retention. Titus (2006b) examined the retention of students from low- and high-SES backgrounds at four-year college and universities. Similar to other research (Terenzini, Cabrera, & Bernal, 2001), Titus (2006b) found that low-SES students were less likely than their more affluent counterparts to complete the baccalaureate degree. Furthermore, Titus (2006b) found that institutional-level finances affected the retention of students. Colleges and universities have multiple revenue streams, which are often comprised of state

appropriations, tuition and fees, and private donations, among other sources. Titus (2006b) found that students are more likely to graduate from institutions where tuition and fees, as opposed to state appropriations and other streams, compose a larger portion of institutional revenue. In other words, at those institutions where more of the fiscal solvency of the university is shouldered by the student through tuition and fees instead of through governmental appropriations, students from those institutions are more likely to graduate. Titus (2006b, p. 394) does not provide a definitive answer as to why this is; however, he indicates that these institutions are more likely to spend more money on students, perhaps on retention-enhancing activities.

Economic context does appear to be an important factor in institutional retention. However, the manner in which the notion of “context” has been utilized is out of context. That is, either the examination of fiscal matters has not been linked to specific outcomes (e.g., retention), or the institution has not been located in the larger context of the state. Additionally, the economic behavior of higher education institutions and the states in which they exist is not very well understood in terms of the impact of economic cycles on finance and the subsequent effect on retention. The purpose of this study is to link these previously unconnected issues in order to better understand the differences in the effects of state-level appropriations, institutional expenditures, tuition pricing, and financial aid on retention at four-year public universities.

Theoretical Framework

On a superficial level it may be intuitive to acknowledge that a state’s economic well-being should have some effect on the public universities dependent on state resources. However, a more holistic understanding would seek to ground this relationship in a body of

theory. Given that universities are organizations that must respond to issues of resource allocation, resource dependence theory was selected as a theory suitable for framing the present study.

Briefly, resource dependence theory “explains organizational behavior in terms of an organization’s internal adjustment to changes in the availability of such external resources as finances that an organization must have in order to function” (Titus, 2006b, p. 373; Pfeffer, 1997; Scott, 1995). As Pfeffer and Salancik (1978, p. 1) note, “...to understand the behavior of an organization you must understand the context of that behavior—that is, the ecology of the organization.... Organizations are inescapably bound up with the conditions of their environment.” Essentially, Resource Dependence Theory is grounded in two primary concepts: a) the context or environment in which the organization exists, generally what the authors refer to as the scarcity or abundance of resources, and b) the extent to which the organization depends on those resources.

The primary assumption of the theory is that all organizational outcomes are products of the environment (Morris, 2004). That is, while the authors recognize changes to the internal structure and operation of the organization, such intraorganizational adjustments are not the cause of changes in organizational outcomes, but rather a product in and of themselves or an intermediary step predicated by environmental inducements. In a later reformulation of the theory, Pfeffer and Salancik (2003) provided greater consideration to constraining factors internal to the organization, in addition to external constraints (“the context/environment”) already considered (Morris, 2007). In this study, such internal constraints (i.e., institutional characteristics) are taken into consideration and controlled for in the statistical analysis. Resource dependence theory allows the researcher to locate those

organizational behaviors within the existing external fiscal context. The fiscal context of state-level appropriations is akin to what Stearns (1986, p. 47) referred to as the capital market, “the resource environment in which corporations meet their capital needs.”

Noting the importance of context to organizational behavior, the principal organizational behavior of interest is the first-year institutional retention rate. This dependent variable was selected in part because it reflects another key theoretical component of Resource Dependence: efficiency and effectiveness (Pfeffer & Salancik, 1978, pp. 32-36). Pfeffer and Salancik (1978, p. 33) caution that efficiency and effectiveness are often misused because they are used interchangeably. As they note, efficiency measures “how well an organization accomplishes its stated, or implied, objectives given the resources used.... [In other words,] output per unit of input....” As such, efficiency is measured objectively and is often interpreted as a value-free measure of organizational behavior. However, Pfeffer and Salancik (1978, p. 93) illuminate the difference between “efficiency” and “effectiveness,” noting, “Instead of asking how much is being produced at what cost, the question increasingly is: *What* is being produced?” [emphasis added]. The former question refers to efficiency, while the latter question signifies effectiveness. For the moment, the question of effectiveness will be left unanswered. Empirically, this study is concerned with the effect of economics (inputs) on the retention of undergraduates (outputs) (Lewis & Dunder, 2001; Paulsen, 2001a). Therefore, matters of efficiency will be addressed in the statistical analysis and subsequent discussion. Matters of effectiveness, on the other hand, will be addressed later as policy implications, because the “effectiveness” of post-secondary education is increasingly a topic of discussion and debate in various legislative and governing bodies.

Having identified the empirical and theoretical issues central to this study, this investigation seeks to answer the following research questions:

1. How does economic context affect the first-to-second year retention of undergraduates at public universities?
 - a. What effect does a state's unemployment rate have on the first-year undergraduate retention rate at four-year, public universities?
 - b. What effect do state appropriations for higher education have on the first-year undergraduate retention rate at four-year, public universities?
 - c. What effect do institutional expenditures have on the first-year undergraduate retention rate at four-year, public universities?
 - d. What effect do tuition revenue and financial aid have on the first-year undergraduate retention rate at four-year, public universities?
 - e. How do these relationships affect the growth (change) in the institutional retention rate over time?
2. How does a state's economic health (as measured by the annual unemployment rate) affect appropriations for higher education?
 - a. How do state-level appropriations for higher education vary with respect to appropriations for Medicaid and the criminal justice system?

Method

This investigation is a longitudinal, predictive study (Johnson, 2001). The investigation is longitudinal in that panel data are utilized. The data are panel in nature because the same units (i.e., institutions of higher education) will be observed over time. This study is predictive because the investigation involves predicting the outcome of

particular events, for example, whether first-year retention is a function of the prior year's appropriation for higher education. Data for this study come from three sources: the National Center for Education Statistics (NCES), the National Association of State Budget Officers (NASBO), and the Bureau of Labor Statistics (BLS). More specifically, higher education institutional measures come from the NCES Integrated Postsecondary Education Data System (IPEDS), measures of state-level appropriations are derived from annual State Expenditure Reports prepared by NASBO, and the BLS supplies measures of the annual state-level unemployment rates.

The research questions for this study, as well as subsequent issues presented, are particularly well-suited for analysis via hierarchical linear modeling (HLM) for several reasons. First, the explanation of the phenomenon in question (institutional retention) is one that is multi-level in nature. Institutional retention rates vary both within and between states. However, we need further clarification as to whether that outcome is more a factor of differences between institutions in a particular state or if the relationship between retention and institutional funding is a product of differences between states. HLM allows for simultaneous examination of both between- and within-context variation, something that conventional (e.g., OLS regression) techniques do not allow. Secondly, there is good reason to speculate that error covariances between higher education funding and institutional retention are highly interrelated. Again, HLM allows us to determine if the variation in funding and retention is more a function between contexts or within contexts. Thirdly, HLM provides for the analysis of longitudinal data. This is important because this investigation explores changes in institutional retention rates over time. Lastly, to re-emphasize, HLM allows us to explore the extent of the effect of multiple levels of analysis for a given

phenomenon through the decomposition of the variance and proportional reduction of variance at each level within and between models. This is useful because it provides a more specific indication as to the contextual source of the variation and variance in the dependent variable.

This study estimates a three-level hierarchical model of the first-year retention rate in four-year public institutions of higher education. While each specific permutation of the general model is discussed in greater detail, below, the general model is as follows. Level 1 encompasses the growth model, estimating the change in institutional retention rate over time. Level 2 is the institutional-level model, which estimates effects of the institutional variables (i.e. revenues, expenditures, and institutional characteristics). Level 3 is the state-level model, estimating effects of economic conditions of the state (i.e., appropriations and labor market conditions).

Prior to estimating the full (conditional) model, a fully unconditional analysis of variance (ANOVA) of the dependent variable is conducted. Assuming that the ANOVA reveals that the Levels 2 and 3 variances are statistically significant from zero, that is, whether differences are revealed between institutions and between states, respectively, a simple growth model is estimated. The purpose of this is to determine whether or not there is actual temporal variation in the institutional retention rate. If the temporal variation variances are found to be statistically significant, then two analysis of covariance (ANCOVA) models are estimated. The first ANCOVA examines just the effect of including institutional-level covariates at Level 2. A second ANCOVA examines just the effect of including the state-level economic covariates at Level 3. Estimating these models separately allows us to determine whether or not these respective variables have any effect on the

institutional retention rate, both within and between contexts. Finally, a full model is estimated. This model includes the Level 1 growth model, the Level 2 institutional covariates, and the Level 3 state economic conditions.

Significance of the Study

This investigation is significant for a few reasons. Perhaps the most significant contribution this study offers is the analysis of multi-wave panel data. Prior to this research, virtually all studies examined retention only from one point in time, lagging only one or two key variables (such as institutional finance *or* state higher education appropriation) to the immediately preceding period. Per Resource Dependence Theory (Pfeffer & Salancik, 1978), such a procedure does not fully capture the significance of resource context and subsequent organizational change. From a theoretical point of view, examining the same institutions over multiple points in time allows for a clearer picture of the shifting organizational behavior to emerge. Different questions arise and answers emerge when behavior is analyzed in terms of single points in time versus trends over time. This investigation examines changes in organizational outcomes (i.e., the institutional retention rate) over multiple years. Additionally, this study uses a more complex specification of the resource context (institutional finance located within state-level finance). Because of the more precise specification of the context, coupled with the examination of the organizational behavior over time, this study presents a more firmly, theoretically grounded investigation.

Beyond the theoretical underpinnings facilitated by the use of panel data, these data also allow for a more robust statistical analysis. Panel data are a merit in and of themselves (Babbie, 1998; Neuman, 1997). Moreover, the institutions comprising the sample are also located in their respective states, resulting in multilevel data. When combined, the

multilevel, panel data examined in this study present an evolution from prior studies that either measured multiple contexts, but only at one point in time (Titus, 2006c), or measured multiple points in time, but only approximating a true multilevel analysis (Monk, Dooris, & Erickson, 2009). From a purely methodological orientation, this study is a departure from prior research.

Finally, related to the unique nature of the data used in this study, the particular data analytic procedure—hierarchical linear modeling (HLM)—is also fairly unique. HLM as a statistical analysis tool has been seldom used in higher education research (Titus, 2004), but it is gaining in popularity (Titus, 2006c). Still, the underutilization of this particular data analytic method sets this study apart from others. More importantly, however, is that HLM is a method that allows for questions about context to be answered. Those are precisely the sorts questions driving this investigation.

This study is described as attempting to analyze a “complex puzzle.” It is, yet simultaneously is not. The issues are complex. The data are complex. The statistical method is complex. However, the research questions are purposefully crafted to disassemble the puzzle into component parts, each of which needs to be examined in its own right. Singularly, these various components appear fairly straightforward in their design, which they are. Yet, like most puzzles, the pieces only fit together in one manner, within a specific sequence. This study seeks to understand how and why first-year retention varies at four-year, public universities. This particular variable is an outcome of organizational practices. The organizational practices are a function of state-level funding activity. In turn, all of these activities and outcomes are also contained within the fiscal context of the state. This cycle

manipulates when and how all of the pieces fit together, requiring the puzzle to be reconsidered all over again.

Limitations and Delimitations

This research has three key limitations, all of which are rooted in the nature of the data. The first limitation is that the data come from secondary sources, specifically government-sponsored data collections. As with any secondary data analysis, the investigator wholly relies on the ability of the original researchers to have accurately collected and recorded the data. This potential problem is resolved by assessing the reliability of the measures to be used in the secondary data analysis. All of the variables used for this study are numeric and measure the amount of one item or another, for example, the institutional retention rate, total dollars appropriated by the state for higher education, and total institutional expenditures (in dollars), to name a few. In a secondary analysis, measurement errors (outliers) can be identified through univariate analysis of the variables. In turn, any discrepancies identified can be handled either by deleting the case from the analysis or by imputing the particular value from the remaining constellation of data. A second potential problem with secondary data concerns validity, whether or not the measures actually reflect what they intend to measure. While specific definitions of the variables used in this investigation are discussed in greater detail in Chapter 3, a comment can be made here. The measures used in this study are all numeric. They measure physical amounts, such as the total dollars spent on instruction, the percentage of students receiving financial aid, or the racial/ethnic population of the institution. Noting the possibility of error in reporting or transcribing the data, for example, these data constitute objective measures of the phenomena in question. This is as opposed to variables measuring attitudes or self-reported measures of

behavior, which are subjective and rely on the expertise of the investigator to assess the accuracy of the measure. Because of their objective measurement of physical phenomena, the variables used in this investigation are deemed to have extremely high face, criterion, construct, and content validity (Babbie, 1998; Neuman, 1997).

Beyond issues of reliability and validity regarding secondary data, another matter concerns the sample and sampling procedure. The NCES defines its sampling universe for the IPEDS data as, “institutions that participate in or are applicants for participation in any federal student financial aid program (such as Pell grants and federal student loans) authorized by Title IV of the Higher Education Act of 1965, as amended (20 USC 1094, Section 487(a)(17) and 34 CFR 668.14(b)(19))” (NCES, 2009, np). The data used in this study constitute a non-random sample, as all institutions participating in or applying for federal aid are potentially included. Additionally, this study is concerned only with public, four-year institutions. The major implication for this study and potential interpretation of results is that any findings can only be generalized to those institutions that participated in the data collection. However, given that most, if not all, four-year public institutions solicit federal funds, it is assumed that a very high percentage of all of these particular institutions is captured in the final sample.

While the secondary nature of the data limit the study in terms of reliability, validity, and sampling, this investigation is also delimited by the data. A more robust study would estimate the retention of individuals within institutions within states. Information at the individual level would provide for a more robust and enlightening investigation. However, data at the level of the individual were unavailable to the investigator at the time the study was conducted. As a result, the study is an examination of institutions, with the dependent

variable being measured at the level of the organization. That said, both the researcher and any persons reviewing the work contained herein are cautioned against committing the ecological fallacy (Robinson, 1950) when interpreting the results. The ecological fallacy occurs when measurements are made at one level of analysis, but conclusions are drawn based on another level (Babbie, 1998; Neuman, 1997). For example, a researcher with data on sections of a particular course cannot draw conclusions about individual student behavior unless those data are available. The issue for this study is similar. Data are measured at the level of the institution, e.g., the *institutional* retention rate. While this figure is an obvious aggregation of individual student behavior, it can only be discussed in terms of other variables measured at the level of the institution, such as the proportion of the budget spent on instruction or the percentage of students receiving any financial aid, for example. Simply, aggregation of behavior at a higher level does not capture the subtleties of behavior between persons, and subsequently does not permit discussion of any alleged differences.

The third limitation of this study is rooted in an extensive amount of missing data on multiple measures. The *only* measure for which there was little to no missing data was the dependent variable, the institutional retention rate. Here, instances of missing data appear to be missing completely at random. However, on other measures, missing data are a significant problem. For example, a large number of institutions did not report their tuition sticker price. These data were systematically missing. This resulted in the percentage of tuition as total revenue being used a proxy, following Titus (2006c). An earlier version of this investigation included the gender composition of the institution. This could not be computed from the IPEDS and was deleted from the final version of the study. Similarly, faculty composition was also a construct included in an earlier version of this study. Due in

part to missing data issues, however, it too was excluded from this version of the investigation.

Despite instances of missing data, it is important to reiterate a few key points. First, there was little to no missing data on the dependent variable, and those few instances were missing completely at random. Almost all other cases of missing data on the remaining constructs were also determined to be missing completely at random. Cases of systematically missing data were deleted listwise. Given the extensive amount of independent variables used in this investigation, coupled with the multiple observations of those measures, this study still used a robust sample.

Summary

This investigation seeks to understand the economic context of undergraduate retention at public universities. Theoretically, “context” is understood as the fiscal environment of the organization. Empirically, the fiscal environment is measured at two distinct levels: the state and the institution. At the state level, the interest lies in how state appropriation for higher education varies as a function of other state appropriations (i.e., state health system and the criminal justice system, respectively) as well as the general economic health of the state (as measured by the annual unemployment rate). These state- and institution-level economic contexts are then analyzed to understand how they affect the organizational behavior of the institution, measured by the institutional retention rate.

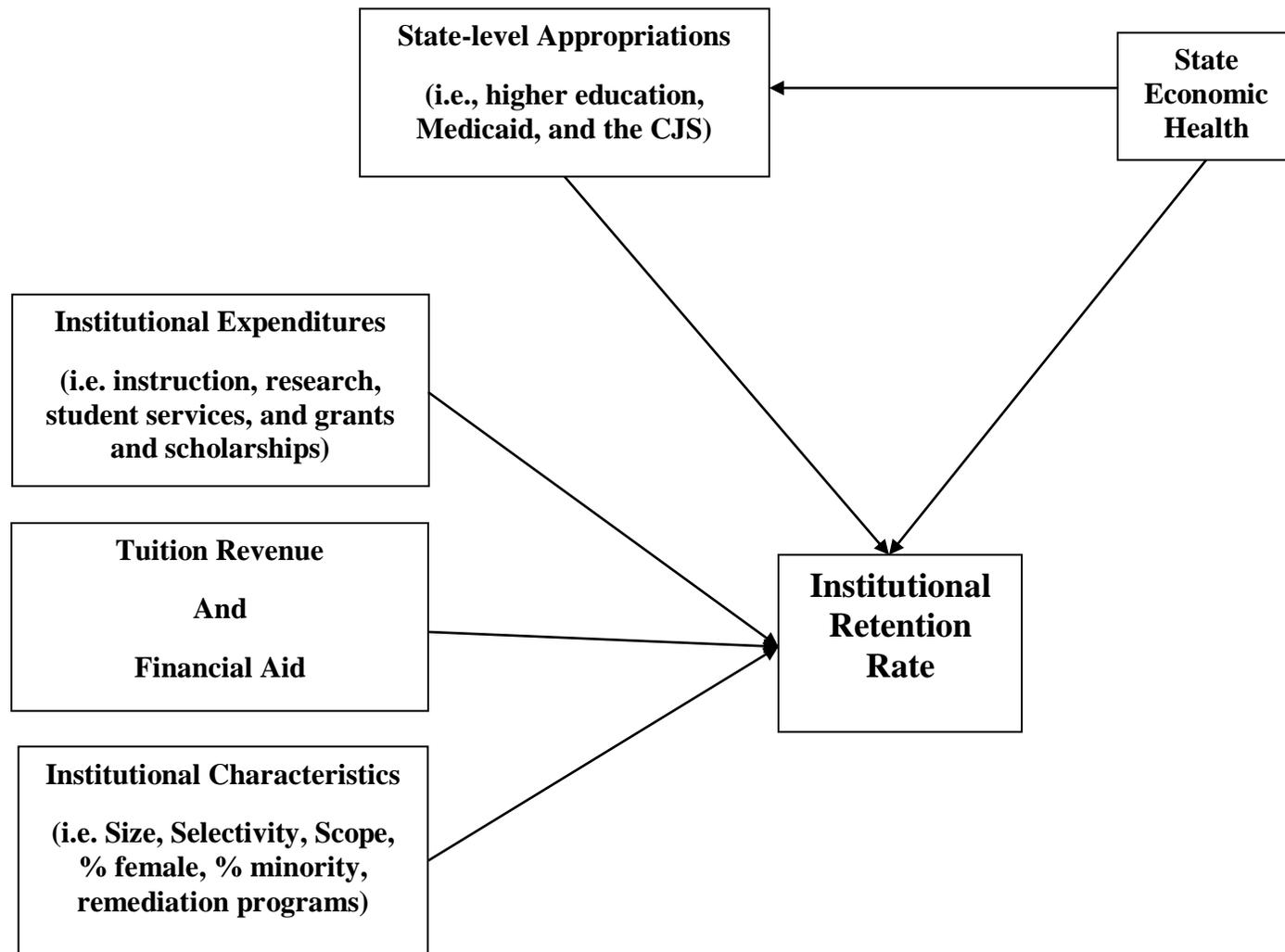


Figure 1. Conceptual framework

CHAPTER 2

Introduction

This chapter presents a review of theory and extant research grounding this dissertation, and is essentially divided into two parts reflecting the significance of each, respectively, to the study. Theory is considered first. This study is informed theoretically by Resource Dependence Theory (Pfeffer & Salancik, 1978). Very briefly, this theory seeks to understand organizational behavior as a product of changes in the resource environment. The principal resource environment with which this study is concerned is the state-level appropriation for higher education. The primary organizational behavior of interest is the institutional retention rate. Of additional interest are intraorganizational responses to the resource environment. This section on theory discusses key constructs from Resource Dependence and how they relate to this investigation. The independent and dependent variables are located within the theoretical explication, which also lays out the logic behind the method of analysis to be employed.

While the first part of this chapter focuses on the theoretical perspective informing this investigation, the second part presents a summary of the extant research on retention. The first section presents selected research studies explaining how state-level economics affects institutional fiscal activity. Then, subsequent sections discuss how different factors affect retention.

Regarding “retention,” two important comments must be made. First, the different empirical studies reviewed in this chapter do not all examine retention, specifically. Some studies examine retention, that is, whether or not students who attend one year of post-secondary education return for a following year. Other studies investigate “persistence” as

the dependent variable, which is defined as the extent to which students keep returning to school until they graduate. Still other studies examine graduation rates, typically whether or not students graduate in four or six years. To graduate, the student most likely persisted, acknowledging that some students may transfer institutions or temporarily stop out—these nuances are not treated in this review or entire investigation. Regardless, if one persisted, one was retained (again, noting exceptions of stopping out). Obviously, graduation is different from persisting is different from retention, and these differences are openly acknowledged. However, both persistence and graduation are viewed as special forms of retention. For this reason, research examining those correlates of interest will invariably include studies focusing on retention, as well as persistence and graduation. It is believed that such a constellation of studies allows for greater understanding of the problem, and will hopefully allow for a more holistic interpretation of the results of the data analysis.

In addition to the inclusion of studies focusing on retention, as well as persistence and graduation, most of the studies included here contain measures both at the level of the individual as well as the level of the institution. This dissertation focuses only on institutional outcomes, the reason for which was discussed in Chapter 1's section on Limitations and Delimitations. Similar to the studies reviewed here that examine retention or persistence or graduation, it is believed that crucial information can be gleaned from studies that examine only individual-level or a combination of individual- and institutional-level data. In fact, it is these latter studies that are of particular interest, as several of them employed the particular data analytic method to be used in this study (hierarchical linear modeling). Understanding how other investigators used HLM and interpreted their findings

should only further enlighten the estimation procedures to be used in the data analysis for this study, as well as provide clearer guidance for the interpretation and discussion of the results.

Resource Dependence Theory

The theoretical framework informing this study is Resource Dependence Theory (Pfeffer & Salancik, 1978), sometimes also referred to as Resource Dependency Theory or Resource Dependent Theory. Prior to expounding on this theory, a few comments are necessary. That “informing” is used to describe the theoretical underpinnings of this research instead of “grounding” or “guiding” reflects three fundamental orientations to the understanding of theory vis-à-vis the research at hand (Reynolds, 1971). First, the research herein is limited in scope, at least in terms of Resource Dependence Theory. The topic of this study concerns the economic context of undergraduate retention. However, Resource Dependence Theory is concerned with more than matters of simple economics. For example, Resource Dependence Theory also treats the activities of one organization as juxtaposed with other organizations or how an organization reacts to the political aspects of its environment. Given the empirical and theoretical delimitations of this study, then, that theory informs rather than grounds or guides the investigation reflects a particular epistemological orientation to scientific inquiry (Collins & Waller, 1994; Reynolds, 1971). Second, and related, this study should not be interpreted as constituting a “test” of the given theoretical framework. Hypotheses were derived primarily from the review of the empirical literature, as understood, however, through a Resource Dependence lens. These theoretical delimitations should not be thought of as questioning the utility of Resource Dependence Theory. To the contrary, the narrow use of Resource Dependence Theory as an informing framework for this investigation is wholly appropriate, as should be demonstrated in the

discussion, below. Third, this study presupposes the assumptions, concepts, and relationships developed in Pfeffer and Salancik's (1978) theoretical explication (Reynolds, 1971). Therefore, no critique of the theory will be offered. The discussion now turns to an overview and elucidation of Resource Dependence Theory.

Pfeffer and Salancik (1978, p. 1) open their exposition of Resource Dependence Theory, saying, "...to understand the behavior of an organization you must understand the context of that behavior—that is, the ecology of the organization...Organizations are inescapably bound up with the conditions of their environment." Essentially, Resource Dependence Theory is grounded in two primary concepts: a) the context or environment in which the organization exists, generally what the authors refer to as the scarcity or abundance of resources, and b) the extent to which the organization depends on those resources. The primary assumption of the theory is that all organizational outcomes are products of the environment (Morris, 2004). That is, while the authors recognize changes to the internal structure and operation of the organization, such intraorganizational adjustments are not the cause of changes in organizational outcomes, but rather a product in and of themselves or an intermediary step predicated by environmental inducements. In a later reformulation of the theory, Pfeffer and Salancik (2003) provided greater consideration to constraining factors internal to the organization, in addition to external constraints ("the context/environment") already considered (Morris, 2007). In this study, such internal constraints (i.e., institutional characteristics) are taken into consideration and controlled for in the statistical analysis.

Resource Dependence Theory seeks to explain organizational behavior as response to constraints imposed by the environment or context. What is meant by "context?" The term has been bandied about in social research during the past several years. Pfeffer and Salancik

(1978, p. 68) define “context,” identifying three characteristics of environment: “concentration, the extent to which power and authority in the environment is widely dispersed; munificence, or the availability or scarcity of critical resources; and interconnectedness, the number and pattern of linkages, or connections, among organizations.” Of these three, this investigation is principally concerned with munificence. More specifically, the critical resource in question is physical capital, and the general environment is the economic and fiscal health of the state.

Pfeffer and Salancik (1978) use “resources” in a general way and appropriately so, because resources can take multiple forms (Galaskiewicz & Marsden, 1978; Johnson, 1995). For this study, physical capital, specifically, state-level appropriations for higher education, was selected as the critical resource to be studied. In her study of corporations (a type of organization), Stearns (1986, p. 51) explains the centrality of physical capital among other sorts of resources, “Capital is the motor driving all corporate activity. Capital supplies the physical resources (i.e., raw materials, supplies, plants, and machinery) and human resources (i.e., management, technicians, workers) necessary for production. The flow of capital determines when and where production takes place. With capital, corporations have the resources to adapt to environmental demands and changes (e.g., diversify, automate) and to manipulate the environment to ensure their survival (e.g., political lobbying, advertising).” Regarding colleges and universities, physical capital provides for classrooms, computer labs, residence halls, and student centers. Such capital also pays faculty and staff salaries and allows students to pay tuition. In terms of this investigation, of particular interest is how dependence on an external resource, specifically state-level higher education appropriation,

affects an organization's behavior, a higher education institution's rate of retention of first year students into their second year.

Even though the focus of this dissertation is munificence (the abundance or scarcity of resources), this is not to say that concentration and interconnectedness are not important. With respect to public IHE's, an examination of concentration would include decision-making within the state legislature, especially where education funding was concerned (McGuinness, 2005). Also included would be any other governance structures, such as state governing boards, that exercise authority or control over the institution (Hines, 1997). For the purposes of this study, however, state-level funding is assumed a priori, while tacitly acknowledging the power and authority various governing bodies wield over colleges and universities (Voogt & Volkwein, 1997). However, the nuances of the exercise of power and authority that occur in state legislature appropriation debate and higher education governing board policy meetings are seen as being outside of the scope of this investigation.

Just as concentration is excluded from consideration for this study, so too is interconnectedness. Interconnectedness provides a means for organizations to adapt to environmental changes (Johnson, 1995). In one fashion, colleges and universities are often associated with or "linked" to each other, for example, whether they exist in the same governance system or participate in the same athletic conference. Another example of the interconnectedness of universities can be found in the emergence of learning communities. Despite these different linkages, however, HEI's mostly exist as singular entities that react to environmental changes by changing their internal structure rather than reaching out to similarly situated others (Huisman, 1997). Contextually, the public colleges and universities comprising the sample for the research here *are* grouped by U.S. state. Nor is this grouping

nominal, because the economic environment of that state is hypothesized to affect organizational outcomes. Beyond simple matters of institutional finance, however, any interconnectedness a particular HEI has with another HEI, corporate body or private foundation is not considered. Despite known implications of such relationships (Pusser, Slaughter, & Thomas, 2006), an a priori assumption of organizational autonomy allows the organization to be treated as having a high degree of control concerning internal matters (Johnson, 1995; Oliver, 1991; Silver, 1993), thus rendering moot any issues of interconnectedness.

Thus far, this discussion treated the first central concept of Resource Dependence Theory, the environment/context, and its three components: concentration, munificence, and interconnectedness. This investigation, however, is most concerned with munificence (the abundance or scarcity of resources). The principal organizational behavior of interest is the first-year institutional retention rate. This dependent variable was selected in part because it reflects another key theoretical component of Resource Dependence: efficiency and effectiveness (Pfeffer & Salancik, 1978, pp. 32-36). Pfeffer and Salancik (1978, p. 33) caution that efficiency and effectiveness are often misused because they are used interchangeably. As they note, efficiency measures “how well an organization accomplishes its stated, or implied, objectives given the resources used.... [In other words,] output per unit of input....” As such, efficiency is measured objectively and is often interpreted as a value-free measure of organizational behavior. However, Pfeffer and Salancik (1978, p. 93) illuminate the difference between “efficiency” and “effectiveness,” noting, “Instead of asking how much is being produced at what cost, the question increasingly is: *What* is being produced?” [emphasis added]. The former question refers to efficiency, while the latter

question signifies effectiveness. For the moment, the question of effectiveness will be left unanswered. Empirically, this study is concerned with the effect of economics (inputs) on the retention of undergraduates (outputs) (Lewis & Dundar, 2001; Paulsen, 2001a).

Therefore, matters of efficiency will be addressed in the statistical analysis and subsequent discussion. Matters of effectiveness, on the other hand, will be addressed later as policy implications, because the “effectiveness” of post-secondary education is increasingly a topic of discussion and debate in various legislative and governing bodies.

Beyond the theoretical underpinnings (efficiency/effectiveness) guiding the selection of the dependent variable (first-year undergraduate retention), inclusion of other variables in this investigation is also informed by theory. The primary independent variables (state economic health and state-level higher education appropriation) measure the broad resource context of the study. However, other variables at the level of the institution are included because of their theoretical relevance. Of immediate attention among these are measures of institutional economics, specifically, institutional expenditures, tuition price, and financial aid. These are measures of the immediate resource context at the institutional level. Institutional expenditures, tuition price, and financial aid are not intervening nor mediating variables in the usual sense, but instead assess the effect of organizational inputs on the output (i.e., institutional retention). On the one hand, expenditures, tuition, and financial aid are outcomes of higher education appropriations at the state level. Simultaneously, however, these institutional economic measures also independently affect the institutional retention rate. The complexities of this relationship will be treated in greater detail in the chapter discussing the data analytic procedure.

State-Level Economics and Institutional Finance

Okunade (2004) examined factors affecting the extent of appropriations for four-year public colleges and universities for all fifty U.S. states. Of particular interest, he found that the most significant predictor of a particular state's appropriation for higher education was the level of outstanding debt, followed by competing expenditures on Medicaid and the criminal justice system. Additionally, Okunade (2004) found that there may be some interplay between tuition pricing and state appropriations for higher education. That is, increases in the price of tuition appear to be a function of decreases in higher education appropriations by the state. However, as Okunade (2004) only had one lagged year to control for tuition pricing changes as well as institutional support, this effect remains to be replicated empirically. Somewhat similar to Okunade (2004), Weerts and Ronca (2006) examined the differences between states in their funding of Research I institutions. The authors found that the level of financial support (more as opposed to less) for the institution generally varied by three factors (p. 952): "(a) campus commitment to public service and outreach; (b) strength of the higher education governance system; and (c) extent of gubernatorial and legislative support." Weerts and Ronca (2006) observed that campus commitment to public service and outreach allows the higher education institution to appear less self-serving and thus more positive in the eyes of the legislators.

The effects of the changing nature of state-based funding were explored in a study by Monk, Dooris, and Erickson (2009). Looking at national data, the authors identified that the general trend over the past decade is one of a "significant downturn" (p. 302) in the amount of state monies appropriated for public research institutions. This decline occurred regardless of the historical extent (great or limited) of a particular state's funding of public

higher education. A somewhat similar trend, decline was observed for university endowments, which are used to shore the financial stability of the institution.

Retention

Institutional Selectivity

Oseguera (2006) examined many institutional factors that affect four- and six-year completion rates. After controlling for all other individual and institutional-level variables, Oseguera found that institutional selectivity (as measured by the composite SAT/ACT score of the entering freshman cohort for a particular academic year) had a positive effect on graduation rates. This effect was consistently greater in magnitude for Asian, Black, and Mexican students than for White students. Phrased in a different way (Oseguera, 2006, p. 48), racial/ethnic minority students experienced lower rates of graduation at institutions of “low selectivity.” In their study of private baccalaureate-level institutions, Gansemer-Topf and Schuh (2006) examined the effect of institutional selectivity on both first-year retention and six-year graduation rates. In general, the authors found that institutional selectivity (derived from the year 2000 report of “Barron’s Profile of American Colleges”) had a statistically significant positive effect ($p < .001$) on both retention and graduation rates among the private IHE’s studied.

The findings from these studies echo an earlier work by Titus (2004), who studied the persistence of undergraduates at four-year institutions. Not surprisingly, Titus (2004) found that institutional selectivity does have a statistically significant positive effect ($p < .001$) on persistence. However, the author also reported that individual (student ability) characteristics have an effect on persistence. Yet, Titus’ (2004) study was unique in that his analytical method (HLM) allowed him to determine that the difference between the institutional- and

individual-level effects was statistically significant, meaning that the context of (greater) institutional selectivity does matter to persistence. Even in the face of individual student characteristics, the environment still influences individual students, regardless of their unique abilities. The singular importance of the effect of institutional selectivity on persistence was also reported by Astin (2006). He found that among all types of institutional variables predicting four-year graduation rates, the degree of selectivity of the institution (high versus low) exhibited the strongest correlation.

Institutional Size and Scope

In addition to studying the effects of institutional selectivity on retention, Antley (1999) examined how institutional size and scope affect the institutional one-year freshman retention rate. In general, the effect of institutional size (small, medium, or large) on retention was not significant, and in only one model, which controlled for the geographic location (western U.S.) of the institution, did institutional size have a significant (negative) effect on retention. Oseguera (2006) (in addition to matters of institutional selectivity mentioned above) also studied the effect of institutional size on baccalaureate completion rates. She found that institutional size affected retention rates differently for White students as compared to racial/ethnic minority students, net of all other factors. For example, when Asian and White students were compared, institutional size had no statistically significant effect on retention rates for Asians, but institutional size had a statistically significant ($p < .001$), positive effect on retention rates for White students. When Black and White students were compared, institutional size had a positive, statistically significant effect for both groups, but the effect was stronger for Black students ($b = .166, p < .001$) than for White students ($b = .086, p < .05$). Finally, when Mexicans (Oseguera specifically references

Mexicans, not “Latinos/Hispanics”) and White students were compared, institutional size had no statistically significant effect on retention for either group.

Huffman and Schneiderman (1997) also studied the effect of institutional size (i.e. enrollment) on graduation rates. Enrollment was negatively (albeit very weakly) correlated with an institution’s graduation rate. However, their regression models were rather robust, accounting for almost two-thirds of the variation in graduation rates. What was more telling in their study was the graphical representation of their quasi-survival analysis, which clearly demonstrated that as institutions grow in size, the percentage of students that eventually graduate grows smaller.

Titus (2004) investigated the effect of institutional size on undergraduate persistence. He found that size does matter, with the greater the unit increase in student enrollment, the greater the likelihood of persistence. It should be noted that “size” was a continuous variable measuring the log-transformed total enrollment at the particular school. In a later study examining six-year graduation rates (Titus, 2006b), institutional size was changed into a somewhat more meaningful construct of “small,” “medium,” and “large.” However, in this study, institutional size had no effect on the six-year graduation rate, net of all other factors.

In addition to the size of an institution, institutional scope (i.e. the research mission or the highest level of degree offered) has also been investigated in terms of its effect on retention. Antley (1999) studied institutional scope in addition to institutional size. For most models, being a Research I institution (as compared to a Research II school) had a positive, significant effect on retention. Other measures of scope (baccalaureate only, terminal master’s, doctoral granting) had no observable effect on retention, except for schools in the west, where doctoral institutions (as compared to baccalaureate) had a negative, significant

effect on retention. Similar to Antley (1999), Cragg (2009) found that, controlling for other institutional-level variables, scope had no statistically significant effect on the probability of an individual student completing his or her baccalaureate degree within four or six years.

As environmental factors, an institution's scope as well as its size may not be very well understood. Part of the problem is that different measures for both scope and size, respectively, are employed. The studies described here are prima facie evidence of such discrepancy. Also, a different sample was used in each of these studies, so they can hardly be thought as replicating each other. Furthermore, each study presented different research questions. For instance, Oseguera (2006) was more interested in how race/ethnicity interacted with institutional size to affect the graduation rate, rather than any main effect of institutional size on the graduation rate itself. Ultimately, these findings point to continued need for consistent research on these environmental factors.

Tuition as Revenue, Tuition Pricing and Financial Aid

Understanding the fiscal context of the institution is one of the aims of this study. Two studies by Titus (2006a, 2006b) are notable for examining the effect that tuition (as a percentage of total institutional revenue) has on the three-year persistence and six-year completion rates of undergraduates, respectively. Regarding the former study (Titus, 2006a), the author examined the effect that tuition as a percentage of institutional revenue has on three-year student persistence. As Titus (2006a, pp. 367-368) succinctly notes, "the likelihood of persisting increases substantially with the percent of revenue derived from tuition (odds-ratio = 6.322, $p < .01$)." In another study, which focused on the socioeconomic background of the individual student as well as the economic context of the institution, Titus (2006b) first observed that among institutions, the percent of revenue derived from tuition

had a statistically significant, positive (albeit small) effect on six-year graduation rates. Additionally, for individuals, being from either of the two lowest SES quartiles had a negative effect on the odds of graduating within six years, compared with students from the highest SES quartile, net of all other factors. To better understand why this might be the case, Titus (2006b) next made a comparison of students grouped by SES quartile by institutions grouped by quartile. The data clearly demonstrate that students from the lowest SES quartile are more likely to attend schools where tuition constitutes a higher source of revenue than other streams. Comparatively, students from the highest SES quartile were more likely to attend schools where tuition comprises a lower portion of institutional revenue. Graduation rates were lower at the former, yet higher at the latter. The financial context of an institution does have an effect on staying in school, but the nature of this relationship merits further investigation.

In a robust study, St. John, Paulsen, and Carter (2005) examined the nexus between tuition price, financial aid, and the undergraduates' decision to persist. Considering African Americans, perceptions of institutional availability of financial aid had a positive effect on the decision to persist. However, perceptions of whether a college had low tuition (versus a school with high tuition) had no effect on persistence. Perhaps what is most startling is that when real dollar (as opposed to perceptions of) amounts of financial aid and tuition were considered, these factors had statistically significant, negative effects on persistence. In other words, increased levels of financial aid to offset a higher tuition price did not improve the likelihood of staying in school. These effects remained even after controlling for cost of living. This finding runs counter to the logic of the "high-tuition/high-aid" approach to tuition pricing. Regardless, it is not so much the absolute dollar amounts that negatively

affect African Americans' decisions to persist, so much as it is the shortfall that aid and income do not cover. The bigger the gap, the greater the likelihood these students will not persist. When White students were examined, many of the same effects as observed for African Americans were observed again. The perception of the availability of financial aid increased the likelihood of persistence. Further, actual grant dollars as well as income from working, relative to the costs of tuition and living all had negative, significant effects on persistence. It appears that a financial gap exists for White students and African American students alike; moreover, the shortfall between aid and tuition is a rather influential factor on the decision to persist for both groups.

In perhaps the most sophisticated study of the relationship between tuition pricing, financial aid, and six-year graduation to date, Titus (2006c) used hierarchical models to contextualize not only the student (individual level) and institutional covariates of graduation, but he also located those institutions within the larger economic context of state higher educational policy, especially in terms of state-level appropriations for higher education. At the individual (student) level, the author considered two economic variables: unmet financial need and hours worked. Not surprisingly, unmet financial need had a significant, negative effect on six-year graduation. Additionally, students who worked eleven or more hours during the week were less likely to graduate in six years than students who did not work at all, net of all other factors. At the institutional level, the average SES of the freshman class (an effect of peer group) had a significant, positive effect on six-year graduation. Among various measures of institutional revenue, only the percentage of revenue derived from tuition was found to have a significant, positive effect on six-year graduation, net all other factors. At the state level, only state appropriations for financial aid

were found to have significant effects on the log-odds of graduating within six years. Total appropriation for higher education at the state-level had no significant effect on graduation, nor did state-level FTE expenditures. Furthermore, unemployment had no significant effect on completing college within six years.

Singell (2004) studied the effect of financial aid on retention of a sample of students from the University of Oregon. Similar to the findings for tuition price, it also was found that financial aid had a positive effect on retention. Net of all other factors (e.g., student, environmental, and institutional characteristics), Singell (2004) reported that students actually having filled out the FAFSA form, plus the availability of grants, subsidized loans, and scholarships all had significant, positive effects on the natural log-odds of re-enrolling at the University of Oregon. However, being engaged in a work study job had a negative, significant effect on the natural log-odds of being retained. The presence of unsubsidized loans had no effect on retention. Of peculiar interest is an interaction term crossing the effect of need-based aid with merit-based aid. A negative effect on the dependent variable was observed, meaning that increases in college GPA reduce the effect of need-based (scholarship) aid on retention. A reason for this is that higher college GPA might reflect better preparation for college itself, and such individuals tend to come from more affluent environments (e.g., family of origin and/or school district). The less needy the individual, the less they will require need-based aid.

Institutional Expenditures

Webber and Ehrenberg (2009) examined the effects of institutional expenditures on institutional graduation rates. Their main effects model revealed that expenditures on student affairs, academic support services, research, and instruction all had statistically significant,

positive effects on graduation rates. However, when institutional size (as expressed by undergraduate and graduate enrollment, respectively), median SAT score, school racial composition, and school gender ratio were controlled for, only expenditures on student affairs and instruction continued to have statistically significant, positive effects on graduation rates, net of all other factors. Curiously, research expenditures now had a *negative* effect on graduation rates. Simultaneously, however, only the size of the graduate student population also had an effect (also negative) on graduation rates. If the presence of graduate students were thought of as an indication of the scope of the school (i.e. the granting of post-baccalaureate degrees), then the negative effect of research dollars on graduation could be interpreted as an indication of greater financial support of graduate students as opposed to undergraduates at the institution..

Gansemer-Topf and Schuh (2006) also investigated how institutional expenditures affect retention at four-year HEI's. The authors parsed the effects of various institutional expenditures (i.e. instruction, student services, academic support) between low- and high-selectivity institutions. The average magnitude of dollars spent in the different fiscal categories differed, with the highly selective institutions spending more than their less selective counterparts. A greater amount of the variance in both retention and graduation was explained by the fiscal expenditures at the highly selective institutions than at the less selective institutions. Interestingly, the fiscal characteristics were standardized through transformation into percentages. Even this procedure revealed that more of the variance in the retention and graduation rates was explained by the fiscal characteristics at the highly selective institutions than at the less selective institutions. The finding that institutional finance has a greater effect at highly selective versus less selective schools points to a

complex trend among IHE's. Highly selective institutions tend to have higher retention rates than less selective institutions. At the same time, highly selective institutions tend to have greater fiscal resources, both in terms of a wider variety of revenue streams as well as more money to spend on retention-enhancing student services. Beyond the economic, highly selective institutions also tend to draw cohorts of students with higher GPAs and standardized test scores than their less selective counterparts. These student characteristics are shown to have positive effects on graduation (Titus, 2006b). If one views these issues from a resource perspective, it appears that highly selective institutions have a greater share of resources at their disposal than less selective institutions. Having more resources allows the institution to more capably address problems of retention.

Titus (2006b) also examined the effect of institutional expenditures on graduation rates. Despite including different areas of expenditures, such as instruction, student services, and research, only the measure of total education and general (E & G) expenditures per FTE student was found to have a statistically significant, positive effect on the odds of six-year graduation. Similar to the finding reported above regarding the effect of tuition as percentage of institutional revenue, Titus (2006b) found that students from the highest SES quartile were more likely to attend those schools spending the most money on total E & G expenditures. On the other hand, students from the lowest two SES quartiles were more likely to attend schools where total E & G expenditures were comparatively lowest. Another study by Titus (2006c) produced similar findings. For example, among the different expenditures examined, only the measure of monies spent per FTE student was found to have a statistically significant (positive) effect on the log-odds of graduating within six years, controlling for all other factors. Curiously, neither income from state appropriations nor

expenditures on instruction, student services, and aid, among other factors, had any significant effect on the chance of graduating.

Very generally, various institutional expenditures typically have positive effects on higher educational outcomes, be it retention, persistence, or graduation. Another general trend is that more highly selective schools usually spend more funds on their students than less selective schools. When different institutional characteristics (such as size, scope, median SAT score, racial and gender composition) are controlled, main effects for most expenditure categories tend to disappear, typically leaving only Total E & G expenditures with any remaining main effect. In sum, expenditures matter, but they have to be examined in light of other institutional factors.

Remediation Programs

Beyond institutional characteristics of selectivity, size, tuition price/financial aid, and, more generally, institutional finance, effects of institutional programs on individual student retention also have been explored. For example, Bettinger and Long (2009) examined how remediation affects whether or not students desist, transfer, or eventually graduate. In their main effects model, remediation was found to have a mixed effect on dropping out during the first year. Students in remediation for English courses were more likely to drop out during their first year, as compared to students not in remediation. For students in math remediation, however, such remediation had a positive effect on *staying in* school (i.e., retention). Even so, remediation was generally found to have negative effects on persistence, as well as four- and six-year graduation rates. In addition to controls for various student characteristics (e.g., gender, race, income, test scores, and so forth), the authors also estimated a model examining the effect of the proximity (geographic distance) between the

student's home and the location of their institution on retention. In this instance, proximity was found to have positive effects on persistence as well as four- and six-year graduation rates.

In addition to programs directly affecting the link between instruction and retention, first-year experience programs have been developed to help reinforce the link between the social aspects of instruction and college life and retention. Jamelske (2009) studied the effects of such a first-year experience (FYE) program on retention among a sample of first year students at a middle-size public institution in the Midwestern United States. Initially, he found that not all courses listed as being in the FYE program actively sought to achieve all of the goals laid out by the program. Not surprisingly, the author found no significant effect on retention for students having attended FYE classes. However, when those courses that fully endorsed the aims of the FYE program were analyzed separately, he found that such courses did have positive, significant main effects on retention. Furthermore, such effects persisted when the programs were analyzed controlling for individual student characteristics. Additionally, results clearly demonstrated that students who participated in the FYE program were more likely to be retained than similarly situated peers, controlling for individual student characteristics.

Race and Retention

As observed in the preceding sections, the race of the individual student (Oseguera, 2006; St. John, Paulsen, & Carter, 2005), the racial/ethnic minority composition of the student body (Lamb, 1999; Museus, Nichols, & Lambert, 2008), or the racial climate of the institution (Nora & Cabrera, 1996) appear fairly often as control variables in the studies discussed. The extant research on race and retention generally suggest that White students

are retained at higher rates, at least as compared to African Americans, Latinos, and Native Americans (Oseguera, 2006; Smith, 1995). When Asians are identified, however, they often exhibit the same, if not greater, rates of retention as White students (Oseguera, 2006). These effects are often net of all other factors. However, it is important to further scrutinize the relationship between race and retention. For example, when other factors are examined, such as the racial diversity of the institution (Nora & Cabrera, 1996), institutional size or selectivity (Alon & Tienda, 2005; Basten et al., 1997; Gansemer-Topf & Schuh, 2006; Niu, Tienda, & Cortes, 2006), or especially financial matters, such as the tuition-funding gap (Arbona & Nora, 2007; St. John et al., 2004; St. John, Paulsen, & Carter, 2005; Titus, 2006b; 2006c), race/ethnicity may or may not have an effect on retention (or persistence or graduation). Part of the issue can be explained most directly by affordability (Baum, 2001, p. 42). In 1971, the cost of attending a public university for a low-income family was 42% of their annual income. By 1999, however, that cost had risen to 61% of income. For private schools, cost increase was more extreme, rising from 91% to 162% over the same period, for those families from low-income backgrounds. When these figures are coupled with the understanding that matters of race and class are often intertwined (Oliver & Shapiro, 2006), the financial considerations for staying in school become harshly clear (Titus, 2006b).

Beyond economic imperatives (i.e., the availability of funds) driving the decision to remain in school, environmental factors might “interact” with the race/ethnicity of the student to also influence thoughts about continuing in school or stopping out. Regarding issues of diversity, size, or selectivity of an institution, one could speculate about the “climate” fostered at colleges and universities (Alon & Tienda, 2005). Without delving into matters of social and cultural capital (Wells, 2008-2009), it could be the case that the

individual student and the particular institution were not a good “fit” for each other or that environmental effects do indeed have a strong “push” or “pull” (Bean, 1980; Nora & Cabrera, 1996; Tinto, 1975, 1993). Still, this is not to fault the individual or the institution, but instead it is to point out that something else might be occurring in the interaction between the student and the school she or he attends (Tinto, 1993). Therefore, it could be the case that interaction effects could exist between race and other covariates discussed. Yet, much research fails to report explicit tests for interaction effects. Regardless, it could be stated that the general comment is, yes, race matters, but we are still figuring out in what ways and by how much race does matter.

Summary

This chapter presented an overview of the theory informing this investigation, as well as a review of the extant literature on the relationship between state and institutional finance of higher education, select institutional characteristics, and the respective effects each of these has on the retention of undergraduates. Resource Dependence Theory (Pfeffer & Salancik, 1978) is the theoretical framework underlying this research. Resource Dependence Theory locates organizational behavior within its larger environmental context. Even though Pfeffer and Salancik (1978) identify “context” as having three distinct components—concentration, munificence, and interconnectedness—this investigation is primarily concerned with munificence, the abundance or scarcity of resources. For this study, the organizational behavior of interest is the institutional retention rate, and state- and institutional-level finances constitute the environment in which that behavior occurs. Institutional retention rate was selected as the organizational behavior to be studied because it also corresponds to the theoretical constructs of efficiency and effectiveness, which assess

the organization's ability to produce what it intends (Pfeffer & Salancik, 1978). As noted previously, though, efficiency will be treated in greater detail in the discussion of the results, while effectiveness will be considered in the section on policy implications.

In addition to elucidating Resource Dependence as the theoretical framework informing this investigation, this chapter also presented a review of the extant literature on the relationship between state funding and institutional finance, select institutional characteristics, and their respective effects on retention. On the one hand, it appears fairly clear that a decline in appropriations for higher education by the state means that the institutions in that state will have to find other ways to compensate for the shortfall, often by turning toward tuition as a revenue stream. On the other hand, at the institutional level, the effect of institutional finance on retention is not so clear. Multiple factors appear to affect the relationship between institutional finance and retention. At the institutional level, those schools that have multiple revenue streams at their disposal and consequently are able to spend more money on students tend to have greater retention of their undergraduates. This is opposed to schools where tuition is the major revenue stream and whole dollar expenditures are smaller. Furthermore, tuition pricing and the availability of financial aid also affect retention, with some indication that both absolute and perceived shortfall negatively affect retention. Complicating the picture, however, is the institutional selectivity—highly selective institutions retain more undergraduates than less selective institutions. Additionally, at the student level, the SES background of the student affects retention. Briefly, more affluent students are more likely to attend highly selective schools, which are more financially sound and retention tends to be higher. This is as opposed to less affluent students, who are more likely to attend less selective schools, which are less fiscally secure

and retention tends to be lower. In sum, the economic puzzle of higher education finance and the effect on retention is complicated, which is the theme of this investigation.

Beyond matters of higher education finance, other institutional characteristics were looked at to understand their relationship with retention. Institutional selectivity, as noted, affects retention, with more students being retained at highly selective versus less selective institutions. The effects of institutional size and scope, respectively, on retention are mixed. At times it appears that the larger the student population, the lower the retention rate. Related, the greater the scope (post-baccalaureate degree granting versus baccalaureate only), the lower the retention rate. However, sometimes there is no effect of size or scope on the retention of undergraduates. As opposed to institutional size or scope, retention-enhancing programs positively affect retention. Race also appears to affect retention. Very generally, Whites and Asians are retained at higher rates than African-Americans and Latinos/Hispanics. A couple caveats must be stated, however. First, matters of race are often intertwined with finances. In other words, main effects found for race at times disappear in the face of economic factors, such as in the perceived ability to afford tuition. Secondly, the climate of the institution might impact a student's decision to stay in school, with students deciding to stay at schools that are more inviting or supportive of them.

Despite what is currently known concerning the retention of undergraduates, there are some things that are not known or not known very well. First, as informed by the theoretical framework (Pfeffer & Salancik, 1978) underlying this investigation, not much is known about the resource context of first-year retention from a *multilevel* perspective. Titus' (2006a; 2006b; 2006c) work investigated the effects of institutional- and state-level contexts on undergraduate retention. The point being stressed here is not the statistical analysis

technique employed (hierarchical linear modeling), so much as the theoretical and conceptual issues bound in the analysis of context. HLM just happens to be a convenient tool to explore the distinct yet related contexts of higher education finance at the level of the institution and the state, respectively, and how each of these affect undergraduate retention. As of this writing, these topics are still fairly unique. This investigation uses Titus' (2006a; 2006b; 2006c) research as a starting point and seeks to expand the knowledge base in this area.

While there are certain weaknesses in the literature with respect to the specification of resource context in the study of retention, it was noted that the phenomenon of college student retention has been studied largely from the perspective of individual students. Extant theory (e.g., Bean, 1980, or Tinto, 1993, for example) is conceived almost exclusively at the level of the individual, albeit identifying key organizational constructs when salient. However, retention can be studied from other perspectives, such as the organization. The dependent variable for retention in this investigation is measured at the level of the institution, not the individual. Given this change in the unit of analysis, the results of this investigation are interpreted differently than typical retention studies. For this reason, this study is distinct from most research on retention and helps expand knowledge surrounding retention as an *institutional* outcome, as opposed to an individual outcome. Interpreting the results of this investigation for retention as organizational behavior yields a different set of theoretical and policy implications than if retention were the behavior of individual students.

CHAPTER 3

Introduction

Economic context appears to be important in terms of the extent of institutional retention. However, the manner in which the notion of “context” has been utilized is out of context. That is, either the examination of fiscal matters has not been linked to specific outcomes (e.g., retention), or the institution has not been located in the larger context of the state’s economy. The economic behavior of higher education institutions and the states in which they exist is not very well understood in terms of the impact of these economic contexts and their subsequent effect on retention over time. The purpose of this study is to link these previously unconnected issues—state-level fiscal conditions, institutional finance, and multiple observations over time—in order to better understand the differences in the effects of state- and institution-level variables on retention at four-year public universities. To that end, the following questions will be addressed in the analysis:

1. How does economic context affect the first-to-second year retention of undergraduates at public universities?
 - a. What effect does a state’s unemployment rate have on the first-year undergraduate retention rate at four-year, public universities?
 - b. What effect do state appropriations for higher education have on the first-year undergraduate retention rate at four-year, public universities?
 - c. What effect do institutional expenditures have on the first-year undergraduate retention rate at four-year, public universities?
 - d. What effect do tuition revenue and financial aid have on the first-year undergraduate retention rate at four-year, public universities?

- e. How do these relationships affect the growth (change) in the institutional retention rate over time?
2. How does a state's economic health (as measured by the annual unemployment rate) affect appropriations for higher education?
 - a. How do state-level appropriations for higher education vary with respect to appropriations for Medicaid and the criminal justice system?

Research Design

The investigation is a longitudinal, predictive study (Johnson, 2001) using secondary data. The investigation is longitudinal in that panel data are utilized, the panel being annual observations of the same higher education institutions. The study is predictive because the investigation involves predicting the outcome of particular events, for example, first-year retention as a function of state appropriations for higher education.

Population and Sample

The population examined in the study is all four-year, public institutions of higher education in the fifty United States. Data for the study come from three sources: the National Center for Education Statistics (NCES), the National Association of State Budget Officers (NASBO), and the Bureau of Labor Statistics (BLS). More specifically, the Integrated Postsecondary Education Data System (IPEDS) derived from NCES will be the source of the higher education institutional data. The population universe for the IPEDS data includes postsecondary institutions that provide "a formal program designed primarily for students beyond the 'compulsory' high school age. This includes programs whose purpose is academic, vocational, or continuing professional education, and excludes avocational and adult basic education programs" (NCES, 2008b, np). Excluded from the IPEDS population

universe are, “training sites at prisons, military bases, and corporations,” as well as, “noncredit continuing education programs and education units...[s]chools whose only mission is to prepare students to take a particular test (e.g., CPA)..., and [h]igh schools with vocational programs” (NCES, 2008b, np). As the NCES (2009, np) further notes, “More than 6,700 institutions complete IPEDS surveys each year. These include research universities, state colleges and universities, private religious and liberal arts colleges, for-profit institutions, community and technical colleges, non-degree-granting institutions such as beauty colleges, and others.” Data are available for the 2003 through 2008 Fall Cohorts.

Beyond the NCES IPEDS data, another source of data for this study is the National Association of State Budget Officers (NASBO). The National Association of State Budget Officers is the professional organization for the financial advisors to the governors of states in the U.S. (NASBO, 2009a, np). For the purposes of this study, of particular interest are the annual State Expenditure Reports, which “examine spending in the functional areas of state budgets: elementary and secondary education, higher education, public assistance, Medicaid, corrections, transportation, and all other.” All fifty U.S. States contribute financial data to the annual State Expenditure Report.

In addition to the National Association of State Budget Officers, state-level data will also be drawn from the Bureau of Labor Statistics (BLS). Specifically, the BLS will provide data on the annual unemployment rate (the economic health) for a particular state. BLS data are collected as part of the Current Population Survey (CPS), which is a monthly survey drawn from a probability sample of U.S. households. Labor force participation estimates are reported for those persons aged sixteen and older, excluding active duty military and

institutionalized persons, such as those in prisons or residential healthcare facilities (BLS, 2009a).

Additional Comments about the Sample

Some additional comments about the sample are warranted, as these have direct bearing on key decisions concerning the analysis. First, the sample for this investigation was not normally distributed. Particular measures, primarily several of the institutional-level independent variables, were often skewed and at times kurtotic. Visual inspection of scatter plots revealed two trends: complete heterogeneity or severe homogeneity, the latter graphically representing the skewness of the data. Second, institutions are not randomly distributed among states. For example, certain states, such as Delaware or Wyoming, each contributed only one institution to the final sample. On the other end of the spectrum, states with very large public systems, such as California and New York, contributed 30 and 34 institutions to the final sample, respectively. (North Carolina contributed 15.)

Variable Operationalization

The dependent variable for this study is the first-year retention rate. IPEDS defines “retention” as the percent of full-time, first-year students enrolled during the fall of one year who re-enrolled as either full- or part-time the following fall (NCES, 2003). For example, the first-year retention rate for the Fall, 2003 cohort is measured and reported in 2004. For the purposes of this study, the first-year retention rate will be used. Data on first-year retention are available for the 2003-2008 first-year cohorts.

The primary independent variable for this study is the state-level appropriation for higher education. According to NASBO (2003, p. 103), state appropriations for higher education include “expenditures made for capital construction, community colleges,

vocational education, law, medical, veterinary, nursing and technical schools, and assistance to private colleges and universities, as well as tuition and fees and student loan programs. Higher education expenditures exclude federal research grants and endowments to universities.” States reported their appropriations for higher education both in whole dollars as well as the percentage of the state budget.

Along with appropriations for higher education, this study also considers state appropriations for Medicaid and the criminal justice system. Together, then, these three items constitute the “State-Level Appropriations” element in the conceptual framework. Regarding Medicaid, expenditures included, “spending from state funds, federal matching funds and other funds and revenue sources used as Medicaid match such as provider taxes, fees, assessments, donations, and local funds” (NASBO, 2003, p. 103). Not included were costs associated with administration. Similar to higher education, both whole dollar and proportional figures were reported. Expenditures for the criminal justice system (identified in NASBO as “corrections”) are as complex as those for education and health: “For corrections, states were asked to include, where applicable, expenditures for capital construction, aid to local governments for jails, parole programs, prison industries, and community corrections, as well as expenditures made for juvenile correction programs. States were asked to exclude expenditures for “drug abuse rehabilitation programs and institutions for the criminally insane” (NASBO, 2003, p. 103). As for higher education and Medicaid, states reported both whole dollar figures as well as the portion (percentage) of the state budget occupied by corrections expenditures.

In addition to state appropriations for higher education, Medicaid, and the criminal justice system, another state-level variable enters into the analysis—state economic health. A

state's economic health is measured by its annual unemployment rate. The BLS (2009b, np) defines "unemployment rate" quite simply as, "the proportion of the civilian labor force that is unemployed." For purposes of this investigation, the annual unemployment rate for each state will be used.

Institutional expenditure is a construct of several items. Following Titus (2006c, p. 300), the following variables are included: expenditures on instruction, research, student services, and grants and scholarships. Expenditure categories are defined by IPEDS (NCES, 2002). "Instruction" refers to expenditures for the academic mission of the institution. "Research" is the funds spent for the pursuit of scholarly investigation. "Student services" includes expenditures beyond formal instruction to benefit the physical and social well-being of students. "Grants and scholarships" are remittances (such as tuition waivers and Pell grants) to enrolled students pursuing formal coursework. Excluded are student loans and expenses incurred from work-study programs. Values are reported in dollars, but the percentage that each (i.e., a) instruction, b) research, c) student services, and d) grants and scholarships) comprises of Total E & G expenditure will be computed to allow for comparison across institutions (Gansemer-Topf and Schuh, 2006; Titus, 2006c).

In addition to select institutional expenditures, two more independent variables are specified: percent of revenue derived from tuition and financial aid. Tuition revenue is defined as, "revenues from all tuition and fees assessed against students (net of refunds and discounts & allowances) for educational purposes" (NCES, 2002, np). The percent that tuition comprises total revenue will be used (Titus, 2006b; 2006c). "Financial aid" is defined as, "Grants, loans, assistantships, scholarships, fellowships, tuition waivers, tuition discounts, veteran's benefits, employer aid (tuition reimbursement) and other monies (other than from

relatives/friends) provided to students to meet expenses” (NCES, 2009, np). For this study, the percentage of first-year students receiving any sort of financial aid will be used.

Lastly, five control variables will be used in this study: institutional size, institutional selectivity, institutional scope, remediation programs, and percent minority. “Institutional size” is measured by the total enrollment. Following Titus (2006c, p. 300), it is recoded into three categories: “small” (population of less than 4,000 students), “medium” (population from 4,000 to 15,000 students) and “large” (population greater than 15,000 students).

“Institutional selectivity” was measured using a Carnegie Classification variable specifying whether the institution was “inclusive,” “selective,” or “more selective.” HEI’s identified as “inclusive,” “...either did not report test score data or the scores indicate that they extend educational opportunity to a wide range of students with respect to academic preparation and achievement” (NCES, 2005, np). Relying on IPEDS estimation procedures of standardized test scores for first-year students, institutions defined as “selective” rank “in roughly the middle two-fifths of baccalaureate institutions” (NCES, 2005, np). Similarly, colleges and universities that are “more selective” rank “in roughly the top fifth of baccalaureate institutions” (NCES, 2005, np). As these estimations approximate how Webber and Ehrenberg (2009) addressed institutional selectivity, “inclusive” HEI’s were recoded as being “low selectivity,” “selective” HEI’s were recoded as being “medium selectivity,” and “more selective” HEI’s were recoded as being “high selectivity.”

“Institutional scope” generally refers to two characteristics of an institution of higher education: 1) its terminal degree offerings and 2) its research mission. Regarding the former, four-year institutions are divided into baccalaureate only, terminal master’s, and doctoral-granting schools. Regarding research mission, colleges and universities used to be

designated in fairly simple terms as “Research I” or “Research II” schools. Beginning in 2005, the Carnegie Foundation implemented a more complicated taxonomy to more accurately capture the research mission of a school. This investigation elected to use the more direct measure of terminal degree offering to measure institutional scope, as there was little ambiguity whether or not a school offered a bachelor’s, master’s, or doctoral degrees.

“Remediation programs” captures whether or not the institution offers remedial programs for its students. This measure is dichotomous (1 = Yes, there is a remediation program; 0 = No, there is no remediation program).

In addition to controlling for institutional selectivity, size, scope, and the existence of retention-enhancing programs, this study will also control for race. Regarding race, IPEDS (2002) measures the number of the student body that is White, Black (non-Hispanic), Native American, Asian/Pacific Islander, and Hispanic, respectively. There are also computed measures of the percent of the study body that falls into each of the racial/ethnic minority categories. This study will control for race as the total percentage of the student body that is racial/ethnic minority.

The variable specifications are summarized in Table 1.

Table 1

Variable specifications

Variable	Definition	Origin of Measure	Quantification
Institutional Retention Rate	the percent of full-time, first-year students enrolled during the fall of one year who re-enrolled as either full- or part-time the following fall	Obtained from NCES IPEDS data archive	Interval (0.0 – 100.0)

Table 1 continued

Variable	Definition	Origin of Measure	Quantification
State HE Appropriation	The percentage of the particular state's fiscal budget allocated to higher education	Obtained from NASBO annual report	Interval: (0.0 – 100.0)
State Medicaid Appropriation	The percentage of the particular state's fiscal budget allocated to Medicaid	Obtained from NASBO annual report	Interval: (0.0 – 100.0)
State CJS Appropriation	The percentage of the particular state's fiscal budget allocated to the Criminal Justice System (police, courts, and prisons)	Obtained from NASBO annual report	Interval: (0.0 – 100.0)
Mean Unemployment Rate	"the proportion of the civilian labor force that is unemployed" (BLS, 2009b, np)	Obtained from BLS Annual Report	Interval (0.0 – 100.0)
Mean Instructional Expenditure	expenditures for the academic mission of the institution; a percentage of total E&G expenditures	Computed from NCES IPEDS data archive	Interval (0.0 – 100.0)
Mean Research Expenditure	funds spent for the pursuit of scholarly investigation; a percentage of total E&G expenditures	Computed from NCES IPEDS data archive	Interval (0.0 – 100.0)
Mean Student Services Expenditure	expenditures beyond formal instruction to benefit the physical and social well-being of students; a percentage of total E&G expenditures.	Computed from NCES IPEDS data archive	Interval (0.0 – 100.0)
Mean Grants Expenditure	remittances (such as tuition waivers and Pell grants) to enrolled students pursuing formal coursework. Excluded are student loans and expenses incurred from work-study programs.; a percentage of total E&G expenditures	Computed from NCES IPEDS data archive	Interval (0.0 – 100.0)

Table 1 continued

Variable	Definition	Origin of Measure	Quantification
Mean Tuition Revenue	percentage that tuition comprises total revenue	Computed from NCES IPEDS data archive	Interval (0.0 – 100.0)
Mean % Student Body Receiving Any Financial Aid	“Financial aid” is defined as, “Grants, loans, assistantships, scholarships, fellowships, tuition waivers, tuition discounts, veteran's benefits, employer aid (tuition reimbursement) and other monies (other than from relatives/friends) provided to students to meet expenses” (NCES, 2009, np). For this study, the percentage of first-year students receiving any sort of financial aid will be used.	Computed from NCES IPEDS data archive	Interval (0.0 – 100.0)
Institutional Size	The total student population of the institution	Recoded from NCES IPEDS data archive	Categorical dummy Small (< 4000 population) Medium (4000 – 15000 population) Large (> 15000 population) [Reference]
Institutional Selectivity	Defined via Carnegie Classification specifying whether the institution was “inclusive,” “selective,” or “more selective.”	Recoded from NCES IPEDS data archive	Categorical dummy Low Selectivity Medium Selectivity High Selectivity [Reference]
Institutional Scope	The terminal degree offering of the institution	Recoded from NCES IPEDS data archive	Categorical dummy Bachelor Master Doctoral [Reference]

Table 1 continued

Variable	Definition	Origin of Measure	Quantification
Remediation Programs	Does the institution offer remediation programs?	Obtained from NCES IPEDS data archive	Categorical 1 = “yes”
Race	% racial/ethnic minority population at the institution	Computed from NCES IPEDS data archive	Interval (0.0 – 100.0)

Data Analysis

Once the final sample for this investigation was determined, the analysis of the data began by analyzing various univariate statistics of the sample. These included: year-by-year descriptives for each wave of the sample, variations over time for each of the state-level covariates (unemployment, higher education appropriation, Medicaid appropriation, and criminal justice appropriation) by state, and HLM analytics. After analyzing the univariate distributions, bivariate correlations (not reported here) were analyzed for possible evidence of multicollinearity. No suspicious correlations were evidenced. Next, OLS regressions (Appendix C) were computed. This was done partly to gain a better understanding of the relationships among the data. These OLS models also allowed for more comparison and greater insight into the HLM models. On a more practical note, if there are no statistically significant effects in OLS models, chances are likely there will be none in HLM models, either.

The research questions for this study, as well as subsequent issues presented, are particularly well-suited for analysis via hierarchical linear modeling (HLM) for several reasons. First the explanation of the phenomenon in question (institutional retention) is one that is multi-level in nature. Institutional retention rates vary both within and between states. However, we need further clarification as to whether that outcome is more a factor of

differences between institutions in a particular state or if the relationship between retention and institutional funding is a product of differences between states. HLM allows for simultaneous examination of both between- and within-context variation, something that conventional (e.g., OLS regression) techniques do not allow. Secondly, there is good reason to speculate that error covariances between higher education funding and institutional retention are highly interrelated. Again, HLM allows us to determine if the variation in funding and retention is more a function between contexts or within contexts. Thirdly, HLM provides for the analysis of longitudinal data. This is important because a key methodological issue of this study concerns the changes in institutional retention rate over time. Lastly, to re-emphasize, HLM allows us to explore the extent of the effect of multiple levels of analysis for a given phenomenon through the decomposition of the variance and proportional reduction of variance at each level within and between models. This is useful because it provides a more specific indication as to the contextual source of the variation and variance in the dependent variable.

In general, statistical tests to determine the significance of the dependent variable (institutional retention) as regressed on the different independent variables are standard per any sort of regression model: a sufficiently robust p-value (e.g., $p < .05$). In order to compute the variance decomposition, Raudenbush and Bryk (2002, p. 230) specify algebraic ratios per the variance in the dependent variable computed for each level. Raudenbush and Bryk (2002, p. 230) also detail the procedure to estimate the reliability of the variance partitioning.

This study proposes to estimate a three-level hierarchical model of the first-year retention rate in four-year public institutions of higher education. While each specific

permutation of the general model is discussed in greater detail, below, the general model is as follows. Level 1 encompasses the growth model, estimating only the change in institutional retention rate over time. Level 2 is the institutional-level model, which estimates effects of the institutional variables (i.e. revenues, expenditures, and institutional characteristics). Level 3 is the state-level model, estimating effects of economic conditions of the state (i.e. appropriations and labor market conditions).

Prior to estimating the full (conditional) model, a fully unconditional analysis of variance (ANOVA) of the dependent variable will be conducted. Assuming that the ANOVA reveals that the Levels 2 and 3 variances are statistically significant from zero, that is, whether differences are revealed between institutions and between states, respectively, a simple growth model will be estimated. The purpose of this is to determine whether or not there is actual temporal variation within the dependent variable, institutional retention rate. If the temporal variation variances are found to be statistically significant, then two analysis of covariance (ANCOVA) models will be estimated. The first ANCOVA will examine just the effect of including institutional-level covariates at Level 2. A second ANCOVA will examine just the effect of including the state-level economic covariates at Level 3. Estimating these models separately allows us to determine whether or not these respective variables have any effect on the institutional retention rate, both within and between contexts. Finally, a full model will be estimated. This model will include the Level 1 growth model, the Level 2 institutional covariates, and the Level 3 state economic conditions.

Before specifying the models and their respective equations, two additional matters deserve attention. First, the Level 1, Level 2, and Level 3 models are expressed in a somewhat general form. On the one hand, variables within the models are enumerated per

their general construct as found in the Conceptual Framework. This nominal style of presentation is done solely to facilitate expression of what the model intends to estimate, and it does not reflect the final form of the respective model. On the other hand, each model includes an error term, which implies that all models are random effects models (Raudenbush & Bryk, 2002, pp. 23-27). The presence of the error term only reflects an initial assumption of the varying effects of the different predictors. Again, such assumption and specification does not reflect the final form of the particular model. Second, the Level 1, Level 2, and Level 3 models take the form of intercepts- and slopes-as-outcomes (Raudenbush & Bryk, 2002, pp. 27-28). This particular form for hierarchical models is what allows us to examine the variability across contexts.

Turning to the particular components of the full, conditional model, Level 1 specifies the growth curve model of the institutional retention rate at time t of institution i in state j . The basic form of a growth model is linear. Raudenbush and Bryk (2002, p. 163) identify that when there are few temporal instances of observation, it is best to use linear growth models as opposed to more complex models, such as piece-wise or quadratic forms. For this study, the linear growth model is expressed mathematically as:

$$Y_{tij} = \pi_{0ij} + \pi_{1ij}(\text{YEAR})_{tij} + e_{tij}, \quad (1)$$

where

Y_{tij} is the institutional retention rate at time t for institution i in state j ;
 $(\text{YEAR})_{tij}$ is 0 in 2003 through 6 in 2008;
 π_{0ij} is the initial status of the institutional retention rate for institution i in state j , that is, the retention rate for institution ij for the 2003 cohort;
 π_{1ij} is the linear growth of institutional retention rate for institution-year i in state j ;
 e_{tij} is a random measurement effect.

The Level 2 model estimates the effects of institutional covariates on the institutional retention rate, thus accounting for variation among institutions within states. For ease of

presentation in the interim, the equations defining the Levels 2 and 3 models, respectively, are left in a somewhat general form. Presentation of the results will show the fully expanded equations for the particular models. Equations (2) and (3) generically express the Level 2 model. There are two sets of equations because each parameter in the Level 1 equation is estimated as a separate function of the individual variables from Level 2. Thus, the initial value of the institutional retention rate (π_{0ij}) is a function of the average retention rate at time $t = 0$ for institution i in state j (β_{00j}), plus some variation from institutional expenditures, plus some variation from institutional characteristics, plus an error term (r_{0ij}). Similarly, the term capturing the change (growth) in institutional retention over time (π_{1ij}) is a function of the average change (growth) in retention at institution i in state j over time (β_{10j}), plus some variation from institutional expenditures, plus some variation from institutional characteristics, plus an error term (r_{1ij}). Arithmetically, these equations are expressed as follows:

$$\begin{aligned} \pi_{0ij} = & \beta_{00j} + \beta_{01j}(\text{INSTITUTIONAL FINANCE}) + \\ & \beta_{02j}(\text{INSTITUTIONAL CHARACTERISTICS}) + \\ & + r_{0ij}, \end{aligned} \tag{2}$$

$$\begin{aligned} \pi_{1ij} = & \beta_{10j} + \beta_{11j}(\text{INSTITUTIONAL FINANCE}) + \\ & \beta_{12j}(\text{INSTITUTIONAL CHARACTERISTICS}) + \\ & + r_{1ij}, \end{aligned} \tag{3}$$

where

- β_{00j} is the average initial status of retention rate in state j ;
- β_{01j} is the regression slope of initial retention rate on institutional finance for institution ij ;
- β_{02j} is the regression slope of initial retention rate on institutional characteristics for institution ij ;
- r_{0ij} is a random institutional effect;
- β_{10j} is the average slope of the growth rate of first year retention rate across institution-years in state j ;

β_{11j} is the regression slope of institutional retention linear growth on institutional finance across institution-years i in state j ;
 β_{12j} is the regression slope of institutional retention linear growth on institutional characteristics across institution-years i in state j ;
 r_{1ij} is a random institutional effect.

The Level 3 model estimates the effects of the state-level economic context on the institutional retention rate, thus accounting for variation across states. Equations (4) through (9) generically express the Level 3 model. Each Level 2 coefficient becomes a function of terms at Level 3. Thus, the average initial status of retention rate in state j (β_{00j}) is a function of the grand mean initial status of the retention rate (γ_{000}) at time $t = 0$, plus some variation from state-level covariates, plus an error term (u_{00j}). Related, the linear growth term (β_{10j}) in state j is in turn a function of the grand mean slope of the first year retention rate (γ_{100}), plus variation from state-level covariates, plus an error term (u_{10j}). These equations are generically expressed as follows:

$$\beta_{00j} = \gamma_{000} + \gamma_{001}(\text{ECONOMIC HEALTH}) + \gamma_{002}(\text{STATE APPROPRIATIONS}) + u_{00j}; \quad (4)$$

$$\beta_{01j} = \gamma_{010}; \quad (5)$$

$$\beta_{02j} = \gamma_{020}; \quad (6)$$

$$\beta_{10j} = \gamma_{100} + \gamma_{101}(\text{ECONOMIC HEALTH}) + \gamma_{102}(\text{STATE APPROPRIATIONS}) + u_{10j}; \quad (7)$$

$$\beta_{11j} = \gamma_{110}; \quad (8)$$

$$\beta_{12j} = \gamma_{120}; \quad (9)$$

where

γ_{000} is the grand mean initial status of institutional retention rate;
 γ_{001} is the regression slope of initial status retention rate on economic health in state j ;
 γ_{002} is the regression slope of initial status retention rate on state appropriations in state j ;
 u_{00j} is a random state-level effect;
 γ_{010} is the intercept of initial retention rate on institutional finance in state j ;
 γ_{011} is the regression slope of average initial institutional finance on economic health in state j ;

γ_{012} is the regression slope of average initial institutional finance on state appropriations in state j ;
 u_{01j} is a random state-level effect;

γ_{020} is the intercept of initial retention rate on institutional characteristics in state j ;
 γ_{021} is the regression slope of average initial institutional characteristics on economic health in state j ;
 γ_{022} is the regression slope of average initial institutional characteristics on state appropriations in state j ;
 u_{02j} is a random state-level effect;

γ_{100} is the grand mean slope of first year retention rate;
 γ_{101} is the regression slope of retention rate linear growth on economic health across institution-years i in state j ;
 γ_{102} is the regression slope of retention rate linear growth on state appropriations across institution-years i in state j ;
 u_{10j} is a random state-level effect;

γ_{110} is the intercept of retention rate linear growth on institutional finance across institution-years i in state j ;
 γ_{111} is the regression slope of institutional finance on economic health for institution-year ij ;
 γ_{112} is the regression slope of institutional finance on state appropriations for institution-year ij ;
 u_{11j} is a random state-level effect;

γ_{120} is the intercept of retention rate linear growth on institutional characteristics across institution-years i in state j ;
 γ_{121} is the regression slope of institutional characteristics on economic health for institution-year ij ;
 γ_{122} is the regression slope of institutional characteristics on state appropriations for institution-year ij ;
 u_{12j} is a random state-level effect

Data Analytic Issues Specific to HLM

Three technical issues central to the HLM method need to be addressed. These are: 1) the centering of the variables, 2) fixed versus random effects, and 3) the use of robust standard errors. First, in any hierarchical analysis, careful consideration must be given to the centering or location of the independent variables, because this decision, in turn, guides the interpretation of the results. In analyses of organizational behavior (Raudenbush & Bryk,

2002, pp. 134-149), selecting the correct centering metric (group-mean versus grand-mean) changes the interpretation of the results. In this investigation, the institutional-level variables were centered around the group-mean for a few reasons. One, group-centering allows for direct estimation of the effects of the independent variables between institutions (or within states, depending on your perspective) (Raudenbush & Bryk, 2002, p. 141). Two, grand-mean centering can create an extrapolation of those data near the lower or upper bound of the range of the measure in question, thus introducing bias in the final estimation of the effects (Raudenbush & Bryk, 2002, pp. 145-147). Three, group-mean centering was necessary to better account for the heterogeneity across the entire sample as well as within each state (Raudenbush & Bryk, 2002, p. 143). Beyond the institutional-level, centering had to be taken into account at the state-level. Here, the matter was much more straightforward. State-level variables were centered around the grand mean, as this would allow for compositional or “between state” interpretation of the results. Level 1 (the growth model) variables were left uncentered, as these are indexing the effects of time on the dependent variable.

In addition to contending with the centering of the institutional- and state-level variables, the next matter concerned whether or not to fix the effects of the predictors or allow them to vary randomly. Attempts were made to specify random effects models. Two problems were encountered. One, for an institutional-level model held unconditional at Level 3, (not reported here), the HLM software was able to estimate random effects, but only with a severely reduced subset of the final sample. (It took the software approximately 7500 iterations for the model to converge.) These results would not provide any meaningful comparison. Two, an attempt was made to estimate a full model with random effects. The HLM software was unable to get the model to converge and produce any results.

The primary issue is heterogeneity among the data. There is too much variation across the sample on the dependent variable and across measures at the institutional- and state-levels. For these reasons, the variance components of the different predictors in the models were constrained to be fixed. The only measures where random effects were estimated included the growth model, specifically the intercept and the linear growth coefficient. The rationale behind this action stemmed from the interest in the first research question concerning the effect of time among the various relationships in question. Due to the variability between institutions in their retention rates, it was necessary to allow the growth coefficient to vary randomly in order to capture that heterogeneity.

After having considered centering and the use of fixed effects, the third matter concerning the analysis is the presentation of robust standard errors. The HLM software estimates both standard errors and robust standard errors. Raudenbush and Bryk (2002, p. 281) note, “For any sample size, fixed-effects estimates are unbiased. However, in the unbalanced case, the standard error estimates for the fixed effects are generally too small, and hypothesis tests based on the unit normal reference distribution will be too liberal.” The data used in this investigation are most decidedly unbalanced. Measures are not normally distributed. Institutions are not randomly distributed among states. For this reason, robust standard errors are reported.

Summary

This chapter put forward the plan of analysis for the research questions derived from the statement of the problem (presented in Chapter One). The research method is a predictive, longitudinal study (Johnson, 2001). This study will analyze a non-random sample of a panel of public institutions of higher education in the United States surveyed annually

for myriad institutional characteristics. The survey data are culled from the Integrated Postsecondary Education Data System (IPEDS), administered by the National Center for Education Statistics (NCES). Additional data concerning the state-level economic context are obtained from annual surveys conducted by the Bureau of Labor Statistics (BLS) and the National Association of State Budget Officers (NASBO). The IPEDS data supply all institutional measures selected for inclusion in this analysis. The dependent variable, the institutional retention rate, is measured as percent of full-time, first-year students enrolled during the fall of one year who re-enrolled as either full- or part-time the following fall (NCES, 2003). Data for the dependent variable are available from calendar years 2003-2008. Beyond the dependent variable, the IPEDS data also contribute the institutional-level independent variables (e.g. expenditures, tuition, and financial aid) as well as the different control variables (e.g. institutional size, selectivity, and scope, among others). The BLS and NASBO data provide the state-level independent variables, those being state economic health and state appropriations, respectively.

Given the multi-level and temporal (longitudinal) nature of the data, hierarchical linear modeling (HLM) was selected as the statistical method to analyze the data. The advantages of using HLM for this analysis include decomposition of the contextual effects to better understand the within- and between-context variance of the dependent variable, as well as better control of error covariances between the independent variables and the dependent variable. HLM also allows for the analysis of longitudinal data. This is crucial, because a key interest in this investigation is the temporal flux of the phenomena in question. To these ends, this study estimated a three-level hierarchical model of the first-year retention rate in four-year public institutions of higher education. First, a set of univariate statistics of the

final sample were generated. Next, OLS regressions of each of the six waves (years) of the sample were analyzed. Finally, the HLM models were analyzed. To estimate the three-level hierarchical model, a predetermined series of data analytic steps were taken, each building on the previous. The general purpose of this specific sequence of analyses is to better allow for greater understanding of how each of the contexts and related independent variables affect the dependent variable. At the same time, the progression from a relatively “free,” unconditional model to the final “full” model contributes greater (statistical) justification for the power and utility of the method.

Chapter 4

Introduction

This chapter presents the results of the analyses described in the preceding chapter.

Two general sets of analyses were conducted in response to each research question:

1. How does economic context affect the first-to-second year retention of undergraduates at public universities?
 - a. What effect does a state's unemployment rate have on the first-year undergraduate retention rate at four-year, public universities?
 - b. What effect do state appropriations for higher education have on the first-year undergraduate retention rate at four-year, public universities?
 - c. What effect do institutional expenditures have on the first-year undergraduate retention rate at four-year, public universities?
 - d. What effect do tuition revenue and financial aid have on the first-year undergraduate retention rate at four-year, public universities?
 - e. How do these relationships affect the growth (change) in the institutional retention rate over time?
2. How does a state's economic health (as measured by the annual unemployment rate) affect appropriations for higher education?
 - a. How do state-level appropriations for higher education vary with respect to appropriations for Medicaid and the criminal justice system?

The organization of the chapter is as follows. First, univariate statistics are shown. These are presented in three stages. First, year-by-year descriptives for institutional variables (found in Appendix A) are described. Second, descriptive statistics summarizing state-level variables

and changes in those variables (see Appendix B) are presented. Third, univariate statistics of the final sample used in the HLM analyses (see Table 2, below) are shown. After describing the univariate statistics, OLS regression models of year-by-year analyses of first-year retention rate regressed on the institutional- and state-level covariates are summarized (see Appendix C). Next, the five models related to the first research question are presented. These five models listed in order are: 1) Fully Unconditional Analysis of Variance, 2) Growth Curve Analysis (unconditional at Levels 2 and 3), 3) Growth Curve Analysis Including Institutional Covariates Only, 4) Growth Curve Analysis Including State-Level Covariates Only, and 5) Fully Combined Growth Curve Analysis. After reporting the results of the five models addressing the first research question, the model pertaining to the second research question will be presented. Lastly, the research questions guiding the investigation are assessed in light of the study results.

Univariate Summary

Year-by-Year Descriptives

Year-by-year descriptive statistics were computed for the final sample. In 2003 (Table A1, Appendix A), the average institutional retention rate was about 74%, ranging from a low of 47% to a high of 96%. Noting the standard deviation, however, ($SD = 9.91$), this variable has a fairly normal distribution. Among the institutional independent variables, only instructional expenditures ($M = 33.62$, $SD = 6.92$) had any kind of normal distribution. The average values for research ($M = 6.09$, $SD = 8.12$), student services ($M = 6.63$, $SD = 3.09$), and grant expenditures ($M = 5.38$, $SD = 3.82$), were skewed, with minimum values all at zero or very near zero. What this reveals is that for most schools, more institutional expenditures tend to be allocated toward instruction than other line items. Beyond

expenditures, on average, tuition comprised 21% of revenue ($SD = 8.65$) and more than three-quarters ($M = 77.32$) of undergraduates received any type of financial aid across most schools.

Regarding institutional characteristics, 82% of universities had remediation programs in place in 2003. 7% were baccalaureate-granting schools, 42% were terminal-master's institutions, and 51% were doctoral-granting colleges and universities. 20% of institutions had a population of less than 4,000 students, 48% could be considered "medium-sized" schools, and 31% of institutions were classified as "large," with student populations in excess of 15,000. In terms of selectivity, 24% of the sample was classified as being "low," 58% as "middle," and 17% as "high" selectivity. The average racial/ethnic minority population among institutions was about 24%; however, given the standard deviation ($SD = 23.19$), this indicates that most campuses were predominantly White. A note needs to be made about these institutional characteristics. With the exception of remediation programs, these were measured once in 2003, and then constrained to be fixed over the time period of the investigation. As such, they are time invarying fixed effects (Allison, 1995). For the remaining years, the values for institution scope, size, selectivity, and racial/ethnic population do not change over the course of the investigation.

Turning to state-based covariates, in 2003, the average unemployment rate across states was 5.6% ($SD = 0.90$). This figure was skewed slightly toward the upper limit of the range, which was 7.7%. Higher education appropriation ($M = 11.35$, $SD = 4.78$), Medicaid appropriation ($M = 21.41$, $SD = 5.15$), and criminal justice system appropriation ($M = 3.39$, $SD = 1.05$) were all skewed toward the lower limits of their respective distributions. These figures will be given more treatment in greater detail, below.

Table A2 (Appendix A) shows the descriptive statistics for 2004. The average retention rate was 74% ($SD = 10.10$) and exhibited a normal distribution, similar to the prior year. Among institutional expenditures, those for instruction were 33% ($SD = 7.16$), research were 6% ($SD = 8.47$), student services were about 7% ($SD = 3.13$), and grants 5% ($SD = 3.83$). Instructional expenditures were the most normally distributed, with the remaining three being skewed toward the lower end of their various distributions. For most schools, instruction occupies a larger portion of the expenditures budget, on average. The average tuition revenues were 23% ($SD = 9.32$), which partly reflects an increase in the upper bound limit for this variable from the previous year. Institutions reported that, on average, 78% of their students received some form of financial aid ($SD = 12.99$). This figure continued to be skewed toward the upper limit of its range. 81% of institutions had a remediation program. Looking at the state-level variables, the average unemployment rate was larger in magnitude than in 2003 ($M = 5.86$, $SD = 0.93$) was skewed more toward the upper bound value than in the prior year. Values for higher education ($M = 11.80$, $SD = 5.42$), Medicaid ($M = 22.39$, $SD = 5.31$), and criminal justice appropriation ($M = 3.38$, $SD = 1.02$) were similar to those for 2003 and were also skewed toward the lower limit of their respective ranges.

In 2005 (Table A3, Appendix A), first-year retention remained in the 70th percentile ($M = 73.24$, $SD = 9.96$) and was normally distributed. The average instructional expenditure was 33% ($SD = 6.91$), which was skewed slightly toward the upper limit of this range, a departure from the prior two years. Expenditures for research ($M = 6.29$, $SD = 8.25$), student services ($M = 6.70$, $SD = 3.17$), and grants ($M = 5.12$, $SD = 3.57$) were consistent with prior years, in that more schools concentrate expenditures in instruction than these other avenues. Tuition comprised 24% of all revenue ($SD = 9.63$), which again reflected an increase in the

maximum for this variable. Still, this variable exhibits a fairly normal distribution. 79% of students at most schools received at least some type of financial aid ($SD = 12.96$). 80% of institutions had some sort of remediation program. The unemployment rate ($M = 5.40$, $SD = 0.88$) was smaller in magnitude than in 2004 and was fairly normally distributed, as well. Appropriations for higher education ($M = 11.34$, $SD = 4.96$), Medicaid ($M = 22.94$, $SD = 5.82$), and criminal justice ($M = 3.34$, $SD = 1.01$) remained relatively unchanged as compared to 2004.

Looking at descriptive statistics for 2006 (Table A4, Appendix A), the average institutional retention rate was 73% ($SD = 10.27$), consistent with years prior. Such consistency was also evidence for instructional expenditures ($M = 33.06$, $SD = 6.88$), research expenditures ($M = 6.15$, $SD = 8.04$), student services expenditures ($M = 6.68$, $SD = 3.14$), and grant expenditures ($M = 4.89$, $SD = 3.43$). Tuition revenue was again larger than in the previous year ($M = 24.89$, $SD = 10.04$). Similarly, still more students ($M = 78.97$, $SD = 13.16$) across colleges received some form of financial aid. 80% of colleges had some type of remediation program. The average unemployment rate was 5% ($SD = 0.93$), smaller than the prior year, and skewed slightly toward the lower bound value (2.80). On average, states allocated 11% of their budget for higher education ($SD = 4.79$), 21% of their budget for Medicaid ($SD = 5.47$) and 3% of their budget for criminal justice ($SD = 0.97$).

Table A5 (Appendix A) shows descriptives for 2007. Across institutions, the retention rate was fairly consistent with prior years at 74% ($SD = 10.29$). The average instructional expenditure was 33% ($SD = 6.78$). Average expenditures for research were 6% ($SD = 8.24$), students services were 7% ($SD = 3.15$), and grants were 5% ($SD = 3.40$). Among just these four expenditures categories, it appears most schools concentrate a larger

portion of their funds in instruction. Tuition revenue was consistent with the previous year ($M = 24.56$, $SD = 10.01$); however, across institutions, now 81% of students received any financial aid ($SD = 12.22$). Looking at remediation, 78% of universities offered such programs to their students. For yet another year, the magnitude of the unemployment rate was smaller than previously ($M = 4.61$, $SD = 0.91$). Otherwise, appropriations for higher education ($M = 11.13$, $SD = 5.15$), Medicaid ($M = 21.18$, $SD = 5.58$), and criminal justice ($M = 3.17$, $SD = 0.94$) were generally consistent with years prior.

Examining Table A6 (Appendix A), in 2008 the average first-year retention rate is 75% ($SD = 9.79$). Instructional expenditures ($M = 33.96$, $SD = 7.45$), research expenditures ($M = 6.16$, $SD = 8.31$), student services expenditures ($M = 7.04$, $SD = 3.44$), and grants expenditures ($M = 4.88$, $SD = 3.38$) were all similar to previous years. In general, among these four expenditures categories, instruction tends to be the largest. 25% of revenue came from tuition ($SD = 9.85$). The average school saw 82% of its students receiving some type of financial aid ($SD = 11.18$). 78% of institutions had some type of remediation program in place. Looking at state-based variables, the average unemployment rate was 5% ($SD = 0.92$). Higher education appropriation ($M = 10.84$, $SD = 4.88$), Medicaid appropriation ($M = 20.59$, $SD = 5.48$), and criminal justice appropriation ($M = 3.24$, $SD = 0.96$), all of which were similar to previous years.

State-Level Covariates

Table B1 (Appendix B) reports the annual unemployment rate from 2003 through 2008 for each state. The mean unemployment rate from 2003 through 2008 was also computed for each state. Table B2 (Appendix B) provides a more in-depth look at how the unemployment rate changed over time within each state. Taking year-to-year fluctuations

into account, 88% of all states (n = 44) experienced a decrease in their unemployment rate from 2003 to 2008. This figure echoes the trend evidenced in the year-by-year univariate statistics presented above.

Annual higher education appropriation figures for each state for 2003 to 2008 are reported in Table B3 (Appendix B). The mean over this same period of time is also reported. At the outset, visual inspection reveals differing patterns of funding of higher education between the states. For example, on average, 40% (n = 20) of states have higher education appropriations at less than 10%. Most states (n = 26) have appropriation levels between 10 and 20% for higher education. Only 8% (n = 4) of states have higher education appropriations in excess of 20%. Looking at Table B4 (Appendix B), a somewhat opaque picture emerges concerning changes in higher education funding over time. Exactly half (n = 25) of all states decreased appropriations for higher education from 2003 to 2008, while the other half increased funding over the same period of time.

Table B5 (Appendix B) reports annual Medicaid appropriations from 2003 to 2008 for each state. 14% (n = 7) of U.S. states attributed 15% or less of their annual budgets to Medicaid, on average. Two-thirds (n = 34) of all states had average Medicaid appropriations between 15 and 25% over this time period. 18% (n = 9) states had Medicaid appropriations in excess of 25%. Table B6 (Appendix B) reports the extent of yearly change in Medicaid appropriation for each state. In sum, states were fairly evenly split in terms of whether or not they increased or decreased their Medicaid appropriations from 2003 to 2008, with the majority 52% (n = 26) experiencing at least some growth.

Criminal justice appropriations by state for 2003 through 2008 are reported in Table B7 (Appendix B). For all states, only a few percent of the annual budget was allocated for

this category. Examining Table B8 (Appendix B), most states did not experience much change in the percent of their total budget allocated to criminal justice. 82% (n = 41) of all states only varied by a total sum of 1% from 2003 to 2008 allocations. By comparison, 62% of states (n = 31) stayed within 0.5% of their 2003 appropriations between 2003 and 2008.

HLM Analytics

Table 2 presents a summary of the univariate statistics for the measures used in this analysis. As discussed above, because of the method in which the HLM software estimates the effects of Level 2 and 3 covariates on the dependent variable, these measures were aggregated.

Table 2

Summary Statistics of Variables Used in HLM Analysis

Variable	N	Mean	SD	Min	Max
Level 1 (Growth Model) Descriptive Statistics					
Institutional Retention Rate	2820	73.69	10.05	42.00	97.00
Year	2820	2.50	1.71	0.00	5.00
Level 2 (Institutional Model) Descriptive Statistics					
Mean Instructional Expenditures (%)	470	33.38	6.77	11.66	49.91
Mean Research Expenditures (%)	470	6.17	8.16	0.00	43.00
Mean Student Services Expenditures (%)	470	6.74	3.09	0.90	17.78
Mean Grant Expenditures (%)	470	5.07	3.33	0.00	17.74
Mean Tuition Revenue (%)	470	23.84	9.25	3.54	57.40
Mean Percentage of Students Receiving Any Financial Aid (%)	470	78.50	11.94	43.25	99.25
Remediation Program	470	0.80	0.38	0.00	1.00
Bachelor	470	0.07	0.25	0.00	1.00
Master	470	0.42	0.49	0.00	1.00
Doctoral ^a	470	0.51	0.50	0.00	1.00
Small (< 4000 pop.)	470	0.20	0.40	0.00	1.00
Medium (4000 – 15000 pop.)	470	0.48	0.50	0.00	1.00
Large ^a (> 15000 pop.)	470	0.31	0.46	0.00	1.00

Table 2 continued

Variable	N	Mean	SD	Min	Max
Level 2 (Institutional Model) Descriptive Statistics					
Low selectivity	470	0.24	0.43	0.00	1.00
Medium selectivity	470	0.58	0.49	0.00	1.00
High selectivity ^a	470	0.17	0.38	0.00	1.00
Total Racial/Ethnic Minority Population (%)	470	23.62	23.19	0.00	96.00
Level 3 (State Model) Descriptive Statistics					
Mean Unemployment Rate (%)	50	4.96	0.93	3.27	7.15
Mean Higher Education Appropriation (%)	50	11.55	5.25	2.55	24.55
Mean Medicaid Appropriation (%)	50	20.40	5.48	7.65	33.63
Mean Criminal Justice Appropriation (%)	50	3.07	0.87	1.00	5.08

^aReference group

At Level 1 (the Growth Model), each of the 470 institutions in the final sample contributed six observations on the dependent variable, institutional retention rate. Across all institutions, across all years, the average institutional retention rate was 74% and displayed considerable variation, ranging from a low of 42% to a high of 97%. Given the standard deviation ($SD = 10.05$) for the institutional retention rate, however, this is one of very few variables in the investigation that evidences any sort of fairly normal distribution. The variable, “Year,” is included, but it is only a time-indexing variable representing the actual years 2003-2008. No mathematical significance should be attributed to the figures reported for this particular variable.

At Level 2 (the Institutional Model), the average instructional expenditure across institution years was 33%, ranging from 12% to 50%. Noting the standard deviation ($SD = 6.77$), this independent variable is one of very few variables in this study with a distribution that is somewhat normal. The means for research ($M = 6.17$, $SD = 8.16$), student services ($M = 6.74$, $SD = 3.09$), and grant expenditures ($M = 5.07$, $SD = 3.33$) were skewed, and the

minimum range for these variables was either zero or near-zero. This information tells us that, on average, more resources of institutions are concentrated in instruction than in other areas. Turning to other matters of institutional finance, across institution-years, tuition comprised about 24% of all revenue, on average. Most institutions also saw a rather high percentage of their undergraduates ($M = 78\%$) receiving any financial aid.

Looking at the control variables, 80% of institutions had some form of remediation program in place at some point during the study period (2003-2008). Only a small percentage (7%) of the sample were baccalaureate institutions, a greater portion (42%) were terminal master's, and the majority (51%) were doctoral-granting schools. One-fifth (20%) of the sample were "small" schools (less than 4,000 student population), most (48%) were "medium-sized" schools (those having a student population between 4,000 and 15,000 students), and almost one-third (31%) would be considered "large" schools (student population in excess of 15,000). About one-quarter (24%) of the colleges in the sample were characterized as being "low selectivity." The majority (58%) were designated "medium selectivity," while less than one-fifth (17%) were classified as "high selectivity." Lastly, the average minority population across the sample was about one-fourth ($M = 23.62$, $SD = 23.19$). Most of the institutions in the sample were fairly racially homogeneous and predominantly White.

At Level 3 (State-level Model), the mean unemployment rate across all states for all years was about 5% and was fairly normally distributed. The average higher education appropriation was about 12%, but this showed a fair amount of variation, ranging from a minimum of almost 3% to a maximum of about 25%. Average Medicaid appropriation ($M = 20.40$) was almost double the average higher education appropriation, while the average

criminal justice appropriation was approximately one-fourth ($M = 3.07$) that of higher education.

OLS Regression Findings

Prior to estimation of the hierarchical models, an elementary series of OLS regression models were conducted for each year of the analysis to get a better feel for the interaction of the variables in the IPEDS dataset. Those results can be found in Appendix C. In general, the regressions show differences from year-to-year not only in the magnitude of the effects of the variables, but there are also differences in which variables are statistically significant.

In 2003 (Table C1, Appendix C), the percent minority/ethnic population had a positive effect on institutional retention rate ($\beta = 0.124$, $p < .01$), indicating that for every 10 unit increase in the minority population at a university, there would be about a 1.2 unit increase in their retention. As compared to “large” schools, schools with “small” ($\beta = -0.362$, $p < .001$) and “medium” populations ($\beta = -0.172$, $p < .001$) had lower rates of retention. A similar effect was evidenced for low selectivity ($\beta = -0.718$, $p < .001$) and medium selectivity ($\beta = -0.507$, $p < .001$) institutions, when compared to high selectivity institutions. The only other institutional covariate that had any statistically significant effect on the first-year retention rate was grant expenditures ($\beta = -0.094$, $p < .05$). Here, every one hundred unit increase in grant expenditures would result in about a one unit decrease in an institution’s retention rate. No other institutional covariates had any statistically significant effects in 2003. Examining the state-based covariates, a state’s unemployment rate had a positive effect on retention for the schools in that state ($\beta = 0.080$, $p < .05$). For every one hundred unit increase in a state’s unemployment rate in 2003, there was a 0.8 unit increase in institutional retention, *regardless of the state or the institution in which the state was located.*

The importance of this issue will be discussed later. Higher education appropriations had a negative effect on retention ($\beta = -0.133$, $p < .01$). For every ten unit increase in higher education appropriation in a given state, first-year retention would decrease by about 1.3 units. Lastly, criminal justice system appropriations also had a negative effect on retention ($\beta = -0.149$, $p < .001$). Medicaid appropriations had no statistically significant effect on first-year retention in 2003. This model accounted for about 57% of the variation in institutional retention rate (Adj. r-sq = 0.57).

Table C2 (Appendix C) presents OLS regressions for institutional retention for 2004. Similar to 2003, percent minority population ($\beta = 0.093$, $p < .05$), institutional size (small: $\beta = -0.318$, $p < .001$; medium: $\beta = -0.154$, $p < .01$), institutional selectivity (low: $\beta = -0.740$, $p < .001$; medium: $\beta = -0.538$, $p < .001$), and grant expenditures ($\beta = -0.127$, $p < .01$) were all statistically significant. For this year, another institutional variable also had a significant effect on first-year retention: percent of student body receiving any financial aid ($\beta = -0.114$, $p < .01$). For every ten unit increase in the percent of the student body receiving any financial aid, we could expect to observe about a 1.1 unit decrease in the retention rate at a particular institution. Among the state-based covariates, only higher education appropriation had any significant effect ($\beta = -0.098$, $p < .01$) in 2004. This model accounted for about 57% of the variation in first-year retention (Adj. r-sq = 0.57).

Examining Table C3 (Appendix C), which shows results for OLS regressions for first-year retention in 2005, significant effects among the institutional covariates are consistent with the prior year (2004). Percent minority population ($\beta = 0.082$, $p < .05$), institutional size (small: $\beta = -0.365$, $p < .001$; medium: $\beta = -0.193$, $p < .001$), institutional selectivity (low: $\beta = -0.708$, $p < .001$; medium: $\beta = -0.520$, $p < .001$), grant expenditures ($\beta =$

-0.101, $p < .01$), and percent of student body receiving any financial aid ($\beta = -0.085$, $p < .05$). No other institutional measures had significant effects. Looking at state-based variables, higher education appropriation ($\beta = -0.143$, $p < .001$) as well as criminal justice system appropriation ($\beta = -0.086$, $p < .05$) had significant effects. Neither unemployment nor Medicaid appropriation had any effect on retention in 2005. Recall that in 2004, only higher education appropriation affected retention. About 58% of the variation in institutional retention rate (Adj. r-sq. = 0.58) was accounted for by this model.

For the year 2006 (Table C4, Appendix C), the OLS regression reveals more changes among those variables that have effects on the institutional retention rate. As opposed to prior years (2003 – 2005), percent minority population does not have a statistically significant effect on retention in 2006. Institutional size (small: $\beta = -0.327$, $p < .001$; medium: $\beta = -0.147$, $p < .01$) and institutional selectivity (low: $\beta = -0.679$, $p < .001$; medium: $\beta = -0.473$, $p < .001$) have significant effects on first-year retention, as before. Similarly, grant expenditures ($\beta = -0.092$, $p < .01$) and percent of student body receiving any financial aid ($\beta = -0.070$, $p < .05$) also significantly affect the institutional retention rate. However, now in 2006, whether or not an institution has a remediation program negatively impacts retention ($\beta = -0.089$, $p < .01$). The effect, however, is minimal: institutions with remediation programs can expect to have their first-year retention rate lowered by not quite one-tenth of a unit. Among state-based covariates, only higher education appropriation ($\beta = -0.134$, $p < .001$) had an effect on retention. This model explained approximately 59% of the variation in first-year retention (Adj. r-sq. = 0.59).

Turning to the OLS regression for 2007 (Table C5, Appendix C), results here are mostly similar to those for 2006. Institutional size (small: $\beta = -0.320$, $p < .001$; medium: $\beta =$

-0.171, $p < .001$), institutional selectivity (low: $\beta = -0.647$, $p < .001$; medium: $\beta = -0.457$, $p < .001$), grant expenditures ($\beta = -0.094$, $p < .01$), and presence of a remediation program ($\beta = -0.092$, $p < .01$) have significant effects on retention. No other institutional covariates have significant effects on the institutional retention rate. The only state-based variable that has an effect on first-year retention is higher education appropriation ($\beta = -0.151$, $p < .001$). This model explained about 57% of the variation in the dependent variable (Adj. r -sq. = 0.57).

Looking at Table C6 (Appendix C), we find a rather unique model in terms of variables with significant effects on first-year retention in 2008. Among institutional covariates, institutional size (small: $\beta = -0.311$, $p < .001$; medium: $\beta = -0.136$, $p < .01$) and institutional selectivity (low: $\beta = -0.641$, $p < .001$; medium: $\beta = -0.453$, $p < .001$) have significant effects on institutional retention rate, as per models for prior years. Now, however, in this model, research expenditures have a significant effect on retention ($\beta = 0.101$, $p < .05$), with each ten unit increase in research expenditures resulting in about a one unit increase in institutional retention rate. Grant expenditures has a negative effect on the dependent variable ($\beta = -0.089$, $p < .01$). Percent of student body receiving any financial aid appears in the model again ($\beta = -0.097$, $p < .01$). Also, institutions with remediation programs have lower rates of retention ($\beta = -0.093$, $p < .01$) than those without such programs. Among state-based covariates, higher education appropriation negatively affects institutional retention rate ($\beta = -0.087$, $p < .01$). For the first time, Medicaid appropriation has a statistically significant effect ($\beta = 0.080$, $p < .05$). Every ten unit increase in Medicaid appropriation increases an institution's first-year retention by about 0.8 units. Also, criminal justice system appropriations positively affect retention ($\beta = 0.073$, $p < .05$). Each ten unit increase in criminal justice appropriations results in about a 0.7 unit increase in institutional

retention. This model explains about 63% of the variation in first-year retention (Adj. r-sq. = 0.63).

Fully Unconditional Analysis

A fully unconditional (ANOVA) model was estimated to determine whether or not there was any significant variance at the different levels in the model. The purpose of estimating such a model is two-fold. First, the ANOVA model provides baseline measures of the variance components for Levels 2 and 3 (τ_π and τ_β , respectively) (Raudenbush & Bryk, 2002, p. 240). Secondly, and perhaps more importantly, the presence of statistically significant ($p < .05$) variances allows us to assume that analyzing the data via hierarchical models is warranted. The results of the fully unconditional analysis are presented in Table 3.

Table 3

Fully Unconditional Analysis of Institutional Retention Rate

Fixed Effect		Coefficient	SE	p-value
INTERCEPT, $\pi_{0ij} = \beta_{00j} = \gamma_{000}$		73.075	0.801	0.000
Random Effect	Variance Component	df	χ^2	p-value
Level 1 (growth model) Institutional Retention Rate variation, e_{ij}	9.539			
Level 2 (institutional level) Institution-year initial Institutional Retention Rate, r_{0ij}	67.860 ($=\tau_\pi$)	420	18448.753	0.000
Level 3 (state level) State mean Institutional Retention Rate, u_{00j}	21.704 ($=\tau_\beta$)	49	210.213	0.000
Variance Decomposition (Percentage by Level)				
Level 2			75.8	
Level 3			24.2	

Note: The parametric equations defining these results can be found in Appendix D.

Two important pieces of information are gleaned from Table 3. First, the Levels 2 and 3 variances, respectively, are statistically significant from zero. This allows us to conclude that HLM is an appropriate method to analyze the retention data, because if the variances were not different from zero, then there would be no variation due to the multilevel nature of the data, and thus no reason to conduct a hierarchical (multilevel) model. Secondly, we can observe the extent to which each particular level of the hierarchical model contributes to the total variance. As seen, most of the variance (three-fourths) is explained at the institutional level (Level 2), with a smaller portion (one-fourth) explained at the state level (Level 3). The variance decomposition was computed using the following two formulae:

$$\text{Level 2: } \rho = \tau_{\pi} / (\tau_{\pi} + \tau_{\beta})$$

$$\text{Level 3: } \rho = \tau_{\beta} / (\tau_{\pi} + \tau_{\beta})$$

Growth Curve Analysis

After having determined that HLM is an appropriate analytic tool for this investigation, a linear growth model was estimated to understand and parcel-out the effects of time. These results are summarized in Table 4.

Table 4

*Linear Growth Model of Institutional Retention Rate
(Unconditional at Levels 2 and 3)*

Fixed Effect	Coefficient	SE	p-value
Growth Model INTERCEPT, $\pi_{0ij} = \beta_{00j} = \gamma_{000}$	72.656	0.835	0.000
Growth Model SLOPE, $\pi_{1ij} = \beta_{10j} = \gamma_{100}$	0.165	0.060	0.009

Table 4 continued

Random Effect	Variance Component	df	χ^2	p-value
Level 1				
Institutional Retention Rate variation, e_{tij}	8.121			
Level 2				
Institution-year Institutional Retention Rate INTERCEPT, r_{0ij}	67.133	420	7085.052	0.000
Institution-year Institutional Retention Rate growth SLOPE, r_{1ij}	0.304	420	691.222	0.000
Level 3				
State mean Institutional Retention Rate growth INTERCEPT, u_{00j}	24.070	49	227.106	0.000
State mean Institutional Retention Rate growth SLOPE, u_{10j}	0.078	49	100.625	0.000

Note: The parametric equations defining these results can be found in Appendix D.

Table 4 shows a very basic model of linear growth for the sample (unconditional at the institutional and state levels). This model is referred to as “unconditional at Levels 2 and 3,” because the dependent variable is not yet being regressed on any of the institutional or state-level covariates. There will always be two principal components to the growth model, the intercept ($\pi_{0ij} = \beta_{00j} = \gamma_{000}$) and the slope of the linear growth term ($\pi_{1ij} = \beta_{10j} = \gamma_{100}$). The intercept ($\pi_{0ij} = \beta_{00j} = \gamma_{000}$) is also the “initial status” of the model. That is, the intercept is the average value of the institutional retention rate when the “YEAR” indexing variable has a value of “zero,” which is also the first year of the study (2003). In this case, the average initial retention rate across institutions is about 73% ($b = 72.656$, $p < .001$). We are more interested in the linear growth term, however. The linear growth term ($\pi_{1ij} = \beta_{10j} = \gamma_{100}$)

captures any change in the institutional retention rate. While statistically significant, the magnitude of the coefficient for the slope of linear growth ($b = 0.165, p = 0.009$) reveals that there is actually very little growth, or change, in the institutional retention rate over time. To illustrate the point, over the six years (2003-2008) encompassing the study, the average institution would see a net increase in their institutional retention rate of 0.99 units (percent).

In addition to the general linear growth model always having two principal components (the intercept or initial status ($\pi_{0ij} = \beta_{00j} = \gamma_{000}$) and the slope of the linear growth term ($\pi_{1ij} = \beta_{10j} = \gamma_{100}$)), the growth models presented below will always have three levels. Level 1 will always be the growth model. This model is only defined by two variables: the intercept or initial status ($\pi_{0ij} = \beta_{00j} = \gamma_{000}$) and the growth term ($\pi_{1ij} = \beta_{10j} = \gamma_{100}$), which is indexed by the “YEAR” variable. Level 2 will always be the Institutional level model. Here, you will only see the institutional covariates, such as institutional expenditures, size and selectivity. Level 3 will always be the State level model, and will be defined only by the state level variables, for example, higher education appropriation. As per Level 1, Levels 2 and 3 will each have two component parts: initial status and linear growth. Initial status and linear growth each are functions of the institutional and state-level covariates. It is not a mistake that the covariates at each level are listed twice. The additional items to note from the linear growth model held unconditional at Levels 2 and 3, respectively, are that the error variances (r_{1ij} and u_{10j} , for Levels 2 and 3, respectively) on the growth term are statistically significantly different from zero. This allows us to conclude that there is statistical variation over time in the institutional retention rate among the sample. Examining the fixed effects portion of Table 4, there appears to positive growth across the sample in the institutional retention rate over time. In turn, this information gives cause to continue to estimate a linear

growth model of institutional retention that includes institutional and state-level covariates. These models are presented below.

Institutional Level Analysis of Covariance

Table 5 presents an analysis of covariance of the Level 2 institutional covariates of first year retention. This model expands on the basic form of the growth model by including independent and control variables at Level 2 (the institutional level). It is left unconditional at Level 3 (no state-level variables are included) to determine the extent to which the institutional variables have an effect on the Level 1 growth terms.

Table 5

Institutional Level ANCOVA (Unconditional at Level 3)

Fixed Effect	b	SE	p-value
Growth model, π_{0ij}			
Institutional model, β_{00j}			
INTERCEPT, γ_{000}	85.006	0.866	0.000
Bachelor, γ_{010}	-2.157	1.255	0.086
Master, γ_{020}	-0.649	0.694	0.350
<i>Doctoral^a</i>			
% Minority/Ethnic Population, γ_{030}	-0.016	0.018	0.354
Small, γ_{040}	-6.438	1.407	0.000
Medium, γ_{050}	-2.953	0.659	0.000
<i>Large^a</i>			
Low Selectivity, γ_{060}	-12.164	1.410	0.000
Medium Selectivity, γ_{070}	-8.319	1.010	0.000
<i>High Selectivity^a</i>			
Mean Instructional Expenditures, γ_{080}	-0.075	0.065	0.250
Mean Research Expenditures, γ_{090}	0.056	0.047	0.234
Mean Student Services Expenditures, γ_{0100}	-0.344	0.125	0.007
Mean Grant Expenditures, γ_{0110}	-0.277	0.091	0.003
Mean Tuition Revenue, γ_{0120}	0.068	0.062	0.273
Mean % Student Body Receiving Any Financial Aid, γ_{0130}	-0.011	0.037	0.756

Table 5 continued

Fixed Effect	b	SE	p-value	
Mean Remediation, γ_{0140}	-1.11	0.900	0.218	
Growth model, π_{1ij}				
Institutional model, β_{10j}				
YEAR slope, γ_{100}	0.323	0.146	0.031	
Bachelor, γ_{110}	0.367	0.294	0.213	
Master, γ_{120}	0.096	0.113	0.398	
<i>Doctoral^a</i>				
% Minority/Ethnic Population, γ_{130}	-0.001	0.003	0.717	
Small, γ_{140}	-0.152	0.250	0.542	
Medium, γ_{150}	-0.835	0.093	0.368	
<i>Large^a</i>				
Low Selectivity, γ_{160}	-0.178	0.177	0.316	
Medium Selectivity, γ_{170}	-0.015	0.102	0.882	
<i>High Selectivity^a</i>				
Mean Instructional Expenditures, γ_{180}	0.021	0.009	0.024	
Mean Research Expenditures, γ_{190}	0.022	0.006	0.001	
Mean Student Services Expenditures, γ_{1100}	0.003	0.022	0.901	
Mean Grant Expenditures, γ_{1110}	0.023	0.021	0.268	
Mean Tuition Revenue, γ_{1120}	-0.004	0.007	0.506	
Mean % Student Body Receiving Any Financial Aid, γ_{1130}	0.004	0.007	0.575	
Mean Remediation, γ_{1140}	-0.092	0.123	0.457	
	Variance			
Random Effect	Component	df	χ^2	p-value
Level 1				
Institutional Retention Rate variation, e_{1ij}	8.121			
Level 2				
Institution-year Institutional Retention Rate INTERCEPT, r_{0ij}	22.177	406	2624.157	0.000
Institution-year Institutional Retention Rate growth SLOPE, r_{1ij}	0.274	406	663.647	0.000

Table 5 continued

Random Effect	Variance Component	df	χ^2	p-value
Level 3				
State mean Institutional Retention Rate growth INTERCEPT, u_{00j}	15.368	49	385.839	0.000
State mean Institutional Retention Rate growth SLOPE, u_{10j}	0.074	49	102.252	0.000

Note: The parametric equations defining these results can be found in Appendix D.

^aReference category

The table opens with the initial status (the intercept) of the linear growth model ($\pi_{0ij} = \beta_{00j} = \gamma_{000}$), which reveals that the average institutional retention rate for the first year of the study considering *this model* was about 85% ($b = 85.006, p < .001$). Institutional size and selectivity each have statistically significant effects on the initial status of linear growth. As compared to large institutions, both small ($b = -6.438, p < .001$) and medium ($b = -2.953, p < .001$) schools had lower retention rates, on average, net of all other factors. Institutions with low selectivity ($b = -12.164, p < .001$) and medium selectivity ($b = -8.319, p < .001$) also had lower rates of institutional retention as compared to high selectivity schools, on average, controlling for all other variables. The only independent variables that had any statistically significant effects on the initial status of the linear growth ($\pi_{0ij} = \beta_{00j} = \gamma_{000}$) were Mean Student Services Expenditures ($b = -0.344, p < .01$) and Mean Grant Expenditures ($b = -0.277, p < .01$), respectively. For every 10% that student services constituted the total expenditures budget, there would be a corresponding 3.4% decrease in the institutional retention rate, on average. Similarly, for every 10% that grants comprised an institution's expenditures, an institution's first-year retention would decrease by about 2.8%, on average.

Turning to the second half of the fixed effects portion of the table, we observe the linear growth slope coefficient ($\pi_{1ij} = \beta_{10j} = \gamma_{100}$) and its effect ($b = 0.323, p < .05$). This tells us that there is growth in first-year retention over the institutional covariates. Based on the results given for *this model*, over the time frame of the investigation (2003-2008), the average institution can expect to see about a 1.9% increase in their institutional retention rate, net of all other factors. Examining the results, only Mean Instructional Expenditures ($b = 0.021, p < .05$) and Mean Research Expenditures ($b = 0.022, p < .01$), respectively, had any effect on the linear growth slope ($\pi_{1ij} = \beta_{10j} = \gamma_{100}$). These effects were minimal. For every 10% in either instructional or research expenditure, there would only be a concomitant increase in the linear growth of institutional retention of 0.2%, on average.

Lastly, while the statistically significant effects of the growth model coefficients inform us that the linear growth model does indicate a basic pattern of change in institutional retention rate across institutions, the models remain misspecified, due to the presence of statistically significant residual parameter variance, r_{1ij} and u_{10j} (Raudenbush & Bryk, 2002, p. 243). In a correctly specified model, all of the predictor variables would capture all of the variation in the dependent variable. Therefore, there would be no significant residual parameter variance (r_{1ij} and u_{10j}). Since variance remains, we can conclude that the model needs to be refined further, which is presented in the combined model, below.

State Level Analysis of Covariance

Table 6 presents an analysis of covariance of the Level 3, state-level covariates of first year retention. This model is similar to the one just discussed, noting certain key exceptions. This state-level model expands on the basic form of the growth model by including independent and control variables at Level 3 (the state level). It is left

Table 6 continued

Random Effect	Variance Component	df	χ^2	p-value
Level 3				
State mean Institutional Retention Rate growth INTERCEPT, u_{00j}	20.870	45	206.439	0.000
State mean Institutional Retention Rate growth SLOPE, u_{10j}	0.055	45	90.129	0.000

Note: The parametric equations defining these results can be found in Appendix D.

The table opens with the initial status (the intercept) of the linear growth model ($\pi_{0ij} = \beta_{00j} = \gamma_{000}$), which reveals that the average institutional retention rate for the first year of the study considering *this model* was about 73% ($b = 72.521, p < .001$). Beyond this figure, none of the state-level covariates have any statistically significant effects on the initial status of linear growth.

Turning to the second half of the fixed effects portion of the table, we observe the linear growth slope coefficient ($\pi_{1ij} = \beta_{10j} = \gamma_{100}$) and its effect ($b = 0.168, p < .01$). This tells us that there is growth in first-year retention at the state-level. However, this growth is not due to the presence of any of the particular state-level covariates selected for this investigation. No variable in the growth slope portion of the model had a statistically significant effect on the linear growth slope coefficient ($\pi_{1ij} = \beta_{10j} = \gamma_{100}$).

Combined Model

Finally, a full model, with linear growth at Level 1, institutional covariates at Level 2, and state-level covariates at Level 3 was estimated. Those results are presented in Table 7.

Table 7

Combined Model

Fixed Effect	b	SE	p-value
Growth model, INTERCEPT, $\pi_{0ij} = \beta_{00j} = \gamma_{000}$	85.076	0.835	0.000
Institutional Model			
Bachelor, γ_{010}	-2.174	1.266	0.086
Master, γ_{020}	-0.670	0.694	0.335
<i>Doctoral^a</i>			
% Minority/Ethnic Population, γ_{030}	-0.016	0.018	0.383
Small, γ_{040}	-6.447	1.460	0.000
Medium, γ_{050}	-2.968	0.663	0.000
<i>Large^a</i>			
Low Selectivity, γ_{060}	-12.258	1.459	0.000
Medium Selectivity, γ_{070}	-8.358	1.040	0.000
<i>High Selectivity^a</i>			
Mean Instructional Expenditures, γ_{080}	-0.075	0.065	0.254
Mean Research Expenditures, γ_{090}	0.054	0.047	0.253
Mean Student Services Expenditures, γ_{0100}	-0.342	0.125	0.007
Mean Grant Expenditures, γ_{0110}	-0.276	0.090	0.003
Mean Tuition Revenue, γ_{0120}	0.067	0.062	0.278
Mean % Student Body Receiving Any Financial Aid, γ_{0130}	-0.011	0.037	0.769
Mean Remediation, γ_{0140}	-1.158	0.906	0.202
State-level Model			
Mean Unemployment Rate, γ_{001}	-0.208	0.608	0.734
Mean Higher Education Appropriation, γ_{002}	-0.145	0.098	0.145
Mean Medicaid Appropriation, γ_{003}	0.102	0.102	0.323
Mean Corrections Appropriation, γ_{004}	0.167	0.713	0.816
Growth model, YEAR Slope, $\pi_{1ij} = \beta_{10j} = \gamma_{100}$	0.302	0.145	0.043
Institutional Model			
Bachelor, γ_{110}	0.355	0.288	0.218
Master, γ_{120}	0.120	0.111	0.282
<i>Doctoral^a</i>			

Table 7 continued

Fixed Effect	b	SE	p-value	
% Minority/Ethnic Population, γ_{130}	-0.001	0.003	0.740	
Small, γ_{140}	-0.134	0.262	0.608	
Medium, γ_{150}	-0.084	0.091	0.352	
<i>Large^a</i>				
Low Selectivity, γ_{160}	-0.161	0.196	0.411	
Medium Selectivity, γ_{170}	0.005	0.110	0.964	
<i>High Selectivity^a</i>				
Mean Instructional Expenditures, γ_{180}	0.021	0.009	0.024	
Mean Research Expenditures, γ_{190}	0.023	0.007	0.001	
Mean Student Services Expenditures, γ_{1100}	0.001	0.021	0.956	
Mean Grant Expenditures, γ_{1110}	0.023	0.021	0.269	
Mean Tuition Revenue, γ_{1120}	-0.004	0.007	0.532	
Mean % Student Body Receiving Any Financial Aid, γ_{1130}	0.004	0.007	0.591	
Mean Remediation, γ_{1140}	-0.099	0.119	0.406	
State-level Model				
Mean Unemployment Rate, γ_{101}	-0.107	0.080	0.189	
Mean Higher Education Appropriation, γ_{102}	-0.016	0.012	0.209	
Mean Medicaid Appropriation, γ_{103}	-0.001	0.012	0.927	
Mean Corrections Appropriation, γ_{104}	0.105	0.076	0.174	
Random Effect	Variance Component	df	χ^2	p-value
Level 1				
Institutional Retention Rate variation, e_{ij}	8.121			
Level 2				
Institution-year Institutional Retention Rate INTERCEPT, r_{0ij}	22.163	406	2625.375	0.000
Institution-year Institutional Retention Rate growth SLOPE, r_{1ij}	0.278	406	664.017	0.000
Level 3				
State mean Institutional Retention Rate growth INTERCEPT, u_{00j}	14.354	45	360.893	0.000

Table 7 continued

Random Effect	Variance Component	df	χ^2	p-value
Level 3				
State mean Institutional Retention Rate growth SLOPE, u_{10j}	0.051	45	92.474	0.000

Note: The parametric equations defining these results can be found in Appendix D.

^aReference category

The table opens with the initial status (the intercept) of the linear growth model ($\pi_{0ij} = \beta_{00j} = \gamma_{000}$), which reveals that the average institutional retention rate for the first year of the study considering *this model* was about 85% ($b = 85.076, p < .001$). Institutional size and selectivity each have statistically significant effects on the initial status of linear growth. As compared to large institutions, both small ($b = -6.447, p < .001$) and medium ($b = -2.968, p < .001$) schools had lower retention rates, on average, net of all other factors. Institutions with low selectivity ($b = -12.258, p < .001$) and medium selectivity ($b = -8.358, p < .001$) also had lower rates of institutional retention as compared to high selectivity schools, on average, controlling for all other variables. The only independent variables that had any statistically significant effects on the initial status of the linear growth ($\pi_{0ij} = \beta_{00j} = \gamma_{000}$) were Mean Student Services Expenditures ($b = -0.342, p < .01$) and Mean Grant Expenditures ($b = -0.276, p < .01$), respectively. For every 10% that student services constituted the total expenditures budget, there would be a corresponding 3.4% decrease in the institutional retention rate, on average. Similarly, for every 10% that grants comprised an institution's expenditures, an institution's first-year retention would decrease by about 2.8%, on average.

Regarding the State-level model of the initial status of linear growth ($\pi_{0ij} = \beta_{00j} = \gamma_{000}$), none of the state-level covariates had any statistically significant effects on the initial status of linear growth.

Turning to the second half of the fixed effects portion of the table, we observe the linear growth slope coefficient ($\pi_{1ij} = \beta_{10j} = \gamma_{100}$) and its effect ($b = 0.302, p < .05$). This tells us that there is growth in first-year retention over the institutional covariates. Based on the results given for *this model*, over the time frame of the investigation (2003-2008), the average institution can expect to see about a 1.8% increase in their institutional retention rate, net of all other factors. Examining the results, only Mean Instructional Expenditures ($b = 0.021, p < .05$) and Mean Research Expenditures ($b = 0.023, p < .01$), respectively, had any effect on the linear growth slope ($\pi_{1ij} = \beta_{10j} = \gamma_{100}$). These effects were minimal. For every 10% in either instructional or research expenditure, there would only be a concomitant increase in the linear growth of institutional retention of 0.2 units (percent), on average.

Inspecting the state-level model for the linear growth slope coefficient ($\pi_{1ij} = \beta_{10j} = \gamma_{100}$), it is clear that any growth is not due to the presence of any of the particular state-level covariates selected for this investigation. No variable in the growth slope portion of the model had a statistically significant effect on the linear growth slope coefficient ($\pi_{1ij} = \beta_{10j} = \gamma_{100}$).

While the statistically significant effects of the growth model coefficients inform us that the linear growth model does indicate a basic pattern of change in institutional retention rate across institutions, the models remain misspecified, due to the presence of statistically significant residual parameter variance, r_{1ij} and u_{10j} (Raudenbush & Bryk, 2002, p. 243). In a correctly specified model, all of the predictor variables would capture all of the variation in the dependent variable. Therefore, there would be no significant residual parameter variance (r_{1ij} and u_{10j}). Since variance remains, we can conclude that the model still needs to be refined further. The implications of this will be discussed in Chapter 5.

Higher Education Appropriations Model

Table 8 presents results from a hierarchical analysis examining the effects of state unemployment, as well as appropriations for Medicaid and corrections, respectively, on appropriations for higher education for all fifty states across all six time observations. It is a hierarchical presentation of an OLS regression with robust standard errors. This model is distinct from the prior models and is designed to assess the second research question.

Table 8

Associations of State-level Covariates with Higher Education Appropriations

Fixed Effect	b	SE	p-value
INTERCEPT, $\beta_{0j} = \gamma_{00}$	7.639	2.641	0.006
Unemployment, γ_{10}	0.218	0.168	0.195
Medicaid Appropriations, γ_{20}	0.018	0.090	0.843
Corrections Appropriations, γ_{30}	0.803	0.457	0.079

Random Effect	Variance Component	df	χ^2	p-value
Level 1				
Higher Education Appropriation variation, r_j	3.612			
Level 2				
INTERCEPT, u_0	28.746	49	2376.639	0.000

Respectively, controlling for other measures, state unemployment rate, Medicaid appropriations, and corrections appropriations, have no effect on higher education appropriations. This lack of interaction is further confirmed by the statistically significant variance component, u_0 , which indicates that variation in higher education appropriations may be due to some other factors.

Assessment of the Research Questions

Given the results of the investigation, they will now be analyzed in the context of the research questions guiding this investigation. The first research question asks broadly about the effect of the economic context on first-year retention at four-year, public universities. This question is best answered by reflecting on its sub-questions, which ask about the key constructs of the investigation. Additionally, the first research question is addressed primarily from the results of the combined model, while attending to the results from the four prior models. Research question 1a asks about the effect of state economic health (the state unemployment rate) on first-year undergraduate retention. Unemployment has no effect on the institutional undergraduate retention rate, neither the initial status nor the rate of growth.

Research question 1b asks about the effect of state appropriations for higher education on first-year undergraduate retention. State appropriations for higher education have no effect on the initial status of first-year undergraduate retention rate or on the growth in undergraduate retention.

Research question 1c asks about the effect of institutional expenditures on first-year undergraduate retention. Controlling for all other factors in the model, mean student services expenditures and mean grant expenditures, respectively, each have negative effects on the initial status of institutional retention rate. When examining the growth term, however, mean instructional expenditures and mean research expenditures, respectively, each have positive effects on the linear growth of the institutional retention rate, controlling for all other variables.

Research question 1d asks about the effect of tuition pricing and financial aid on undergraduate retention. These variables have no effect on the initial status of the institutional retention rate or the growth in the institutional retention rate.

Research question 1e asked how the various covariates affected the growth (change) in the institutional retention rate over time. Only two covariates had any statistically significant effect on the growth in first-year retention: instructional expenditure and research expenditure. The magnitude of these effects was rather small.

While the first research question asked about the effects of different constructs on the institutional retention rate, the second research question was concerned with factors that affected variations in state-level appropriations for higher education. The second research question is best assessed with the results of the higher education appropriations model. Research question 2 asks how state economic health affects higher education appropriation. It does not. Research question 2a asks how state appropriations for higher education vary with appropriations for Medicaid and corrections. They do not.

Summary

This chapter presented the results of the investigation. The analysis revealed multiple statistical issues with the data, including: non-normal distribution of the data, non-random distribution of cases, as well as severe heterogeneity, extreme homogeneity, skewness, and kurtosis, respectively, of various measures. In turn, this had implications for the hierarchical analysis, namely that effects were fixed and not allowed to vary at random, and that it was necessary to use robust standard errors when analyzing the coefficients of the fixed effects.

Most of the findings were not statistically significant. In terms of the initial status (the intercept) of the linear growth model, only institutional size, institutional selectivity,

mean student services expenditures, and mean grant expenditures had any significant effects on that coefficient. Regarding the linear growth term, only mean instructional expenditures and mean research expenditures had statistically significant effects on the slope coefficient. No state-level covariate had any effect on either the initial status of linear growth or the linear growth slope. The implications of these results will be discussed in the next chapter.

Chapter 5

Introduction

This chapter contains the discussion of the research findings and implications to be drawn from those findings. The organization of the chapter is as follows. First, the findings are discussed. Next, theoretical implications are presented. This is followed by implications for policy. Fourth, limitations of the current research are reviewed. Finally, directions for future research are proposed.

Summary of Findings

Looking at institutional characteristics, institutional scope, whether the institution was a baccalaureate, terminal master's, or doctoral-granting institution, had no effect on retention. This finding is consistent with prior research (Antley, 1999; Cragg, 2009) that showed institutional scope also has no effect on retention (Antley, 1999) or four- six-year graduation (Cragg, 2009). On the other hand, institutional size ("small," "medium," or "large") did have statistically significant effects on institutional retention, with small and medium-sized schools retaining fewer students compared to large schools. With the exception of Titus (2004), these findings for institutional size generally run counter to those discussed in the review of the literature (Antley, 1999; Huffman & Schneiderman, 1997; Oseguera, 2006; Titus, 2006b) in which institutional size usually has no effect or a minor, negative effect on retention, persistence, or graduation. There are several reasons why this could be the case. Other studies included interaction effects for geographic region (Antley, 1999) or race/ethnicity (Oseguera, 2006). In other research, graduation rate was the dependent variable (Huffman & Schneiderman, 1997; Oseguera, 2006; Titus, 2006b). Noting these variations, however, this investigation found that size of the school does have a significant,

main effect on the initial status of retention, with large, public institutions retaining more of their first-year students into the second year than medium or small public schools. From the perspective of Resource Dependence Theory (Pfeffer & Salancik, 1978), large schools simply have more physical capital (i.e., larger budgets) to draw from than their less-populous counterparts.

In addition to institutional scope, institutional selectivity also had a statistically significant effect on the initial status (the intercept) of the growth in the institutional retention rate. Not surprisingly, those schools characterized as having “low” and “medium” selectivity had lower rates of first- to second-year retention as compared to “high” selectivity schools. These findings echo those of prior research (Astin, 2006; Gansemer-Topf & Schuh, 2006; Oseguera, 2006; Titus, 2004) in which students from “lower” selectivity schools had lower rates of retention and graduation than students from “higher” selectivity schools.

Beyond institutional scope, size, and selectivity, percent minority population as an institutional characteristic was also investigated. The percent minority population variable included in this investigation was used to measure the racial/ethnic minority composition of the student body (Lamb, 1999; Museus, Nichols, & Lambert, 2008). There were two aims. First, it was a basic step to control for general trends by race/ethnicity in retention outcomes. Second, and perhaps more importantly, the percent minority population variable was designed to capture a “critical mass” quantitative measure of the racial climate of the institution (Alon & Tienda, 2005; Nora & Cabrera, 1996). Regardless, there was no statistically significant effect for this finding on the initial status (i.e. the intercept) of institutional retention rate. This is not surprising for two reasons. One, most research that has found main effects for race/ethnicity measured the variable at the level of the individual,

the student (Oseguera, 2006; Smith, 1995; St. John, Paulsen, & Carter, 2005). Second, these individual-level main effects are then often occluded by other factors, such as institutional size or selectivity (Alon & Tienda, 2005; Basten et al., 1997; Gansemer-Topf & Schuh, 2006; Niu, Tienda, & Cortes, 2006), or the fiscal resource context of the institution (Arbona & Nora, 2007; St. John et al., 2004; St. John, Paulsen, & Carter, 2005; Titus, 2006b; 2006c).

Having treated the effects of the various institutional characteristics on the initial status (the intercept) of the linear growth of the institutional retention rate, the discussion now turns to the effects of the different institutional expenditures on the intercept ($\pi_{0ij} = \beta_{00j} = \gamma_{000}$) of the growth model. Expenditures on instruction and research, respectively, had no effect on institutional retention. Moreover, expenditures on student services and (Pell) grants, respectively, had statistically significant, *negative* effects on retention. Generally, each of these findings runs contradictory to those found in the review of the literature, either in statistical significance and/or magnitude of direction (Gansemer-Topf & Schuh, 2006; Titus, 2006b; Titus, 2006c; Webber & Ehrenberg, 2009).

Given the results from the regression models in APPENDIX C, the results for the institutional expenditures in the combined hierarchical model were completely unexpected. An immediate reason for this may be measurement. In the regression models, each expenditure measure captures data for that particular year only, while in the hierarchical model, it was necessary to aggregate (average) the data across institution-years due to estimation procedures. For example, in the 2003 regression model in APPENDIX C, the institutional retention rate is regressed on the student services expenditure for 2003 *only*; whereas, in the hierarchical model, the 2003 institutional retention rate (i.e. the initial status of institutional retention) is regressed on the *average* student services expenditure from 2003-

2008 for a particular institution. This does not mean that the findings are to be disregarded, however, only that their interpretation is somewhat different between the simple OLS regression model and the hierarchical model. In any case, the fact of the matter is that the average expenditures on student services and (Pell) grants, respectively, have negative effects on the initial status of the institutional retention rate.

A few reasons can be offered as to why student services and grants expenditures have negative effects on the initial status of first-year retention. The first two reasons are interrelated based on variable measurement. First, the student services variable might be confounded to some extent (Babbie, 1998; Neuman, 1997). It captures much more than typical activities that occur under a student affairs purview, such as student life programming, events in the student center, intramural sports and so forth. The student services variable also contained dollar amounts for bureaucratic and organizational elements necessary to conduct those services, such as salaries for the student affairs staff and costs related to programming and events. This might be the case not so much of the “quantity” of the student services so much as their “quality.” Second, looking at the grant expenditures measure, which primarily measured funds spent on Pell grants, it should be recognized that not all first-year students receive Pell grant aid. Prior to running the OLS regression and HLM analyses, bivariate correlations (not reported here) were conducted, and it was determined that the grant expenditures and percent of students receiving any aid variables did not evidence any multicollinearity, so that is not an issue. Instead, a more refined measure of the financial need of the student body may be warranted. Third, and perhaps most interesting, the causal ordering of these variables might be at issue. As the model is specified, student services and grants expenditures cause retention. However, what makes

more logical sense is that an institution would ascertain its first-year retention rate, and then possibly adjust its budget for the *following* year in order to approve the next year's rate of retention.

Turning next to tuition revenues and financial aid, the percent of revenue derived from tuition and the percent of the study body receiving any financial aid, respectively, did not have a statistically significant effect on the initial status of the institutional retention rate. These findings run counter to those reported in the literature review (Singell, 2004; St. John, Paulsen, & Carter, 2005; Titus, 2006a; Titus, 2006b; Titus, 2006c) in which tuition revenues and financial aid were found to have statistically significant effects on retention, persistence, or graduation. Theoretically, we would expect the tuition revenue and financial aid variables to have an effect on the institutional retention rate, because revenue (income) and the percent of the student body receiving financial aid (loss) directly address resource availability, what Pfeffer and Salancik (1978) refer to as, "munificence." Part of this may be a measurement issue, because figures were aggregated across institution-years. However, per-year regression models did not show statistically significant findings for these variables, either. Another measurement issue concerns the dependent variable: Titus (2006a; 2006b; 2006c) examined persistence to graduation. This investigation examined first- to second-year retention. The issues *are* related conceptually, yet distinct. For example, students who persist for a given length of time (e.g., three years) are retained for each of those years. On the other hand, this investigation only examined retention from the first-to-second year, for a successive cohort for each year of the study. So, each year involved in this study represented a unique observation of the dependent variable in terms of retention, which was *not* persistence, as per prior research (Titus, 2006a; 2006b; 2006c). A third measurement issue is

that other tuition and financial aid matters were partially confounded as institutional characteristics (e.g., the tuition price as set by the institution) shouldered by the individual student (Singell, 2004; St. John, Paulsen, & Carter, 2005). Returning to theory, however, it could be the case that tuition revenue is more theoretically relevant to persistence (Titus, 2006a; Titus, 2006b; Titus, 2006c) than it is to first- to second-year retention.

Finally, remediation also had no effect on the initial status ($\pi_{0ij} = \beta_{00j} = \gamma_{000}$) in the linear growth of the institutional retention rate. The equivocal nature of this effect tends to fall in line with those reported in the literature review (Bettinger & Long, 2009; Jamelske, 2009). It is suspected that the reason remediation did not have a statistically significant effect on first- to second-year retention is because the construct was measured fairly broadly: whether or not the institution had any remediation-enhancing programs. This was a limitation imposed by the nature of the secondary data. Prior research analyzed specific programs, such as English or mathematics remediation (Bettinger & Long, 2009) or FYE courses (Jamelske, 2009). Perhaps what is needed is a more refined measure of remediation, such as the percentage of remedial English or mathematics courses at the institution, or the amount (percent or n) of students enrolled in such courses at the institution, instead of the more global measure of whether or not the institution simply has or does not have remediation programs. From an empirical point of view, this figure might be akin to knowing the percentage of students receiving any type of financial aid. Knowing the percentage of remedial courses or percentage of first-year students taking remedial courses could possibly serve as an indicator of the academic distress of the institution.

Having discussed the effects of the institutional covariates on the initial status of linear growth, the discussion now turns to the effects of the state-level covariates. No state-

level covariate had a statistically significant effect on the intercept ($\pi_{0ij} = \beta_{00j} = \gamma_{000}$) of the growth model. Net of all other factors (state economic health, Medicaid appropriations, and criminal justice system appropriations, respectively), appropriations for higher education had no effect on the retention of first-year students at a particular institution within that state. However, when compared to the OLS regression model for 2003 in APPENDIX C, there are some discrepancies. The measures for state-level unemployment, higher education appropriation, and criminal justice system appropriation, respectively, all have statistically significant effects in the single-year (2003) regression model. The primary reason for this is that a basic OLS regression does two things: 1) it estimates all of the independent variables simultaneously, and 2) it fails to truly take into account the multilevel nature of the data. In this instance, even though we know that institutions are nested within states, the OLS model regresses the dependent variable on the institutional- and state-level variables as if they were all at the same level.

Two empirical reasons are offered as to why state-level economic variables had no effect on the initial status of the linear growth rate. First, similar to certain institutional covariates, all state-level covariates had to be averaged across state-years. In the OLS regression model, the institutional retention rate for 2003 (which is also the initial status of the linear growth model) is regressed on covariates for 2003 *only*. In the hierarchical model, the linear growth intercept term is regressed on aggregated (averaged) measures, which might introduce some bias. Second, as discussed in Chapter 3, part of the reason for conducting a hierarchical analysis is to partition the effects of nested contexts. A basic OLS regression does not permit this—all variables are treated as if occurring at the same “level” and independently of each other. The hierarchical analysis allows for a true estimation of the

effects of the context by making the Level 1 intercept term a function of the Level 2 covariates, and ultimately the Level 3 covariates.

Theoretically, these non-significant findings are somewhat puzzling, because they address salient issues of the resource-context of higher education at the state-level (Monk, Dooris, & Erickson, 2009; Okunade, 2004; Weerts & Ronca, 2006). Perhaps the most telling piece is informed empirically by the proportion of variance explained by the level of the model. Even though public institutions obtain part of their funding from state appropriations, how those funds are used, what Pfeffer and Salancik (1978) term “efficiency,” is left to the discretion of the institution. Granted, state legislatures are becoming increasingly concerned about the funds they allocate to higher education (Weerts & Ronca, 2006), but this appears to be more a political issue than either a theoretical or an empirical one. In terms of Resource Dependence Theory, it appears that the more immediate resource context, such as the institution, has greater salience than a resource context that is more removed (i.e. the state).

To summarize, the various effects on the initial status (the intercept, $\pi_{0ij} = \beta_{00j} = \gamma_{000}$) of the linear growth model include only a few institutional covariates that were statistically significant. Net of all other effects, institutional size and institutional selectivity each had positive effects on the initial status of linear growth, while student services expenditures and (Pell) grant expenditures, individually, had negative effects on the intercept (initial status) of the linear growth model. None of the state-level covariates were statistically significant. Part of the purpose in discussing the initial status of the linear growth model—which is the value of the institutional retention rate at time $t = 0$, or the first year of the study, in this case, 2003—is that it is a unique term requiring its own interpretation. Another reason is that it

helps to provide a basis of comparison for discussion of the linear growth term. The discussion now turns to an examination of the linear growth coefficient portion of the model.

While the preceding portion of the discussion focused on the initial status of the linear growth mode, which is the value of the institutional retention rate at time $t = 0$, or the first year of the study, in this case, 2003, the discussion now turns to the discussion of the linear growth term, that is, the actual change (or growth) in the institutional retention rate over time. No institutional characteristic had a statistically significant effect on the linear growth slope ($\pi_{1ij} = \beta_{10j} = \gamma_{100}$). These included: institutional size, scope, selectivity, and percent minority population, respectively. That institutional scope and percent minority population, respectively, had no statistically significant on the linear growth term is not problematic, because these did not have statistically significant effects on the intercept term, either. Therefore, the findings are consistent within the model. What is curious is that institutional size and institutional selectivity, respectively, did not have statistically significant effects on the growth term. These were expected, because they appeared in the OLS regression models, as well as in the intercept portion of the growth model. However, now the findings for institutional size are more in accordance with those discussed in the literature review (Antley, 1999; Huffman & Schneiderman, 1997; Oseguera, 2006; Titus, 2006b) in which institutional size usually has no effect or a minor, negative effect on retention, persistence, or graduation. Also, the literature identified that selectivity does have an effect on retention or graduation, with students from “lower” selectivity schools had lower rates of retention and graduation than students from “higher” selectivity schools (Astin, 2006; Gansemer-Topf & Schuh, 2006; Oseguera, 2006; Titus, 2004).

An empirical reason for the findings that size and selectivity, respectively, matter within year but not over time, is that the magnitude of the linear growth term in the combined model ($b = 0.302$, $p = 0.043$) is still quite small. Over the six year span of the study, the average institution will only see an increase in their institutional retention rate of about 1.8%, net of all other factors. Growth, while positive, is still very small, or, to restate from an earlier paragraph, growth is essentially static. The conclusion to be drawn, then, is that within an institution for a particular year, size and selectivity, respectively, matter. Over time for that same institution, however, institutional covariates do not have any effect on the growth in first- to second-year retention.

Turning to institutional expenditures, of the four measures examined in this study, only mean instructional expenditures and mean research expenditures, respectively, had statistically significant, positive effects on the linear growth term; however, expenditures for student services and (Pell) grants, respectively, had no statistically significant effects on linear growth slope. These findings are somewhat more in line with the literature (Gansemer-Topf & Schuh, 2006; Webber & Ehrenberg, 2009), which found that in the presence of other institutional covariates, main effects for various institutional expenditures on the dependent were not statistically significant. Over time, expenditures for instruction and research, respectively, increase retention, but those expenditures for student services and grants, respectively, do not. Resource Dependence Theory (Pfeffer & Salancik, 1978) would only tell us that the resource context is important. Instructional and research expenditures directly tap into the utilitarian aspects of college attendance: coursework and academic pursuits leading to a degree. As informed by retention theory (Bean, 1980), this makes more

sense, but does not completely explain why only those expenditures directly addressing academics had statistically significant effects on the linear growth in retention.

One consideration as to why, over time, instructional and research expenditures have effects on retention (and student services and grant expenditures do not) is that the ultimate goal of the educational enterprise is degree conferral, which is accomplished in part by retaining students. Retention has to take place each year until graduation. Even though this study only looked at first-to-second year retention, perhaps what the instructional and research expenditures tap into are those integrative aspects of the academic portion of college life (Bean, 1980). Despite the theoretical importance of the social aspects of college life, as well as the ability to pay, what appears to matter most to retention from the perspective of the institution is what happens in the classroom. More consideration of these issues will be given below.

Regardless, the magnitude of the effects of instructional expenditures ($b = 0.021$, $p = 0.024$) and research expenditures ($b = 0.023$, $p < 0.001$), individually, on the linear growth slope are very small. For example, at the average institution, if 10% of the budget was apportioned to either instruction or research, this would only increase the linear growth in the institutional retention rate by 0.2 units per year, or a total of 1.2 units (%) over the time frame of this investigation (2003-2008). In sum, institutional expenditures matter to the growth of the institutional retention rate over time albeit very little.

Looking next at tuition and financial aid, similar to the findings for the initial status of the linear growth term, neither tuition nor financial aid had statistically significant effects on the linear growth slope ($\pi_{1ij} = \beta_{10j} = \gamma_{100}$). A number of theoretical and empirical issues regarding why tuition revenue and percent of student body receiving any financial aid,

respectively, were not related to the initial status of the institutional retention rate ($\pi_{0ij} = \beta_{00j} = \gamma_{000}$) have already been discussed. Theoretically, tuition and financial aid directly address resource availability or “munificence” (Pfeffer & Salancik, 1978). Empirically, issues of data aggregation, differences in the dependent variable (first-year retention in this study as opposed to persistence or graduation in other research), or the unit of analysis (institutions as in this investigation versus individuals in other studies) may explain why these variables had no statistically significant effect on the linear growth term.

The final institutional covariate to be examined is remediation. As per the initial status portion of the growth model, remediation also had no statistically significant effect on the linear growth slope ($\pi_{1ij} = \beta_{10j} = \gamma_{100}$). The non-finding for remediation is also consistent with the per-year OLS finding (APPENDIX C). Reasons for why this is the case are similar to those outlined above: remediation appears to be more an issue driven at the level of the individual student than at the level of the institution.

Having considered the effects of the various institutional-level covariates on the linear growth slope portion of the growth model, the discussion now turns to the effects of the state-level covariates on the linear growth slope ($\pi_{1ij} = \beta_{10j} = \gamma_{100}$). As for the portion of the linear growth model estimating the initial status of linear growth (the intercept, $\pi_{0ij} = \beta_{00j} = \gamma_{000}$), no particular state-level covariate had a statistically significant effect on the linear growth slope, net of all other covariates. Given the literature (Monk, Dooris, & Erickson, 2009; Okunade, 2004; Weerts & Ronca, 2006), as well as per-year OLS findings (APPENDIX C), some findings were anticipated at the state level. However, when the proportion of variance was partitioned, it was not surprising that no significant effects were revealed. As discussed previously, a theoretical reason for lack of findings at the state level

could be the immediacy of the context; the institutional retention rate is more directly affected by matters of institutional finance than it is state appropriations.

The state-level covariates merit closer inspection, because they were a key set of constructs in this investigation. The unemployment rate will be considered first, because it was conceived of as the measure of the “economic health” of the state. State-to-state variation aside, the data revealed that the annual unemployment rate for most states dropped from 2003 to 2008. As unemployment drops, the economic health of the state should improve. Examining higher education appropriation, the most summative statement could be that the majority of states are “in the middle,” so to speak, both in terms of their appropriations, as well as whether or not they were increasing or decreasing those funds. Looking at appropriations for Medicaid, a greater majority of states had larger appropriations for this category than for higher education. What was a little surprising was how relatively small each state’s appropriation for criminal justice as compared to either higher education or Medicaid, given that crime is a perennial topic for politicians and news pundits.

The covariates in the state-level economic context were analyzed in a separate HLM analysis to better understand how they influence each other. The short answer is: they do not. Neither unemployment, Medicaid appropriation, or criminal justice appropriation have any effect on higher education appropriation. This was somewhat unexpected. Okunade (2004) found that state appropriation for higher education are most affected by the extent of the state’s outstanding debt, followed by Medicaid and criminal justice appropriation. While this study did not have a measure for the outstanding debt load for each state, it did employ figures for Medicaid and criminal justice. In sum, state economic health does not affect

higher education appropriation. Higher education appropriation does not vary with funding for Medicaid or criminal justice.

Before concluding this portion of the discussion, some elaborations concerning differences between the OLS regression and HLM models should be made. A standard reason for this concerns the way in which HLM treats contextualized effects relative to OLS regression. In regression, all variables are entered at the same “level” and are assumed to affect the dependent variable independently of each other (Allison, 1999). Under correctly specified hierarchical conditions, however, contextualized variables are properly located and no longer affect the dependent variable with the same degree of independence as previously (Raudenbush & Bryk, 2002).

As noted above, an obvious difference between the OLS and HLM models is observed in the growth portion of the HLM model, where only two of the covariates are statistically significant: instructional expenditures and research expenditures. This is completely opposite of nearly every single finding from each of the six regression tables (Appendix C). However, it is necessary to remember that the growth portion of the HLM model is unique, because it captures the actual change over time. It is fluid. Each OLS model captures some change, but this is segmented. To further explore the differences between the OLS and HLM models, consistencies across the OLS models can be examined. Regardless of the wave (year), one institutional expenditure was always statistically significant: grants expenditures. Its effect was negative in each year. Interestingly, among the state-level covariates, higher education appropriation also always had a significant, negative effect in each OLS model. That the effects for each of these variables was negative could be similar to the issue of causal ordering presented above. Instead of grants

expenditures and higher education appropriations “causing” retention, perhaps retention might lead to changes in expenditures and appropriations.

Regarding time, these problems with the different expenditures variables might be evidence of autocorrelation. Essentially, autocorrelation is the correlation of the same variable over time. More precisely, it is the correlation of the residuals associated with that variable, usually as part of a regression analysis over time (Bollen & Curran, 2006). The OLS analyses were not investigated for autocorrelation. Autocorrelation results in underestimation of standard errors (Bollen & Curran, 2006). In this investigation, due to various sampling and data issues, robust standard errors were used in the HLM analyses (Raudenbush & Bryk, 2002). Furthermore, the HLM software did not provide any additional indication as to potential issues related to autocorrelation. [The HLM software indicates if autocorrelation is an issue.] There is little reason to suspect any problem related to autocorrelation in the HLM analysis. However, autocorrelation might explain why certain patterns were evidenced in the OLS regressions and not in the HLM models.

Data analytic issues aside, a more simple reason to account for some of the discrepancies between the OLS and HLM models relates to a basic issue in research methodology. Certain of these differences could merely be artifacts of the data (Babbie, 1998; Neuman, 1997). Granted, two consistent patterns have been identified concerning the grants expenditures and the higher education appropriations. However, these are the only two variables that consistently have statistically significant effects across all six waves of data. Other variables come into or drop out of significance, seemingly at random. Yet, some consideration should be given that certain of the OLS findings are merely random products of the data.

In summary, on average, across institutions over time, the institutional retention rate is fairly static. Essentially, the institutional retention rate does not change. Within-year change at an institution is negatively affected by institutional size (small- and medium-sized schools as compared to large), institutional selectivity (low- and medium-selectivity schools as compared to high-selectivity institutions), student services expenditures and grant expenditures. Over time, only instructional expenditures and research expenditures each had any significant effect on the growth in the institutional retention rate, and the magnitude of these individual effects was minimal, at best. No state-level covariate had any effect on the linear growth in institutional retention. Additionally, no state-level covariate had any effect on higher education appropriation. Differences between the OLS and HLM models are most likely due to proper contextualization of the variables in the hierarchical environment; however, autocorrelation among the variables or statistical artifacts in the data might also explain some of these differences.

Theoretical Implications

Prior to discussing any implications for theory resulting from this investigation, it is necessary to remind the reader of the specific manner in which theory was used in this research. Resource Dependence Theory (Pfeffer & Salancik, 1978) was used to inform this study. That “informing” is used to describe the theoretical underpinnings of this research instead of “grounding” or “guiding” reflects three fundamental orientations to the understanding of theory vis-à-vis the research at hand (Reynolds, 1971). This specific use of theory reflects a particular epistemological orientation to scientific inquiry (Collins & Waller, 1994; Reynolds, 1971); therefore, this study should not be interpreted as constituting a “test” of the given theoretical framework. Hypotheses were derived primarily from the review of

the empirical literature, as understood, however, through a Resource Dependence lens. These theoretical delimitations should not be thought of as questioning the utility of Resource Dependence Theory. To the contrary, the narrow use of Resource Dependence Theory as an informing framework for this investigation is still appropriate, because the key concepts (e.g., munificence), in conjunction with the extant literature, guided the inclusion of the variables for investigation.

Still, we are left with the question: what do the results of this investigation leave for Resource Dependence Theory as an informing framework? First, and perhaps most direct, the salience of the resource context should be considered. This was addressed in part via the hierarchical nesting of the data: institutions within states. The dependent variable for this study, first- to second-year retention, was measured at the level of the institution. Even though we have theoretical and empirical reasons (Monk, Dooris, & Erickson, 2009; Okunade, 2004; Titus, 2006c; Weerts & Ronca, 2006) to believe that the state resource context (i.e. higher education appropriations) should affect institutional outcomes, the results reported here clearly indicate that it does not. These non-significant findings for the state-level covariates are juxtaposed with the various statistically significant findings for institutional-level covariates. Those different institutional expenditure variables identified above, being in closer theoretical and empirical “proximity” to the dependent variable (the institutional retention rate), should be expected to have greater effects than more “distant” variables.

In addition to the nature (salience) of the resource context, a second issue that should be considered is the particular organizational behavior in question. For this study, the dependent variable was the institutional retention rate, which was measured as the percent of

full-time, first-year students enrolled during the fall of one year who re-enrolled as either full- or part-time the following fall (NCES, 2003). It could be the case that this measure of organizational behavior was overly specified. Prior research (Titus, 2006a; Titus, 2006b; Titus, 2006c) examined persistence and six-year graduation rates, which would capture broader trends at the organization as opposed annual measures of first-year retention. The difference is as follows. When one studies persistence to graduation, one can generally speak of the effects of an institution on a first-year cohort during their entire tenure at that institution. A study of first-year retention can only speak of the effect of the institution on that first year. Granted, the first year in college is important. Yet, while both first-year retention and six-year graduation are important institutional outcomes, institutional finance could have vastly different effects on these constructs. Even though the panel is the institution, the dependent variable is first-year retention. Under a Resource Dependence (Pfeffer & Salancik, 1978) framework, it could simply be the case that first-year retention is not a dependent variable suitable for study.

Examining the particular nature of organizational behavior with respect to resources leads to a third consideration: the resource context may need to be respecified. In their discussion of Resource Dependence Theory, Pfeffer and Salancik (1978) present the notion of “efficiency.” As the authors note (Pfeffer & Salancik, 1978, p. 93), efficiency asks the question, “how much is being produced at what cost?” In terms of basic institutional finance, “efficiency” refers to the effect of economics (inputs) on the retention of undergraduates (outputs) (Lewis & Dunder, 2001; Paulsen, 2001a). As the results from this investigation demonstrate, physical capital outlay matters, even though the effects of expenditures on growth in institutional retention are small. Perhaps for first-year retention, fiscal resources

are not the only issue, but other factors, such as social integration (Tinto, 1993), are more important than the economic factors at an institution with respect to the percentage of students it graduates within six years (Titus, 2006c). Pfeffer and Salancik (1978) provide for such openness in their theory, allowing for a broad variety of resources to affect the organizational environment. Resources do not just have to be physical capital or the economic context of the institution. Instead, other sorts of resources beyond physical capital, those that touch on human, social, and cultural capital, should also be considered. In this sense, perhaps it is not the actual budget for student services, so much as the types of programming conducted by the Student Affairs division that contributes to the institutional retention rate. Looking at remediation programs, for example, it is not simply the presence of those sets of courses at an institution that increases retention, so much as it appears to be the specific skills acquired in those programs (Bettinger & Long, 2009; Jamelske, 2009).

In summary, even though this investigation only used Resource Dependence Theory (Pfeffer & Salancik, 1978) under the guise as an informing framework, a few implications can be drawn regarding the theory. First, to continue a thread that began the current research, context matters, but we have a better idea of how context matters theoretically. Even though public colleges and universities are situated in the economic contexts of the various states in which they are located, organizational outcomes, such as the institutional retention rate, are most directly affected by the immediate resource context, the context of the institution. When examined hierarchically, state-level appropriations for higher education are too distant a resource to affect a particular institution's first-year retention rate. Second, given the limited extent of change in institutional retention over time, this could indicate that not all organizational outcomes are appropriate for study using Resource Dependence as a

theoretical rubric. There simply was not much variation in the dependent variable. Perhaps there could be other causes for variation in the dependent variable that are not related to resources. Or, maybe the dependent variable really does not vary at all, regardless of the resource context. Third, in terms of organizational studies of first-year retention, resource contexts in addition to economic contexts should be considered. To reiterate, Pfeffer and Salancik (1978) left room in Resource Dependence Theory for consideration of multiple types of resources, not just physical capital. Further research could specify those other resource contexts that might better account for variation in institutional retention as an organizational outcome.

Policy Implications

One theme has been repeated in the presentation of the results, as well as in the discussion: while there is growth (change) in the institutional retention rate over time, the magnitude of that change is very small. The word “static” has been used to describe the change. While the statistical models clearly indicate that, on average, the first- to second-year retention rate at four-year, public institutions does grow, the practical consideration is that the growth in the institutional retention rate is so small, it is almost nil. Furthermore, most of the covariates assessed in this study do not have statistically significant effects on the dependent variable, or if they do, the effects are almost always negative. For those two measures (instructional expenditures and research expenditures) with positive effects, their magnitude was small. Additionally, at the state level, higher education appropriations did not have any effect on the retention of first-year students.

A key policy implication of this study, then, is that fiscal resources do not matter, or do not matter to the extent we might think they do, at least in terms of the retention of first-

year students into the second year. However, this assertion carries with it a very strong caveat: the nature of time. One issue that should be considered is that during the historical period captured by this study (2003-2008), university budgets and corresponding state budgets, on average, were still fairly stable. Obviously, most states and their respective institutions had not yet observed the general budget shortfalls that occurred on July 1, 2009 and July 1, 2010, and that will occur on July 1, 2011.

All of this consistency, however, belies a more grave issue: on average, the nature of an institution does not change. Noting minor (1-2%), year-to-year fluctuations in the institutional retention rate, an institution that began the study period in the 90th percentile will end the study period in the 90th percentile, those that began in the 80th percentile will end in the 80th percentile, and so forth. Size is static. Selectivity is static. Within an institution, there is little variation in the resource context over time, and the resource context has little effect on the change (growth) in the institutional retention rate over time. This is not to say that institutions cannot change, but there appears to be a strong amount of what could be termed “organizational inertia” keeping institutions in place.

The discussion is practically begging the question of effectiveness (Pfeffer & Salancik, 1978, p. 93), “What is being produced?” In terms of first-year retention, given the findings, it almost appears that the institution is not acting on the input (first-year students) at all. This study can only say that “sophomores,” or more accurately, a certain percent of first-to-second year students, are being produced. Within each year, some institutions appear more impressive than others. Over time, however, the average ability of an institution to “produce” more sophomores is rather bland. For those institutions with first-year retention rates already in the 90th percentile, this is not so troubling. For those institutions with first-

year retention rates in the 70th or 80th percentiles (or worse), the implications are very disturbing.

The policy implications to be drawn from this investigation depend on how one approaches time: as a fixed point or over a number of years. If one examines the sample of institutions for any given year, it is size and selectivity each that have positive effects on the institutional retention rate. However, the solution is not to simply increase the “size” and “selectivity” of the institution with the lower (below the 90th percentile) first-year retention rate. The reason for this is that for every year, there is but a finite population of entering first-year students. Among these, there is a smaller, finite population who meet the criteria for admittance to the more selective institutions. This smaller population of students enters the more selective institutions, and there are no more of these “elite” students to enter other “less selective” institutions.

Despite this finite population of first-year students (inputs) entering each year, the first policy recommendation is that each entering class should be treated as if it were highly selective. It appears that students at highly selective institutions are more successful for a combination of two reasons: 1) their individual ability makes them “high achievers” and 2) they create an environment of academic success. Regarding the latter, recent research (Arum & Roksa, 2011) indicates that “less selective” individual students admitted to otherwise highly selective schools perform on par with their highly selective institutional peers. A reason given for this is that the highly selective environment is a catalyst or impetus for the student to excel. Therefore, those institutions characterized as having “low” or “medium” selectivity as compared to “high” selectivity institutions could create an atmosphere of achievement, of collaborative competition. A component of such an environment, however,

will have to be an increase in the academic rigor with which their students are evaluated. The intent behind such rigor is not to make coursework unachievably difficult but to push the student to excel. A practical example of how such a “drive for excellence” is to be accomplished is embodied in a recent report compiled by the American Association of Colleges and Universities (AACU, 2007). In sum, the report notes that excellence in higher education begins before the student’s higher educational career, it involves broad integration across disciplines, it involves practice outside of the classroom, and it involves acquiring life skills beyond those just basic to learning.

While looking at an institution’s first-year retention rate in reference to a single point in time yields one sort of policy implication, a different policy implication arises if the institution is examined over a period of time. If one chooses to address the institutional retention rate over time, one can increase an institution’s expenditures for instruction and research. On average, however, such expenditures are only going to have a minute effect on the growth in retention over time. Alternatively, it might be the case that the policy implication is not to “throw money at the problem.” By all means, this is not to stop spending money on instruction and research. To the contrary, it could very well be the case of “how little is too little?” In the calculus of an institution’s budget, what is the derivative value where negative outcomes begin? For example, all universities have instruction as part of their mission. At what point would cuts to instructional expenditures begin to have deleterious effects on first-year retention? Given a looming era of budget constraints, it might be useful to find where those minimum values for expenditures exist. In other words, is there a point at which any potential budget cuts begin to have negative effects on an institution’s retention rate?

In summary, any policy implications derived from this investigation need to take into account the trends demonstrated by the data. Those trends clearly indicate that, on average, institutions exhibit little growth over time in their rates of retention of first-year students. Within years, institutional size and selectivity each appear to have the strongest effects on whether or not students are retained into their second year. Over time, however, only instructional and research expenditures, respectively, have any positive effect on retention and then only very little. First-year retention, as an *organizational* outcome, might be better studied at the individual level.

Limitations of the Current Research

Several limitations are identified with the current research, most of which are tied to the nature of the data. First, with the exception of the dependent variable, key measures used in this investigation were plagued by systematically missing data or peculiarly inconsistent data reporting patterns. A primary example of this is with the tuition variable. An earlier version of this investigation included the tuition price. However, it was revealed that for most years of the investigation, about one-third of the final sample did not report their tuition sticker price. Furthermore, for many that did report their tuition sticker price, there was significant year-to-year variation, positive *and* negative. Schools did not just report increasing tuition amounts but shrinking tuition prices, as well. These discrepancies often differed by an order of magnitude. Another example of systematically missing data occurred with the faculty variable. An earlier version of this study included a measure concerning the effect of the percentage of part-time faculty at the institution on the institutional retention rate. The part-time faculty measure was removed. Many institutions simply did not report

the number, let alone type, of faculty at their institution, even though this figure would have been in aggregate form.

Besides issues of missing data, a second limitation of this research also relating to the data concerns the aggregation of the data. Due to the estimation procedures required by the HLM software, all the independent and control variables at both the institutional and state levels were aggregated over time, across institutions and across states. As a result, the arithmetic mean over time was computed for all of the independent variables, and the institutional retention rate (the dependent variable) was regressed on these aggregated variables. For this investigation, six individual waves (years) of data were assembled. For each institution in the final sample, there were six observations for each measure. Prior to the computation of the mean for each independent variable, there were six unique observations for these measures. This was for the institution and the state. It was originally thought that the HLM software would have allowed for the estimation of the dependent variable by each independent variable for each institution-year (2003-2008, respectively). Instead, as stated, measures were averaged across institution-years (2003-2008, inclusive). The loss of such a wealth of data is viewed as a limitation, because the mean of a variable contains or restricts the variation in a construct. Expressed another way, the variation is glossed over. What we are left with is some general characteristic of the institution or the state, literally, the “average” economic context.

Related to the aggregation issue were other matters revolving around measurement of variables. To begin, when possible, this investigation attempted to use operationalizations of variables from prior research primarily to be consistent with that research. This practice also facilitates comparison to the extant literature (Babbie, 1998; Neuman, 1997). As identified

above, the institutional expenditures variables yielded some inconsistent and, at times, counter-intuitive findings. Instruction, research, student services, and grants expenditures were proportioned as a percentage of total educational and general (E & G) expenditures as per prior research (Titus, 2006c, p. 300). Percentages were also used to allow for comparison across institutions, because this provides a more standardized metric. However, there are other ways to standardize, such as using “per student” expenditures figures. It should be noted that a per FTE figure was originally intended to be included in this investigation; however, the FTE population could not be computed over all waves for each institution in the final sample. For this reason, any measurements pertaining to FTE were discarded. Regardless, the implication of selecting a particular standardizing metric constrains how one can ultimately interpret the results.

In a discussion of this investigation’s findings, a concern surrounding the operationalization of institutional size was raised. Similar to institutional expenditures, institutional size was measured along prior research (Titus, 2006c, p. 300). Institutional size was originally an interval variable that was recoded into to a categorical variable with an excluded category so comparisons could be made between categories. In the literature, most institutions are described generically as “small,” “medium,” or “large.” At some level, it seemed intuitive to transform the population figures into similar categories. Granted, converting interval-level variables to categorical variables results in some loss in the variability of those variables (Babbie, 1998; Neuman, 1997). The relationship between first-year retention and the student population (as a continuous variable) was not graphed to observe nature of the relationship between the variables. While it was assumed the relationship was linear, in actuality, the relationship could have been curvilinear, log-linear,

cubic, or some other variation. We could be missing part of the picture with respect to the relationship between institutional size and first-year retention.

Beyond matters surrounding variable selection and their subsequent measurement, another methodological issue revolves around causality. In an earlier conception of this investigation, some thought was given to studying non-recursivity, or the causal-ordering of events. A cursory explication of the test of non-recursivity is as follows. One series of analyses would be similar to this investigation. A separate series would have the different economic variables as dependent, with retention as an independent variable. [The inspiration for this method was drawn from Liska and Reed (1985) and Reed and Rose (1998).] As part of the discussion above concerning the effects of student services and grants expenditures alluded, is there importance in the sequencing of the variables? Is it correct to say that student services expenditures cause retention, or, rather, might it be the case that low retention rates lead to increases in budget line items for student services? Without knowing which of these is correct, we do not know if we have a correctly specified model.

Another methodological limitation of this study was the unavailability of individual-level data. Prior research (Titus, 2006a; 2006b; 2006c) was able to capitalize on the analysis of individuals nested within schools. While this investigation is adequate, the study of retention is ultimately about individual *students*, not *institutional* rates of retention. These latter data *are* valuable, but a more robust investigation would have included individual students nested within schools over time.

In summary, several limitations arose that were not identified prior to the start of this investigation. First, this study was plagued by missing data on nearly every variable, with the exception of the dependent variable. Second, it was unexpected that measures would

have to be aggregated across the Level 2 and Level 3 units. Third, there were some measurement issues—alternatives could be explored to the percentages employed here. Fourth, the causal ordering of variables was problematic. Lastly, having individual data available would have made for a more robust investigation.

Directions for Future Research

One direction for future research would be to follow individuals within schools over time, especially if the same cohort could be followed from matriculation through to graduation. A primary reason for this is that much of the extant literature regarding retention focuses on those processes and factors that directly affect whether or not the individual student is retained not only from their first into their second year, but also whether the individual student persists through graduation. (Recall from Chapter 2 there was a brief discussion of graduation and persistence being special forms of retention.) Another reason for following a panel of individual students within their institutional context over time would allow us to better explore the way in which individuals respond and possibly change to their educational environments. As an individual progresses through an institution, perhaps the institution affects them differently in their first year than it does as they near matriculation.

Continuing the discussion of institutional context, this investigation was delimited to four-year public universities. It did not include private institutions or make specific reference to minority-serving institutions. Regarding private institutions, these also have an institutional fiscal context, and it would be interesting to understand how their institutional finances affect their institutional retention rates. Consequently, it would also be useful to know how public and private schools compare in terms of their fiscal contexts and how any potential differences might affect institutional outcomes. Looking at the status of an

institution as minority-serving, retention of racial/ethnic minority students is generally higher at HBCUs, HSIs, and Tribal-affiliated schools. This investigation included a control measure for the racial/ethnic minority make-up of the institution (which did not have a statistically significant finding). Whether a school is a HBCU, HSI, Tribal-affiliated, or PWI is a contextual variable that should be considered in the future. Being a member of a racial/ethnic minority at a minority-serving institution or at a PWI has direct bearing on such issues as social and cultural capital, which are other forms of resources alluded to by Pfeffer and Salancik (1978).

As identified in the limitations section, certain of the variables might not accurately capture the constructs as they were intended. Future research could explore whether or not per student versus percentaged expenditures are more accurate measures. Also, it might be the case that the per student measure more accurately reflects an effect of the institution acting on the student. For example, at some level, instructional expenditure as a percentage of all expenditure has some “effect” on students, because students receive instruction. However, this mode of measurement is purely institutional. To measure such a fiscal outlay by the actual dollar amount spent on instruction per student, however, appears to provide a more tangible example of the institution “acting on” the individual student. Related, future research should take care not to summarily percentage or categorize continuous variables, but to explore different possibilities for expressing interval level variables.

The variables in the state-level models were selected based on reading and discussion, as informed by theory. Similar to other variables mentioned, maybe percentaging was not the best option for operationalizing the appropriations measures. Per capita spending on higher education, Medicaid, and criminal justice might produce more meaningful results.

Also, different methods should be explored to ascertain whether or not the aggregation problem can be circumvented. Regardless, specification of the state economic context merits a study in and of itself, primarily because the data evidence a significant amount of variation between the states in terms of their fiscal environments. Perhaps one additional variable that should be considered is the geographic region of the state, such as Northeast, South, and so forth.

The causal ordering of the variables also bears further study. Does institutional finance affect retention, or does retention affect institutional finance? Similarly, an earlier version of this study proposed to investigate how changes in finance affect retention. For example, how might a decrease in instructional expenditures from time 1 to time 2 affect first-year retention?

From the early stages in the development of this dissertation, another investigation was envisioned. This separate investigation revolved around a similar theme, the study of retention; however, the focus would be rooted more in a human capital framework and would examine the effects of local labor markets on higher education outcomes. The research question to be addressed is: do changes in local labor markets increase or decrease retention at higher education institutions within those labor markets? The question would be best answered if the sample were comprised of individual students in a state with a sufficiently large higher education system with a few localized labor markets exhibiting either growth or decline. Either four-year schools or community colleges could be used.

In summary, future research should explore several different issues. One, following the same panel of individual students from matriculation to graduation would hopefully provide for a significant study. Two, the context could be expanded beyond public

institutions to include private schools, as well as make for comparisons between HBCUs, HSIs, Tribal-affiliated colleges and PWIs. Three, future research should take care when operationalizing constructs. Four, the state-level resource context needs to be investigated further and most likely needs to be respecified. Five, the timing of retention and finance merits closer inspection. Finally, a more localized study that takes into account the effects of labor markets should be explored.

Summary

This investigation studied change in the rate of an institution's retention of first-year students into their second year via a hierarchical linear growth model. On average, across institutions over time, the institutional retention rate is fairly static. Essentially, the institutional retention rate does not change. Within-year change at an institution is negatively affected by institutional size (small- and medium-sized schools as compared to large), institutional selectivity (low- and medium-selectivity schools as compared to high-selectivity institutions), student services expenditures and grant expenditures. Over time, only instructional expenditures and research expenditures each had any significant effect on the growth in the institutional retention rate, and the magnitude of these individual effects was minimal, at best. No state-level covariate had any effect on the linear growth in institutional retention.

Theoretically, Resource Dependence is still viewed as a very useful orienting tool. What this investigation revealed is that the proximity of the resource context may be salient when considering the particular outcome. For first-year retention as an organizational outcome, it should not be surprising that measures such as institutional spending have

significant effects but more-removed state-level spending (higher education appropriations) do not.

The central policy implication derived from this investigation is that an institution simply cannot “spend its way” out of a problem of poor institutional retention rate. Solutions to improve the rate at which the organization retains students from the first year into the second must be sought elsewhere. Most likely, those solutions will not come at the level of the institution, but more at the level of the individual. In other words, institutions should probably focus on those factors that most directly address matters pertaining to the retention of individuals.

This investigation was hampered by problems common to the use of secondary data, specifically, many instances of systematically missing data across key variables. In the future, however, I would very much like to see a more robust use of these data. Six annual observations on institutions could be supplemented with information on individuals within those institutions. It would be very enlightening to follow a cohort from entry into a sample of institutions, analyzing factors that impact their retention through graduation. Doing so would allow us to fully exploit the full potential of conducting a hierarchical analysis: individuals nested within some organizational unit over time. Hopefully we could better understand how students progress through the higher educational environment, from matriculation to graduation.

Despite the various issues associated with the use of secondary data and the limited set of statistically significant findings, this study is unique in one respect in that it had not been attempted previously. Hierarchical analysis had been used, institutional finance had been studied, but no prior research had linked these, especially in terms of a longitudinal

(panel) study of institutional retention. This study demonstrates the importance of correctly specifying context when performing social research, and it also demonstrates the utility of such research.

REFERENCES

- Allison, P. D. (1995). *Survival analysis using the SAS system: A practical guide*. Cary, NC: SAS Institute.
- Allison, P. D. (1999). *Multiple regression: A primer*. Thousand Oaks, CA: Pine Forge Press.
- American Association of Colleges & Universities. (2007). *College learning for the new global century*. Washington, DC: Author. Retrieved from http://www.aacu.org/advocacy/leap/documents/GlobalCentury_final.pdf
- Alexander, F. K. (2000). The changing face of accountability: Monitoring and assessing institutional performance in higher education. *Journal of Higher Education*, 71, 411–430.
- Alon, S., & Tienda, M. (2005). Assessing the ‘mismatch’ hypothesis: Differences in college graduation rates by institutional selectivity. *Sociology of Education*, 78, 294-315.
- Antley, H.W. (1999). The development of a predictive model for one-year freshman retention rate: A macro-approach. Paper presented at the Annual Forum of the Association for Institutional Research, Seattle, WA.
- Arbona, C., & Nora, A. (2007). The influence of academic and environmental factors on Hispanic college degree attainment. *The Review of Higher Education*, 30, 247-269.
- Arum, R., & Roksa, J. (2011). *Academically adrift: Limited learning on college campuses*. Chicago, IL: University of Chicago Press.
- Astin, A. W. (2006). Making sense out of degree completion rates. *Journal of College Student Retention*, 7, 5-17.
- Babbie, E. (1998). *The practice of social research* (8th ed.). Belmont, CA: Wadsworth Publishing Company.

- Barr, M. J. (2002). *The Jossey-Bass Academic Administrator's Guide to Budgets and Financial Management*. San Francisco, CA: John Wiley & Sons, Inc.
- Basten, J., Cole, J., Maestas, R., & Mason, K. (1997). Redefining the virtuous cycle: Replacing the criterion of race with socioeconomic status in the admissions process in highly selective institutions. Paper presented at the Annual Meeting of the Association for the Study of Higher Education, Albuquerque, NM.
- Baum, S. (2001). College education: Who can afford it? In M. B. Paulsen, & J. C. Smart (eds.), *The Finance of Higher Education: Theory, Research, Policy & Practice* (pp. 39-52). New York, NY: Agathon Press.
- Bean, J. P. (1980). Dropout and turnover: The synthesis and test of a causal model of student attrition. *Research in Higher Education*, 12, 155–187.
- Bettinger, E. P. and Long, B. T. (2009). Addressing the needs of underprepared students in higher education: Does college remediation work? *The Journal of Human Resources*, 44, 736-771.
- Bollen, K. A., & Curran, P. J. (2006). *Latent curve models: A structural equation perspective*. Hoboken, NJ: John Wiley & Sons.
- Bureau of Labor Statistics. (2009a). Labor force data derived from the Current Population Survey: Description of the survey. *BLS Handbook of Methods*. Retrieved from: http://www.bls.gov/opub/hom/homch1_b.htm
- Bureau of Labor Statistics. (2009b). Labor force data derived from the Current Population Survey: Concepts. *BLS Handbook of Methods*. Retrieved from: http://www.bls.gov/opub/hom/homch1_c.htm
- Collins, R., & Waller, D. (1994). Did social science break down in the 1970s? In J. Hage

- (ed.), *Formal Theory in Sociology: Opportunity or Pitfall?* (pp. 15-40). Albany, NY: State University of New York Press.
- Cragg, K. M. (2009). Influencing the probability for graduation at four-year institutions: A multi-model analysis. *Research in Higher Education, 50*, 394-413.
- Farmer, J. (2004). Financing instructional technology and distance education: Reviewing costs and outcomes. In E. P. St. John & M. D. Parson (eds.), *Public Funding of Higher Education: Changing Contexts and New Rationales* (pp. 186-212). Baltimore, MD: The Johns Hopkins University Press.
- Gansemer-Topf, A. M., & Schuh, J. H. (2006). Institutional selectivity and institutional expenditures: Examining organizational factors that contribute to retention and graduation. *Research in Higher Education, 47*, 613-642.
- Galaskiewicz, J., & Marsden, P. J. (1978). Interorganizational resources networks: Formal patterns of overlap. *Social Science Research, 7*, 89-107.
- Hearn, J. C. (2001). The paradox of growth in federal aid for college students: 1960-1990. In M. B. Paulsen, & J. C. Smart (eds.), *The Finance of Higher Education: Theory, Research, Policy & Practice* (pp. 267-316). New York, NY: Agathon Press.
- Hearn, J. C., and Holdsworth, J. M. (2004). Federal student aid: The shift from grants to loans. In E. P. St. John & M. D. Parson (eds.), *Public Funding of Higher Education: Changing Contexts and New Rationales* (pp. 40-59). Baltimore, MD: The Johns Hopkins University Press.
- Hines, E. R. (1997). State leadership in higher education. In L. F. Goodchild, C. D. Lovell, E. R. Hines, & J. I. Gill (eds.), *Public Policy in Higher Education* pp. 376-409. Boston, MA: Pearson Custom Publishing.

- Hossler, D. (2004). Refinancing public universities: Student enrollments, incentive-based budgeting, and incremental revenue. In E. P. St. John & M. D. Parson (eds.), *Public Funding of Higher Education: Changing Contexts and New Rationales* (pp. 145-163). Baltimore, MD: The Johns Hopkins University Press.
- Huffman, J. P., Jr. and Schneiderman, S. (1997). Size matters: The effect of institutional size on graduation rates. Paper presented at the Annual Forum of the Association for Institutional Research, Orlando, FL.
- Huisman, J. (1997). New study programs and specializations: The effect of governmental funding and paradigmatic development. *Research in Higher Education*, 38, 399-417.
- Jamelske, E. (2009). Measuring the impact of a university first-year experience program on student GPA and retention. *Higher Education: The International Journal of Higher Education and Educational Planning*, 57, 373-391.
- Johnson, B. (2001). Toward a new classification of nonexperimental quantitative research. *Educational Researcher*, 30, 3-13.
- Johnson, B. L., Jr. (1995). *Resource dependence theory: A political economy model of organizations*. (ED387871).
- Lamb, V. L. (1999). Institutional and period determinants of baccalaureate degrees from historically black colleges and universities: A research note. *Sociological Spectrum*, 19, 249-263.
- Lewis, D. R., & Dunder, H. (2001). Costs and productivity in higher education: Theory, evidence, and policy implications. In M. B. Paulsen, & J. C. Smart (eds.), *The Finance of Higher Education: Theory, Research, Policy & Practice* (pp. 133-188). New York, NY: Agathon Press.

- Liska, A. E., & Reed, M. D. (1985). Ties to conventional institutions and delinquency: Estimating reciprocal effects. *American Sociological Review*, 50, 547-560.
- McGuinness, A. C. (2005). The states and higher education. In P. G. Altbach, R. O. Berdahl, & P. J. Gumpert (eds.), *American higher education in the Twenty-First Century* (pp. 198-225). Baltimore, MD: Johns Hopkins.
- Monk, D. H., Dooris, M. J., & Erickson, R. A. (2009). In search of a new equilibrium: Economic aspects of higher education's changing faculty composition. *Education Finance and Policy*, 4, 300-318.
- Morris, T. (2004). Bank mergers under a changing regulatory environment. *Sociological Forum*, 19, 435-463.
- Morris, T. (2007). Internal and external sources of organizational change: Corporate form and the banking industry. *The Sociological Quarterly*, 48, 119-140.
- Mumper, M. (1993a). The problem of college affordability: A review of recent literature on potential solutions. *Journal of Student Financial Aid*, 23, 27-35.
- Mumper, M. (1993b). The affordability of public higher education. *Review of Higher Education*, 16, 157-180.
- Mumper, M. (2001). State efforts to keep public colleges affordable in the face of fiscal stress. In M. B. Paulsen, & J. C. Smart (eds.), *The Finance of Higher Education: Theory, Research, Policy & Practice* (pp. 321-350). New York, NY: Agathon Press.
- Museus, S. D., Nichols, A. H., & Lambert, A. D. (2008). Racial differences in the effects of campus racial climate on degree completion: A structural equation model. *The Review of Higher Education*, 32, 107-134.
- National Association of State Budget Officers.(2009, November). About NASBO: Overview.

- Retrieved from: <http://nasbo.org/about.php>
- National Association of State Budget Officers. (2003). *2003 State Expenditure Report*. Washington, DC: National Association of State Budget Officers.
- National Center for Education Statistics. (2002). Public institutions - GASB reporting standards before (GASB 34/35), fiscal year 2002: Data dictionary. Retrieved from: http://nces.ed.gov/IPEDS/datacenter/data/F0102_F1_Dict.zip
- National Center for Education Statistics. (2003). Total entering class and retention rates, Fall 2003: Data dictionary. Retrieved from: http://nces.ed.gov/IPEDS/datacenter/data/EF2003D_Dict.zip
- National Center for Education Statistics (2008a, September). Fast facts: Tuition costs of colleges and universities. Retrieved from: <http://nces.ed.gov/fastfacts/display.asp?id=76>
- National Center for Education Statistics (2005). Institutional characteristics: Directory information. Retrieved from: http://nces.ed.gov/ipeds/datacenter/data/HD2005_Dict.zip
- National Center for Education Statistics (2008b, November). Integrated Postsecondary Education Data System: Institutions covered. Retrieved from: http://nces.ed.gov/IPEDS/about/types_institutions.asp
- National Center for Education Statistics (2009, November). About IPEDS: Which institutions report to IPEDS?. Retrieved from: <http://nces.ed.gov/ipeds/about/>
- Neuman, W. L. (1997). *Social Research Methods: Qualitative and Quantitative Approaches* (3rd ed.). Boston, MA: Allyn and Bacon.
- Niu, S. X., Tienda, M., & Cortes, K. (2006). College selectivity and the Texas top 10% law.

- Economics of Education Review*, 25, 259-272.
- Nora, A., & Cabrera, A. F. (1996). The role of perceptions of prejudice and discrimination on the adjustment of minority students to college. *Journal of Higher Education*, 67, 119–148.
- Okunade, Albert A. (2004). What factors influence state appropriations for public higher education in the United States? *Journal of Educational Finance*, 30, 123-138.
- Oliver, C. (1991). Network relations and loss of organizational autonomy. *Human Relations*, 44, 943-961.
- Oliver, M. L., & Shapiro, T. M. (2006). *Black Wealth/White Wealth: A New Perspective on Racial Inequality*. New York, NY: Routledge.
- Oseguera, L. (2006). Four and six-year baccalaureate degree completion by institutional characteristics and racial/ethnic groups. *Journal of College Student Retention: Research, Theory & Practice*, 7, 19-59.
- Oseguera, L., & Rhee, B. S. (2009). The influence of institutional retention climates on student persistence to degree completion: A multilevel approach. *Research in Higher Education*, 50, 546-569.
- Paulsen, M. B. (2001a). The economics of the public sector: The nature and role of public policy in the finance of higher education. In M. B. Paulsen, & J. C. Smart (eds.), *The Finance of Higher Education: Theory, Research, Policy & Practice* (pp. 95-132). New York, NY: Agathon Press.
- Paulsen, M. B. (2001b). Economic perspectives on rising college tuition: A theoretical and empirical exploration. In M. B. Paulsen, & J. C. Smart (eds.), *The Finance of Higher Education: Theory, Research, Policy & Practice* (pp. 193-258). New York: Agathon

- Press.
- Pfeffer, J. (1997). *New Directions for Organization Theory: Problems and Prospects*. New York, NY: Oxford University Press.
- Pfeffer, J., & Salancik, G. R. (1978; 2003). *The external control of organizations: A resource dependence perspective*. New York, NY: Harper & Row.
- Pusser, B., Slaughter, S., & Thomas, S. I. (2006). Playing the board game: An empirical analysis of university trustee and corporate board interlocks. *Journal of Higher Education, 77*, 747-775.
- Raudenbush, S. W., & Bryk, A. S. (2002). *Hierarchical linear models: Applications and data analysis methods* (2nded.). Thousand Oaks, CA: Sage Publications.
- Reed, M. D., & Rose, D. R. (1998). Doing what simple simon says? Estimating the underlying causal structures of delinquent associations, attitudes, and serious theft. *Criminal Justice and Behavior, 25*, 240-274.
- Reynolds, P. D. (1971). *A primer in theory construction*. Boston, MA: Allyn and Bacon.
- Robinson, W. S. (1950). Ecological correlations and the behavior of individuals. *American Sociological Review, 15*, 351–357.
- Schuh, J. H. (1993). Fiscal pressures on higher education and student affairs. In M. J. Barr (ed.), *The handbook of student affairs administration* (pp. 49–68), San Francisco, CA: Jossey-Bass.
- Scott, W. R. (1995). *Institutions and organizations*. Thousand Oaks, CA: Sage.
- Silver, R. S. (1993). Conditions of autonomous action and performance. *Administration and Society, 24*, 487-511.
- Singell, L.D., Jr. (2004). Come and stay a while: Does financial aid effect retention

- conditioned on enrollment at a large public university? *Economics of Education Review*, 23, 459-471.
- Smith, T. Y. (1995). The retention status of underrepresented minority student: An analysis of survey results from sixty-even U.S. colleges and universities. Paper presented at the Annual Forum of the Association for Institutional Research, Boston, MA.
- St. John, E. P., & Asker, E. H. (2001). The role of finances in student choice: A review of theory and research. In M. B. Paulsen, & J. C. Smart (eds.), *The Finance of Higher Education: Theory, Research, Policy & Practice* (pp. 419-438). New York, NY: Agathon Press.
- St. John, E. P., Hu, S., Simmons, A., Carter, D. F., & Weber, J. (2004). What difference does a major make? The influence of college major field on persistence by African American and White students. *Research in Higher Education*, 45, 209-232.
- St. John, E. P., Paulsen, M. B., & Carter, D. F. (2005). Diversity, college costs, and postsecondary opportunity: An examination of the financial nexus between college choice and persistence for African Americans and whites. *The Journal of Higher Education*, 76, 545-569.
- Stearns, L. B. (1986). Capital market effects on external control of corporations. *Theory and Society*, 15, 47-75.
- Terenzini, P. T., Cabrera, A. F., & Bernal, E. M. (2001). *Swimming against the tide: The poor in American higher education*. New York, NY: College Entrance Examination Board.
- Thelin, J. R. (2004). Higher education and the public trough: A historical perspective. In E. P. St. John & M. D. Parson (eds.), *Public Funding of Higher Education: Changing*

- Contexts and New Rationales* (pp. 21-39). Baltimore, MD: The Johns Hopkins University Press.
- Tinto, V. (1975). Dropout from higher education: A theoretical synthesis of recent research. *Review of Educational Research*, 45, 89–125.
- Tinto, V. (1993). *Leaving college: Rethinking the causes and cures of student attrition* (2nd ed.). Chicago, IL: University of Chicago Press.
- Titus, M.A. (2004). An examination of the influence of institutional context on student persistence at 4-year colleges and universities: A multilevel approach. *Research in Higher Education*, 45, 673-699.
- Titus, M.A. (2006a). Understanding the influence of the financial context of institutions on student persistence at four-year colleges and universities. *The Journal of Higher Education*, 77, 353-375.
- Titus, M.A. (2006b). Understanding college degree completion of students with low socioeconomic status: The influence of the institutional financial context. *Research in Higher Education*, 47, 371-398.
- Titus, M.A. (2006c). No college student left behind: The influence of financial aspects of a state's higher education policy on college completion. *The Review of Higher Education*, 29, 293-317.
- Toutkoushian, R. K. (2001). Trends in revenues and expenditures for public and private higher education. In M. B. Paulsen & J. C. Smart (eds.), *The Finance of Higher Education: Theory, Research, Policy & Practice*. New York, NY: Agathon Press.
- Trammell, M. L. (2004). Reconstructing rationales for public funding: A case study. In E. P. St. John & M. D. Parson (eds.), *Public Funding of Higher Education: Changing*

- Contexts and New Rationales* (pp. 164-185). Baltimore, MD: The Johns Hopkins University Press.
- Voogt, A. C., & Volkwein, J. F. (1997). A longitudinal study of institutional autonomy in thirty community colleges. Paper presented at the Annual Forum of the Association for Institutional Research, Orland, FL.
- Webber, D. A., & Ehrenberg, R. G. (2009). *Do expenditures other than instructional expenditures affect graduation and persistence rates in American higher education*. Working Paper 15216. National Bureau of Economic Research Working Paper Series. Cambridge, MA.
- Weerts, D.J. & Ronca, J.M. (2006). Examining differences in state support for higher education: A comparative study of state appropriations for research I universities. *The Journal of Higher Education*, 935-967.
- Wells, R. (2008-2009). Social and cultural capital, race and ethnicity, and college student retention. *Journal of College Student Retention*, 10, 103-128.
- Zumeta, W. (2004). State higher education financing: Demand imperatives meet structural, cyclical, and political constraints. In E. P. St. John & M. D. Parson (eds.), *Public Funding of Higher Education: Changing Contexts and New Rationales* (pp. 79-107). Baltimore, MD: The Johns Hopkins University Press.

APPENDIX

APPENDIX A: YEAR-TO-YEAR DESCRIPTIVE STATISTICS

Table A1

Summary Statistics of Variables, Year = 2003

Variable	N	Mean	SD	Min	Max
Institutional Retention Rate	470	73.54	9.91	47.0	96.0
Instructional Expenditures (%)	470	33.62	6.92	12.20	52.61
Research Expenditures (%)	470	6.09	8.12	0.00	42.88
Student Services Expenditures (%)	470	6.63	3.09	0.91	22.14
Grant Expenditures (%)	470	5.38	3.82	0.00	25.04
Tuition Revenue (%)	470	21.42	8.65	3.63	51.22
Percentage of Students Receiving Any Financial Aid (%)	470	77.32	13.43	40.00	100.00
Remediation Program	470	0.82	0.39	0.00	1.00
Bachelor	470	0.07	0.25	0.00	1.00
Master	470	0.42	0.49	0.00	1.00
Doctoral ^a	470	0.51	0.50	0.00	1.00
Small (< 4000 pop.)	470	0.20	0.40	0.00	1.00
Medium (4000 – 15000 pop.)	470	0.48	0.50	0.00	1.00
Large ^a (> 15000 pop.)	470	0.31	0.46	0.00	1.00
Low selectivity	470	0.24	0.43	0.00	1.00
Medium selectivity	470	0.58	0.49	0.00	1.00
High selectivity ^a	470	0.17	0.38	0.00	1.00
Total Racial/Ethnic Minority Population (%)	470	23.62	23.19	0.00	96.00
Unemployment Rate (%)	50	5.60	0.90	3.10	7.70
Higher Education Appropriation (%)	50	11.35	4.78	3.00	25.30
Medicaid Appropriation (%)	50	21.41	5.15	7.90	33.90
Criminal Justice Appropriation (%)	50	3.39	1.05	1.00	6.10

^aReference group

Table A2

Summary Statistics of Variables, Year = 2004

Variable	N	Mean	SD	Min	Max
Institutional Retention Rate	470	73.67	10.10	47.0	97.0
Instructional Expenditures (%)	470	33.37	7.16	12.80	55.75
Research Expenditures (%)	470	6.24	8.47	0.00	51.23
Student Services Expenditures (%)	470	6.66	3.13	0.91	20.05
Grant Expenditures (%)	470	5.27	3.83	0.00	27.56
Tuition Revenue (%)	470	23.32	9.32	3.61	54.77
Percentage of Students Receiving Any Financial Aid (%)	470	78.47	12.99	23.00	100.00
Remediation Program	470	0.81	0.39	0.00	1.00
Bachelor	470	0.07	0.25	0.00	1.00
Master	470	0.42	0.49	0.00	1.00
Doctoral ^a	470	0.51	0.50	0.00	1.00
Small (< 4000 pop.)	470	0.20	0.40	0.00	1.00
Medium (4000 – 15000 pop.)	470	0.48	0.50	0.00	1.00
Large ^a (> 15000 pop.)	470	0.31	0.46	0.00	1.00
Low selectivity	470	0.24	0.43	0.00	1.00
Medium selectivity	470	0.58	0.49	0.00	1.00
High selectivity ^a	470	0.17	0.38	0.00	1.00
Total Racial/Ethnic Minority Population (%)	470	23.62	23.19	0.00	96.00
Unemployment Rate (%)	50	5.86	0.93	3.60	8.20
Higher Education Appropriation (%)	50	11.80	5.42	3.50	26.60
Medicaid Appropriation (%)	50	22.39	5.31	4.60	35.20
Criminal Justice Appropriation (%)	50	3.38	1.02	1.00	5.60

^aReference group

Table A3

Summary Statistics of Variables, Year = 2005

Variable	N	Mean	SD	Min	Max
Institutional Retention Rate	470	73.24	9.96	42.0	97.0
Instructional Expenditures (%)	470	33.20	6.91	11.30	51.29
Research Expenditures (%)	470	6.29	8.25	0.00	40.38
Student Services Expenditures (%)	470	6.70	3.17	0.88	18.38
Grant Expenditures (%)	470	5.12	3.57	0.00	18.45
Tuition Revenue (%)	470	24.16	9.63	3.49	59.70
Percentage of Students Receiving Any Financial Aid (%)	470	79.25	12.96	26.00	100.00
Remediation Program	470	0.80	0.40	0.00	1.00
Bachelor	470	0.07	0.25	0.00	1.00
Master	470	0.42	0.49	0.00	1.00
Doctoral ^a	470	0.51	0.50	0.00	1.00
Small (< 4000 pop.)	470	0.20	0.40	0.00	1.00
Medium (4000 – 15000 pop.)	470	0.48	0.50	0.00	1.00
Large ^a (> 15000 pop.)	470	0.31	0.46	0.00	1.00
Low selectivity	470	0.24	0.43	0.00	1.00
Medium selectivity	470	0.58	0.49	0.00	1.00
High selectivity ^a	470	0.17	0.38	0.00	1.00
Total Racial/Ethnic Minority Population (%)	470	23.62	23.19	0.00	96.00
Unemployment Rate (%)	50	5.40	0.88	3.30	7.50
Higher Education Appropriation (%)	50	11.34	4.96	3.30	22.20
Medicaid Appropriation (%)	50	22.94	5.82	7.70	35.70
Criminal Justice Appropriation (%)	50	3.34	1.01	1.00	6.10

^aReference group

Table A4

Summary Statistics of Variables, Year = 2006

Variable	N	Mean	SD	Min	Max
Institutional Retention Rate	470	73.39	10.27	45.0	97.0
Instructional Expenditures (%)	470	33.06	6.88	10.92	53.83
Research Expenditures (%)	470	6.15	8.04	0.00	40.15
Student Services Expenditures (%)	470	6.68	3.14	0.89	18.08
Grant Expenditures (%)	470	4.89	3.43	0.00	17.90
Tuition Revenue (%)	470	24.89	10.04	3.45	62.06
Percentage of Students Receiving Any Financial Aid (%)	470	78.97	13.16	42.00	100.00
Remediation Program	470	0.80	0.40	0.00	1.00
Bachelor	470	0.07	0.25	0.00	1.00
Master	470	0.42	0.49	0.00	1.00
Doctoral ^a	470	0.51	0.50	0.00	1.00
Small (< 4000 pop.)	470	0.20	0.40	0.00	1.00
Medium (4000 – 15000 pop.)	470	0.48	0.50	0.00	1.00
Large ^a (> 15000 pop.)	470	0.31	0.46	0.00	1.00
Low selectivity	470	0.24	0.43	0.00	1.00
Medium selectivity	470	0.58	0.49	0.00	1.00
High selectivity ^a	470	0.17	0.38	0.00	1.00
Total Racial/Ethnic Minority Population (%)	470	23.62	23.19	0.00	96.00
Unemployment Rate (%)	50	5.08	0.93	2.80	7.90
Higher Education Appropriation (%)	50	10.95	4.79	1.70	24.60
Medicaid Appropriation (%)	50	21.46	5.47	6.60	32.90
Criminal Justice Appropriation (%)	50	3.20	0.97	0.90	5.20

^aReference group

Table A5

Summary Statistics of Variables, Year = 2007

Variable	N	Mean	SD	Min	Max
Institutional Retention Rate	470	73.79	10.29	43.0	97.0
Instructional Expenditures (%)	470	33.07	6.78	10.46	49.14
Research Expenditures (%)	470	6.10	8.24	0.00	60.42
Student Services Expenditures (%)	470	6.72	3.15	0.90	17.34
Grant Expenditures (%)	470	4.87	3.40	0.00	17.96
Tuition Revenue (%)	470	24.56	10.01	2.61	62.19
Percentage of Students Receiving Any Financial Aid (%)	470	80.64	12.22	44.00	100.00
Remediation Program	470	0.78	0.41	0.00	1.00
Bachelor	470	0.07	0.25	0.00	1.00
Master	470	0.42	0.49	0.00	1.00
Doctoral ^a	470	0.51	0.50	0.00	1.00
Small (< 4000 pop.)	470	0.20	0.40	0.00	1.00
Medium (4000 – 15000 pop.)	470	0.48	0.50	0.00	1.00
Large ^a (> 15000 pop.)	470	0.31	0.46	0.00	1.00
Low selectivity	470	0.24	0.43	0.00	1.00
Medium selectivity	470	0.58	0.49	0.00	1.00
High selectivity ^a	470	0.17	0.38	0.00	1.00
Total Racial/Ethnic Minority Population (%)	470	23.62	23.19	0.00	96.00
Unemployment Rate (%)	50	4.61	0.91	2.40	6.90
Higher Education Appropriation (%)	50	11.13	5.15	1.00	25.10
Medicaid Appropriation (%)	50	21.18	5.58	8.90	35.50
Criminal Justice Appropriation (%)	50	3.17	0.94	0.00	5.30

^aReference group

Table A6

Summary Statistics of Variables, Year = 2008

Variable	N	Mean	SD	Min	Max
Institutional Retention Rate	470	74.49	9.79	42.0	97.0
Instructional Expenditures (%)	470	33.96	7.45	11.17	53.66
Research Expenditures (%)	470	6.16	8.31	0.00	58.83
Student Services Expenditures (%)	470	7.04	3.44	0.92	22.85
Grant Expenditures (%)	470	4.88	3.38	0.00	19.75
Tuition Revenue (%)	470	24.70	9.85	2.22	62.04
Percentage of Students Receiving Any Financial Aid (%)	470	82.32	11.18	44.00	100.00
Remediation Program	470	0.78	0.42	0.00	1.00
Bachelor	470	0.07	0.25	0.00	1.00
Master	470	0.42	0.49	0.00	1.00
Doctoral ^a	470	0.51	0.50	0.00	1.00
Small (< 4000 pop.)	470	0.20	0.40	0.00	1.00
Medium (4000 – 15000 pop.)	470	0.48	0.50	0.00	1.00
Large ^a (> 15000 pop.)	470	0.31	0.46	0.00	1.00
Low selectivity	470	0.24	0.43	0.00	1.00
Medium selectivity	470	0.58	0.49	0.00	1.00
High selectivity ^a	470	0.17	0.38	0.00	1.00
Total Racial/Ethnic Minority Population (%)	470	23.62	23.19	0.00	96.00
Unemployment Rate (%)	50	4.54	0.92	2.60	7.20
Higher Education Appropriation (%)	50	10.84	4.88	1.00	25.20
Medicaid Appropriation (%)	50	20.59	5.48	8.40	34.50
Criminal Justice Appropriation (%)	50	3.24	0.96	0.00	5.30

^aReference group

APPENDIX B: SUMMARY OF STATE-LEVEL COVARIATES

Table B1

Annual Unemployment Rate, by State, 2003-2008

State	2003	2004	2005	2006	2007	2008	Mean, 2003-2008
AK	7.7	8.0	7.5	6.8	6.7	6.2	7.2
AL	5.9	5.8	5.6	4.0	3.6	3.5	4.7
AR	5.4	6.2	5.7	4.9	5.3	5.4	5.5
AZ	6.2	5.6	5.0	4.7	4.1	3.8	4.9
CA	6.7	6.7	6.2	5.4	4.9	5.4	5.9
CO	5.7	6.0	5.5	5.0	4.3	3.8	5.1
CT	4.3	5.5	4.9	4.9	4.3	4.6	4.8
DE	4.2	4.4	4.1	4.2	3.6	3.4	4.0
FL	5.5	5.1	4.8	3.8	3.3	4.0	4.4
GA	5.1	4.7	4.6	5.3	4.6	4.4	4.8
HI	4.2	4.3	3.3	2.8	2.4	2.6	3.3
IA	4.0	4.5	4.8	4.6	3.7	3.8	4.2
ID	5.8	5.4	4.7	3.8	3.4	2.7	4.3
IL	6.5	6.7	6.2	5.7	4.5	5.0	5.8
IN	5.1	5.1	5.2	5.4	5.0	4.5	5.1
KS	5.1	5.4	5.5	5.1	4.5	4.1	5.0
KY	5.6	6.2	5.3	6.1	5.7	5.5	5.7
LA	6.1	6.6	5.7	7.1	4.0	3.8	5.6
MA	5.3	5.8	5.1	4.8	5.0	4.5	5.1
MD	4.4	4.5	4.2	4.1	3.9	3.6	4.1
ME	4.4	5.1	4.6	4.8	4.6	4.7	4.7
MI	6.2	7.3	7.1	6.7	6.9	7.2	6.9
MN	4.4	5.0	4.7	4.0	4.0	4.6	4.5
MO	5.5	5.6	5.7	5.4	4.8	5.0	5.3
MS	6.8	6.3	6.2	7.9	6.8	6.3	6.7
MT	4.6	4.7	4.4	4.0	3.2	3.1	4.0
NC	6.7	6.5	5.5	5.2	4.8	4.7	5.6
ND	4.0	4.0	3.4	3.4	3.2	3.2	3.5
NE	3.6	4.0	3.8	3.8	3.0	3.0	3.5
NH	4.7	4.3	3.8	3.6	3.4	3.6	3.9
NJ	5.8	5.9	4.8	4.4	4.6	4.2	5.0

Table B1 continued

State	2003	2004	2005	2006	2007	2008	Mean, 2003-2008
NM	5.4	6.4	5.7	5.3	4.2	3.5	5.1
NV	5.5	5.2	4.3	4.1	4.2	4.8	4.7
NY	6.1	6.3	5.8	5.0	4.5	4.5	5.4
OH	5.7	6.1	6.1	5.9	5.5	5.6	5.8
OK	4.5	5.7	4.8	4.4	4.0	4.3	4.6
OR	7.5	8.2	7.4	6.1	5.4	5.2	6.6
PA	5.7	5.6	5.5	5.0	4.7	4.4	5.2
RI	5.1	5.3	5.2	5.0	5.1	5.0	5.1
SC	6.0	6.8	6.8	6.8	6.5	5.9	6.5
SD	3.1	3.6	3.5	3.9	3.2	3.0	3.4
TN	5.1	5.8	5.4	5.6	5.2	4.7	5.3
TX	6.3	6.8	6.1	5.3	4.9	4.3	5.6
UT	6.1	5.6	5.2	4.3	2.9	2.7	4.5
VA	4.1	4.1	3.7	3.5	3.0	3.0	3.6
VT	3.7	4.6	3.7	3.5	3.6	3.9	3.8
WA	7.3	7.5	6.2	5.5	5.0	4.5	6.0
WI	5.5	5.6	4.9	4.7	4.7	4.9	5.1
WV	6.1	6.1	5.3	5.0	4.9	4.6	5.3
WY	4.2	4.4	3.9	3.6	3.2	3.0	3.7

Table B2

Change in Annual Unemployment Rate, by State, 2003-2008

State	2003- 2004	2004- 2005	2005- 2006	2006- 2007	2007- 2008	2003- 2008
AK	0.3	-0.5	-0.7	-0.1	-0.5	-1.5
AL	-0.1	-0.2	-1.6	-0.4	-0.1	-2.4
AR	0.8	-0.5	-0.8	0.4	0.1	0.0
AZ	-0.6	-0.6	-0.3	-0.6	-0.3	-2.4
CA	0.0	-0.5	-0.8	-0.5	0.5	-1.3
CO	0.3	-0.5	-0.5	-0.7	-0.5	-1.9
CT	1.2	-0.6	0.0	-0.6	0.3	0.3
DE	0.2	-0.3	0.1	-0.6	-0.2	-0.8
FL	-0.4	-0.3	-1.0	-0.5	0.7	-1.5
GA	-0.4	-0.1	0.7	-0.7	-0.2	-0.7
HI	0.1	-1.0	-0.5	-0.4	0.2	-1.6
IA	0.5	0.3	-0.2	-0.9	0.1	-0.2
ID	-0.4	-0.7	-0.9	-0.4	-0.7	-3.1
IL	0.2	-0.5	-0.5	-1.2	0.5	-1.5
IN	0.0	0.1	0.2	-0.4	-0.5	-0.6
KS	0.3	0.1	-0.4	-0.6	-0.4	-1.0
KY	0.6	-0.9	0.8	-0.4	-0.2	-0.1
LA	0.5	-0.9	1.4	-3.1	-0.2	-2.3
MA	0.5	-0.7	-0.3	0.2	-0.5	-0.8
MD	0.1	-0.3	-0.1	-0.2	-0.3	-0.8
ME	0.7	-0.5	0.2	-0.2	0.1	0.3
MI	1.1	-0.2	-0.4	0.2	0.3	1.0
MN	0.6	-0.3	-0.7	0.0	0.6	0.2
MO	0.1	0.1	-0.3	-0.6	0.2	-0.5
MS	-0.5	-0.1	1.7	-1.1	-0.5	-0.5
MT	0.1	-0.3	-0.4	-0.8	-0.1	-1.5
NC	-0.2	-1.0	-0.3	-0.4	-0.1	-2.0
ND	0.0	-0.6	0.0	-0.2	0.0	-0.8
NE	0.4	-0.2	0.0	-0.8	0.0	-0.6
NH	-0.4	-0.5	-0.2	-0.2	0.2	-1.1
NJ	0.1	-1.1	-0.4	0.2	-0.4	-1.6
NM	1.0	-0.7	-0.4	-1.1	-0.7	-1.9

Table B2 continued

State	2003- 2004	2004- 2005	2005- 2006	2006- 2007	2007- 2008	2003- 2008
NV	-0.3	-0.9	-0.2	0.1	0.6	-0.7
NY	0.2	-0.5	-0.8	-0.5	0.0	-1.6
OH	0.4	0.0	-0.2	-0.4	0.1	-0.1
OK	1.2	-0.9	-0.4	-0.4	0.3	-0.2
OR	0.7	-0.8	-1.3	-0.7	-0.2	-2.3
PA	-0.1	-0.1	-0.5	-0.3	-0.3	-1.3
RI	0.2	-0.1	-0.2	0.1	-0.1	-0.1
SC	0.8	0.0	0.0	-0.3	-0.6	-0.1
SD	0.5	-0.1	0.4	-0.7	-0.2	-0.1
TN	0.7	-0.4	0.2	-0.4	-0.5	-0.4
TX	0.5	-0.7	-0.8	-0.4	-0.6	-2.0
UT	-0.5	-0.4	-0.9	-1.4	-0.2	-3.4
VA	0.0	-0.4	-0.2	-0.5	0.0	-1.1
VT	0.9	-0.9	-0.2	0.1	0.3	0.2
WA	0.2	-1.3	-0.7	-0.5	-0.5	-2.8
WI	0.1	-0.7	-0.2	0.0	0.2	-0.6
WV	0.0	-0.8	-0.3	-0.1	-0.3	-1.5
WY	0.2	-0.5	-0.3	-0.4	-0.2	-1.2

Table B3

Annual Higher Education Appropriation, by State, 2003-2008

State	2003	2004	2005	2006	2007	2008	Mean, 2003-2008
AK	9.6	8.2	8.7	8.1	7.3	7.0	8.2
AL	17.4	18.5	18.1	10.3	10.7	10.5	14.3
AR	14.6	15.3	14.9	16.1	16.2	16.3	15.6
AZ	13.5	13.3	14.3	15.2	13.8	10.9	13.5
CA	10.8	11.1	11.2	11.4	9.7	8.4	10.4
CO	13.0	14.9	12.5	15.8	14.1	13.9	14.0
CT	10.4	9.8	11.6	10.9	11.9	10.7	10.9
DE	5.0	6.2	5.1	5.9	4.5	4.3	5.2
FL	9.6	8.4	7.9	8.1	8.9	9.9	8.8
GA	14.9	19.0	10.5	6.3	7.1	7.9	11.0
HI	9.0	9.7	10.3	10.2	9.8	10.1	9.9
IA	25.3	26.6	20.5	24.6	25.1	25.2	24.6
ID	8.6	8.9	9.0	9.4	8.8	8.3	8.8
IL	7.9	5.4	6.5	6.2	6.2	6.0	6.4
IN	8.1	7.7	6.7	8.6	7.3	7.9	7.7
KS	17.1	16.8	17.4	17.1	17.1	17.5	17.2
KY	19.2	19.1	20.5	19.7	20.6	24.1	20.5
LA	11.9	11.8	15.5	11.6	9.5	9.6	11.7
MA	4.1	3.6	3.7	9.2	9.7	9.7	6.7
MD	15.1	22.4	14.5	14.5	14.0	15.0	15.9
ME	3.7	3.5	3.6	3.6	3.6	3.7	3.6
MI	6.1	5.5	5.4	5.3	5.0	5.5	5.5
MN	6.5	9.8	9.6	10.0	10.5	10.7	9.5
MO	5.6	5.5	5.2	5.1	5.2	5.6	5.4
MS	16.3	18.0	17.2	14.9	10.3	16.8	15.6
MT	9.5	10.1	11.2	10.4	10.4	11.8	10.6
NC	14.8	14.2	14.1	14.5	15.1	11.8	14.1
ND	11.7	22.6	22.2	22.5	23.8	23.5	21.1
NE	21.3	21.5	21.8	21.1	21.3	22.0	21.5
NH	4.8	4.6	4.5	4.8	4.6	5.0	4.7
NJ	7.3	7.6	7.5	7.8	7.5	7.3	7.5
NM	24.2	20.4	20.2	6.5	20.9	18.3	18.4

Table B3 continued

State	2003	2004	2005	2006	2007	2008	Mean, 2003-2008
NV	10.1	10.8	9.6	9.4	10.1	11.0	10.2
NY	7.0	6.5	6.8	6.6	7.0	7.1	6.8
OH	5.7	5.6	5.4	5.2	5.4	5.3	5.4
OK	18.1	13.5	16.8	16.7	22.5	12.2	16.6
OR	12.2	12.8	13.7	11.6	11.5	12.0	12.3
PA	5.2	4.2	4.0	4.0	4.1	4.0	4.3
RI	10.8	10.9	10.6	10.5	11.5	11.8	11.0
SC	18.7	19.0	19.1	20.4	20.2	20.6	19.7
SD	16.7	16.8	18.1	17.0	17.3	18.4	17.4
TN	11.6	11.1	12.0	13.1	13.8	14.3	12.7
TX	13.5	15.0	13.2	14.3	12.8	12.1	13.5
UT	13.3	13.0	12.9	11.8	11.9	10.9	12.3
VA	13.4	15.7	13.8	13.6	15.3	12.9	14.1
VT	3.0	3.6	3.3	1.7	1.9	1.8	2.6
WA	17.0	17.0	17.3	13.4	13.5	13.7	15.3
WI	11.6	11.9	13.0	12.7	13.1	13.1	12.6
WV	8.3	8.2	8.5	8.1	9.2	9.8	8.7
WY	3.4	9.0	5.0	4.6	1.0	1.0	4.0

Table B4

Change in Annual Higher Education Appropriation, by State, 2003-2008

State	2003- 2004	2004- 2005	2005- 2006	2006- 2007	2007- 2008	2003- 2008
AK	-1.4	0.5	-0.6	-0.8	-0.3	-2.6
AL	1.1	-0.4	-7.8	0.4	-0.2	-6.9
AR	0.7	-0.4	1.2	0.1	0.1	1.7
AZ	-0.2	1.0	0.9	-1.4	-2.9	-2.6
CA	0.3	0.1	0.2	-1.7	-1.3	-2.4
CO	1.9	-2.4	3.3	-1.7	-0.2	0.9
CT	-0.6	1.8	-0.7	1.0	-1.2	0.3
DE	1.2	-1.1	0.8	-1.4	-0.2	-0.7
FL	-1.2	-0.5	0.2	0.8	1.0	0.3
GA	4.1	-8.5	-4.2	0.8	0.8	-7.0
HI	0.7	0.6	-0.1	-0.4	0.3	1.1
IA	1.3	-6.1	4.1	0.5	0.1	-0.1
ID	0.3	0.1	0.4	-0.6	-0.5	-0.3
IL	-2.5	1.1	-0.3	0.0	-0.2	-1.9
IN	-0.4	-1.0	1.9	-1.3	0.6	-0.2
KS	-0.3	0.6	-0.3	0.0	0.4	0.4
KY	-0.1	1.4	-0.8	0.9	3.5	4.9
LA	-0.1	3.7	-3.9	-2.1	0.1	-2.3
MA	-0.5	0.1	5.5	0.5	0.0	5.6
MD	7.3	-7.9	0.0	-0.5	1.0	-0.1
ME	-0.2	0.1	0.0	0.0	0.1	0.0
MI	-0.6	-0.1	-0.1	-0.3	0.5	-0.6
MN	3.3	-0.2	0.4	0.5	0.2	4.2
MO	-0.1	-0.3	-0.1	0.1	0.4	0.0
MS	1.7	-0.8	-2.3	-4.6	6.5	0.5
MT	0.6	1.1	-0.8	0.0	1.4	2.3
NC	-0.6	-0.1	0.4	0.6	-3.3	-3.0
ND	10.9	-0.4	0.3	1.3	-0.3	11.8
NE	0.2	0.3	-0.7	0.2	0.7	0.7
NH	-0.2	-0.1	0.3	-0.2	0.4	0.2
NJ	0.3	-0.1	0.3	-0.3	-0.2	0.0
NM	-3.8	-0.2	-13.7	14.4	-2.6	-5.9

Table B4 continued

State	2003- 2004	2004- 2005	2005- 2006	2006- 2007	2007- 2008	2003- 2008
NV	0.7	-1.2	-0.2	0.7	0.9	0.9
NY	-0.5	0.3	-0.2	0.4	0.1	0.1
OH	-0.1	-0.2	-0.2	0.2	-0.1	-0.4
OK	-4.6	3.3	-0.1	5.8	-10.3	-5.9
OR	0.6	0.9	-2.1	-0.1	0.5	-0.2
PA	-1.0	-0.2	0.0	0.1	-0.1	-1.2
RI	0.1	-0.3	-0.1	1.0	0.3	1.0
SC	0.3	0.1	1.3	-0.2	0.4	1.9
SD	0.1	1.3	-1.1	0.3	1.1	1.7
TN	-0.5	0.9	1.1	0.7	0.5	2.7
TX	1.5	-1.8	1.1	-1.5	-0.7	-1.4
UT	-0.3	-0.1	-1.1	0.1	-1.0	-2.4
VA	2.3	-1.9	-0.2	1.7	-2.4	-0.5
VT	0.6	-0.3	-1.6	0.2	-0.1	-1.2
WA	0.0	0.3	-3.9	0.1	0.2	-3.3
WI	0.3	1.1	-0.3	0.4	0.0	1.5
WV	-0.1	0.3	-0.4	1.1	0.6	1.5
WY	5.6	-4.0	-0.4	-3.6	0.0	-2.4

Table B5

Annual Medicaid Appropriation, by State, 2003-2008

State	2003	2004	2005	2006	2007	2008	Mean, 2003-2008
AK	12.1	12.8	11.8	11.1	9.2	8.4	10.9
AL	22.3	23.5	23.3	12.6	12.3	11.0	17.5
AR	19.5	19.8	21.0	20.5	19.9	20.3	20.2
AZ	20.7	17.6	19.5	24.0	23.7	22.8	21.4
CA	18.5	18.8	20.6	18.0	18.3	19.7	19.0
CO	17.8	19.9	17.6	17.0	15.6	11.1	16.5
CT	25.3	27.0	17.6	17.4	17.2	17.4	20.3
DE	11.5	15.6	14.8	16.6	12.3	11.5	13.7
FL	22.3	25.2	23.8	22.5	21.7	23.2	23.1
GA	17.6	19.0	22.2	20.2	19.8	19.6	19.7
HI	9.7	10.8	10.4	10.3	10.0	11.2	10.4
IA	18.1	17.8	18.9	18.1	17.4	17.9	18.0
ID	19.6	20.8	21.9	21.8	20.5	21.9	21.1
IL	25.4	20.9	28.3	26.2	27.2	29.5	26.3
IN	20.5	20.0	17.7	21.6	21.9	21.7	20.6
KS	16.0	17.0	20.4	18.9	18.6	18.7	18.3
KY	20.8	21.7	22.0	21.4	20.3	21.3	21.3
LA	26.2	24.1	33.3	21.7	17.6	19.3	23.7
MA	20.8	22.6	22.8	17.6	18.1	18.7	20.1
MD	17.7	27.1	20.9	19.0	18.5	18.9	20.4
ME	28.2	31.3	31.1	32.0	30.2	28.2	30.2
MI	20.0	20.8	21.4	20.1	21.7	22.2	21.0
MN	20.8	22.0	21.6	21.5	22.2	22.6	21.8
MO	32.6	32.0	34.3	32.9	35.5	34.5	33.6
MS	25.8	32.2	30.4	22.4	21.7	22.4	25.8
MT	15.6	16.2	17.3	16.3	15.3	16.8	16.3
NC	23.4	23.0	23.9	25.1	26.5	26.4	24.7
ND	19.0	16.8	16.1	15.4	14.7	15.1	16.2
NE	18.9	19.4	19.2	18.2	18.7	17.7	18.7
NH	26.4	26.4	27.6	24.7	25.9	26.0	26.2
NJ	20.6	20.6	18.2	21.2	20.0	19.5	20.0
NM	17.8	24.4	23.0	21.5	19.0	20.8	21.1

Table B5 continued

State	2003	2004	2005	2006	2007	2008	Mean, 2003-2008
NV	20.2	18.2	16.2	15.7	15.2	12.3	16.3
NY	28.4	28.3	29.2	29.0	28.7	26.7	28.4
OH	23.1	25.9	24.8	25.1	24.0	23.2	24.4
OK	18.4	19.7	19.5	18.4	17.2	18.6	18.6
OR	18.7	15.9	16.1	15.5	15.9	13.7	16.0
PA	28.8	31.3	32.4	31.9	30.7	30.3	30.9
RI	26.3	24.9	27.5	23.3	24.4	25.9	25.4
SC	22.0	24.9	24.0	21.6	22.4	21.1	22.7
SD	14.9	21.8	18.5	21.5	20.9	22.3	20.0
TN	33.9	35.2	35.7	29.3	28.6	28.5	31.9
TX	23.0	24.3	27.3	25.9	25.4	16.4	23.7
UT	14.5	16.1	16.4	17.0	14.9	13.6	15.4
VA	13.5	13.6	13.6	14.8	14.5	15.1	14.2
VT	25.8	21.5	23.1	18.0	18.3	18.9	20.9
WA	22.2	19.9	22.4	21.8	19.0	19.6	20.8
WI	12.6	14.6	13.8	13.4	13.9	13.5	13.6
WV	11.1	12.0	11.8	10.4	11.6	12.1	11.5
WY	7.9	4.6	7.7	6.6	8.9	10.2	7.7

Table B6

Change in Annual Medicaid Appropriation, by State, 2003-2008

State	2003- 2004	2004- 2005	2005- 2006	2006- 2007	2007- 2008	2003- 2008
AK	0.7	-1.0	-0.7	-1.9	-0.8	-3.7
AL	1.2	-0.2	-10.7	-0.3	-1.3	-11.3
AR	0.3	1.2	-0.5	-0.6	0.4	0.8
AZ	-3.1	1.9	4.5	-0.3	-0.9	2.1
CA	0.3	1.8	-2.6	0.3	1.4	1.2
CO	2.1	-2.3	-0.6	-1.4	-4.5	-6.7
CT	1.7	-9.4	-0.2	-0.2	0.2	-7.9
DE	4.1	-0.8	1.8	-4.3	-0.8	0.0
FL	2.9	-1.4	-1.3	-0.8	1.5	0.9
GA	1.4	3.2	-2.0	-0.4	-0.2	2.0
HI	1.1	-0.4	-0.1	-0.3	1.2	1.5
IA	-0.3	1.1	-0.8	-0.7	0.5	-0.2
ID	1.2	1.1	-0.1	-1.3	1.4	2.3
IL	-4.5	7.4	-2.1	1.0	2.3	4.1
IN	-0.5	-2.3	3.9	0.3	-0.2	1.2
KS	1.0	3.4	-1.5	-0.3	0.1	2.7
KY	0.9	0.3	-0.6	-1.1	1.0	0.5
LA	-2.1	9.2	-11.6	-4.1	1.7	-6.9
MA	1.8	0.2	-5.2	0.5	0.6	-2.1
MD	9.4	-6.2	-1.9	-0.5	0.4	1.2
ME	3.1	-0.2	0.9	-1.8	-2.0	0.0
MI	0.8	0.6	-1.3	1.6	0.5	2.2
MN	1.2	-0.4	-0.1	0.7	0.4	1.8
MO	-0.6	2.3	-1.4	2.6	-1.0	1.9
MS	6.4	-1.8	-8.0	-0.7	0.7	-3.4
MT	0.6	1.1	-1.0	-1.0	1.5	1.2
NC	-0.4	0.9	1.2	1.4	-0.1	3.0
ND	-2.2	-0.7	-0.7	-0.7	0.4	-3.9
NE	0.5	-0.2	-1.0	0.5	-1.0	-1.2
NH	0.0	1.2	-2.9	1.2	0.1	-0.4
NJ	0.0	-2.4	3.0	-1.2	-0.5	-1.1
NM	6.6	-1.4	-1.5	-2.5	1.8	3.0

Table B6 continued

State	2003- 2004	2004- 2005	2005- 2006	2006- 2007	2007- 2008	2003- 2008
NV	-2.0	-2.0	-0.5	-0.5	-2.9	-7.9
NY	-0.1	0.9	-0.2	-0.3	-2.0	-1.7
OH	2.8	-1.1	0.3	-1.1	-0.8	0.1
OK	1.3	-0.2	-1.1	-1.2	1.4	0.2
OR	-2.8	0.2	-0.6	0.4	-2.2	-5.0
PA	2.5	1.1	-0.5	-1.2	-0.4	1.5
RI	-1.4	2.6	-4.2	1.1	1.5	-0.4
SC	2.9	-0.9	-2.4	0.8	-1.3	-0.9
SD	6.9	-3.3	3.0	-0.6	1.4	7.4
TN	1.3	0.5	-6.4	-0.7	-0.1	-5.4
TX	1.3	3.0	-1.4	-0.5	-9.0	-6.6
UT	1.6	0.3	0.6	-2.1	-1.3	-0.9
VA	0.1	0.0	1.2	-0.3	0.6	1.6
VT	-4.3	1.6	-5.1	0.3	0.6	-6.9
WA	-2.3	2.5	-0.6	-2.8	0.6	-2.6
WI	2.0	-0.8	-0.4	0.5	-0.4	0.9
WV	0.9	-0.2	-1.4	1.2	0.5	1.0
WY	-3.3	3.1	-1.1	2.3	1.3	2.3

Table B7

Annual Criminal Justice System Appropriation, by State, 2003-2008

State	2003	2004	2005	2006	2007	2008	Mean, 2003-2008
AK	3.3	2.8	2.6	2.5	2.4	2.4	2.7
AL	2.4	2.6	2.6	1.5	1.5	1.4	2.0
AR	1.8	1.8	1.8	2.2	2.2	2.3	2.0
AZ	3.6	3.8	4.0	3.7	3.6	4.2	3.8
CA	3.4	3.8	4.1	4.3	4.8	5.0	4.2
CO	4.0	3.9	3.9	3.8	3.8	3.0	3.7
CT	2.9	2.9	2.9	2.8	2.8	2.9	2.9
DE	3.3	4.1	3.3	4.2	3.2	3.1	3.5
FL	3.6	3.7	3.5	4.3	4.4	4.8	4.1
GA	4.5	4.3	4.4	3.1	2.9	3.3	3.8
HI	2.0	2.1	2.1	2.1	2.0	2.1	2.1
IA	2.2	2.4	2.6	2.5	2.7	2.6	2.5
ID	4.0	3.9	3.9	4.0	4.3	4.1	4.0
IL	3.3	2.6	3.1	2.6	2.9	3.0	2.9
IN	3.6	3.5	2.9	3.1	3.2	3.0	3.2
KS	3.2	3.1	3.1	3.2	3.1	3.1	3.1
KY	2.7	2.5	2.4	2.4	2.4	2.5	2.5
LA	4.2	3.5	4.6	2.9	2.1	2.7	3.3
MA	3.4	4.0	3.9	2.7	2.7	2.8	3.3
MD	4.0	5.3	4.3	4.5	4.4	4.4	4.5
ME	2.0	1.9	2.0	1.7	2.0	2.1	2.0
MI	4.7	4.9	5.1	5.2	5.3	5.3	5.1
MN	1.8	1.8	1.7	1.7	2.0	1.8	1.8
MO	3.0	3.1	2.8	2.7	2.9	2.9	2.9
MS	2.3	2.7	2.3	2.0	2.0	2.2	2.3
MT	2.9	2.9	3.1	3.2	3.1	3.8	3.2
NC	3.1	4.7	3.2	3.4	3.2	3.3	3.5
ND	2.1	1.7	1.7	2.0	1.9	2.0	1.9
NE	2.5	2.5	2.4	2.2	2.4	2.5	2.4
NH	1.9	1.8	1.8	2.1	2.1	2.2	2.0
NJ	3.6	3.6	3.5	3.6	3.6	3.4	3.6
NM	2.2	2.3	2.2	2.1	1.8	2.0	2.1

Table B7 continued

State	2003	2004	2005	2006	2007	2008	Mean, 2003-2008
NV	4.0	3.2	3.9	3.4	3.8	4.2	3.8
NY	3.0	2.8	2.9	2.7	3.0	2.9	2.9
OH	3.9	3.9	3.8	3.7	3.8	3.6	3.8
OK	3.2	3.1	2.9	2.8	2.6	2.8	2.9
OR	5.5	3.4	3.3	3.7	3.9	3.7	3.9
PA	3.8	3.6	3.4	3.5	3.4	3.4	3.5
RI	2.6	5.6	6.1	3.0	2.5	2.8	3.8
SC	2.9	3.0	2.7	3.0	2.9	3.0	2.9
SD	2.6	2.7	2.7	3.1	3.0	3.2	2.9
TN	2.5	2.3	2.4	2.8	2.9	2.6	2.6
TX	6.1	5.5	5.5	4.8	3.7	4.0	4.9
UT	3.7	3.6	3.4	3.5	3.5	2.9	3.4
VA	3.8	3.7	3.9	4.4	4.0	4.2	4.0
VT	3.3	2.6	2.8	2.3	2.4	2.5	2.7
WA	3.0	2.9	3.1	3.2	3.5	3.7	3.2
WI	3.2	3.0	3.3	3.3	3.4	3.4	3.3
WV	1.0	1.0	1.0	0.9	1.0	1.1	1.0
WY	2.0	3.8	1.8	1.7	0.0	0.0	1.6

Table B8

Change in Annual Criminal Justice System Appropriation, by State, 2003-2008

State	2003- 2004	2004- 2005	2005- 2006	2006- 2007	2007- 2008	2003- 2008
AK	-0.5	-0.2	-0.1	-0.1	0.0	-0.9
AL	0.2	0.0	-1.1	0.0	-0.1	-1.0
AR	0.0	0.0	0.4	0.0	0.1	0.5
AZ	0.2	0.2	-0.3	-0.1	0.6	0.6
CA	0.4	0.3	0.2	0.5	0.2	1.6
CO	-0.1	0.0	-0.1	0.0	-0.8	-1.0
CT	0.0	0.0	-0.1	0.0	0.1	0.0
DE	0.8	-0.8	0.9	-1.0	-0.1	-0.2
FL	0.1	-0.2	0.8	0.1	0.4	1.2
GA	-0.2	0.1	-1.3	-0.2	0.4	-1.2
HI	0.1	0.0	0.0	-0.1	0.1	0.1
IA	0.2	0.2	-0.1	0.2	-0.1	0.4
ID	-0.1	0.0	0.1	0.3	-0.2	0.1
IL	-0.7	0.5	-0.5	0.3	0.1	-0.3
IN	-0.1	-0.6	0.2	0.1	-0.2	-0.6
KS	-0.1	0.0	0.1	-0.1	0.0	-0.1
KY	-0.2	-0.1	0.0	0.0	0.1	-0.2
LA	-0.7	1.1	-1.7	-0.8	0.6	-1.5
MA	0.6	-0.1	-1.2	0.0	0.1	-0.6
MD	1.3	-1.0	0.2	-0.1	0.0	0.4
ME	-0.1	0.1	-0.3	0.3	0.1	0.1
MI	0.2	0.2	0.1	0.1	0.0	0.6
MN	0.0	-0.1	0.0	0.3	-0.2	0.0
MO	0.1	-0.3	-0.1	0.2	0.0	-0.1
MS	0.4	-0.4	-0.3	0.0	0.2	-0.1
MT	0.0	0.2	0.1	-0.1	0.7	0.9
NC	1.6	-1.5	0.2	-0.2	0.1	0.2
ND	-0.4	0.0	0.3	-0.1	0.1	-0.1
NE	0.0	-0.1	-0.2	0.2	0.1	0.0
NH	-0.1	0.0	0.3	0.0	0.1	0.3
NJ	0.0	-0.1	0.1	0.0	-0.2	-0.2
NM	0.1	-0.1	-0.1	-0.3	0.2	-0.2

Table B8 continued

State	2003- 2004	2004- 2005	2005- 2006	2006- 2007	2007- 2008	2003- 2008
NV	-0.8	0.7	-0.5	0.4	0.4	0.2
NY	-0.2	0.1	-0.2	0.3	-0.1	-0.1
OH	0.0	-0.1	-0.1	0.1	-0.2	-0.3
OK	-0.1	-0.2	-0.1	-0.2	0.2	-0.4
OR	-2.1	-0.1	0.4	0.2	-0.2	-1.8
PA	-0.2	-0.2	0.1	-0.1	0.0	-0.4
RI	3.0	0.5	-3.1	-0.5	0.3	0.2
SC	0.1	-0.3	0.3	-0.1	0.1	0.1
SD	0.1	0.0	0.4	-0.1	0.2	0.6
TN	-0.2	0.1	0.4	0.1	-0.3	0.1
TX	-0.6	0.0	-0.7	-1.1	0.3	-2.1
UT	-0.1	-0.2	0.1	0.0	-0.6	-0.8
VA	-0.1	0.2	0.5	-0.4	0.2	0.4
VT	-0.7	0.2	-0.5	0.1	0.1	-0.8
WA	-0.1	0.2	0.1	0.3	0.2	0.7
WI	-0.2	0.3	0.0	0.1	0.0	0.2
WV	0.0	0.0	-0.1	0.1	0.1	0.1
WY	1.8	-2.0	-0.1	-1.7	0.0	-2.0

APPENDIX C: WITHIN-YEAR OLS REGRESSION MODELS

Table C1

OLS Regression of Institutional Retention Rate, 2003

Variable	<i>B</i>	<i>SE B</i>	β
Intercept	96.786	4.271	0
Bachelor	-1.764	1.599	-0.044
Master	0.163	0.852	0.008
<i>Doctoral^a</i>			
% Minority/Ethnic Population	0.053	0.018	0.124**
Small	-8.932	1.258	-0.362***
Medium	-3.407	0.840	-0.172***
<i>Large^a</i>			
Low Selectivity	-16.530	1.280	-0.718***
Medium Selectivity	-10.174	0.948	-0.507***
<i>High Selectivity^a</i>			
Instructional Expenditures	-0.092	0.058	-0.064
Research Expenditures	-0.022	0.057	-0.018
Student Services Expenditures	-0.051	0.125	-0.016
Grant Expenditures	-0.244	0.096	-0.094*
Tuition Revenue	-0.003	0.048	-0.002
% Student Body Receiving Any Financial Aid	-0.021	0.025	-0.029
Remediation Program	-1.287	0.833	-0.050
Unemployment Rate Higher Education	0.884	0.396	0.080*
Appropriation	-0.276	0.075	-0.133**
Medicaid Appropriation	-0.020	0.066	-0.011
Corrections Appropriation	-1.408	0.322	-0.149***

r-sq 0.58***

Adj r-sq 0.57***

^aReference category

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

Table C2

OLS Regression of Institutional Retention Rate, 2004

Variable	<i>B</i>	<i>SE B</i>	β
Intercept	105.467	4.248	0
Bachelor	-1.803	1.625	-0.044
Master	0.087	0.870	0.004
<i>Doctoral^a</i>			
% Minority/Ethnic			
Population	0.040	0.018	0.093*
Small	-7.993	1.270	-0.318***
Medium	-3.100	0.857	-0.154**
<i>Large^a</i>			
Low Selectivity	-17.362	1.337	-0.740***
Medium Selectivity	-10.998	0.984	-0.538***
<i>High Selectivity^a</i>			
Instructional Expenditures	-0.089	0.057	-0.063
Research Expenditures	-0.066	0.054	-0.056
Student Services			
Expenditures	0.004	0.125	0.001
Grant Expenditures	-0.336	0.096	-0.127**
Tuition Revenue	-0.060	0.045	-0.055
% Student Body Receiving			
Any Financial Aid	-0.089	0.027	-0.114**
Remediation Program	-0.269	0.836	-0.011
Unemployment Rate	-0.424	0.384	-0.039
Higher Education			
Appropriation	-0.183	0.065	-0.098**
Medicaid Appropriation	0.026	0.065	0.014
Corrections Appropriation	-0.328	0.345	-0.033

r-sq 0.58***

Adj r-sq 0.57***

^aReference category

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

Table C3

OLS Regression of Institutional Retention Rate, 2005

Variable	<i>B</i>	<i>SE B</i>	β
Intercept	100.445	3.893	0
Bachelor	0.237	1.580	0.006
Master	0.094	0.846	0.005
<i>Doctoral^a</i>			
% Minority/Ethnic			
Population	0.035	0.018	0.082*
Small	-9.054	1.242	-0.365***
Medium	-3.850	0.839	-0.193***
<i>Large^a</i>			
Low Selectivity	-16.382	1.312	-0.708***
Medium Selectivity	-10.483	0.954	-0.520***
<i>High Selectivity^a</i>			
Instructional Expenditures	0.014	0.059	0.010
Research Expenditures	0.010	0.055	0.009
Student Services			
Expenditures	-0.061	0.118	-0.019
Grant Expenditures	-0.281	0.103	-0.101**
Tuition Revenue	-0.028	0.042	-0.027
% Student Body Receiving			
Any Financial Aid	-0.065	0.026	-0.085*
Remediation Program	-1.088	0.796	-0.044
Unemployment Rate	-0.249	0.401	-0.022
Higher Education			
Appropriation	-0.287	0.067	-0.143***
Medicaid Appropriation	0.050	0.060	0.029
Corrections Appropriation	-0.843	0.333	-0.086*

r-sq 0.60***

Adj r-sq 0.58***

^aReference category

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

Table C4

OLS Regression of Institutional Retention Rate, 2006

Variable	<i>B</i>	<i>SE B</i>	β
Intercept	96.963	3.754	0
Bachelor	0.940	1.609	0.023
Master	0.265	0.867	0.013
<i>Doctoral^a</i>			
% Minority/Ethnic			
Population	0.010	0.018	0.022
Small	-8.351	1.288	-0.327***
Medium	-3.016	0.865	-0.147**
<i>Large^a</i>			
Low Selectivity	-16.192	1.351	-0.679***
Medium Selectivity	-9.833	0.994	-0.473***
<i>High Selectivity^a</i>			
Instructional Expenditures	0.006	0.062	0.004
Research Expenditures	0.075	0.058	0.059
Student Services			
Expenditures	0.020	0.122	0.006
Grant Expenditures	-0.274	0.106	-0.092**
Tuition Revenue	-0.065	0.041	-0.064
% Student Body Receiving			
Any Financial Aid	-0.054	0.027	-0.070*
Remediation Program	-2.299	0.832	-0.089**
Unemployment Rate	-0.248	0.374	-0.023
Higher Education			
Appropriation	-0.288	0.070	-0.134***
Medicaid Appropriation	0.038	0.065	0.020
Corrections Appropriation	0.240	0.356	0.023

r-sq 0.60***

Adj r-sq 0.59***

^aReference category

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

Table C5

OLS Regression of Institutional Retention Rate, 2007

Variable	<i>B</i>	<i>SE B</i>	β
Intercept	95.914	3.982	0
Bachelor	0.079	1.630	0.002
Master	-0.083	0.875	-0.004
<i>Doctoral^a</i>			
% Minority/Ethnic			
Population	0.004	0.018	0.009
Small	-8.182	1.301	-0.320***
Medium	-3.513	0.876	-0.171***
<i>Large^a</i>			
Low Selectivity	-15.464	1.396	-0.647***
Medium Selectivity	-9.526	1.017	-0.457***
<i>High Selectivity^a</i>			
Instructional Expenditures	-0.041	0.063	-0.027
Research Expenditures	0.040	0.057	0.032
Student Services			
Expenditures	0.025	0.121	0.008
Grant Expenditures	-0.286	0.105	-0.094**
Tuition Revenue	-0.032	0.041	-0.031
% Student Body Receiving			
Any Financial Aid	-0.032	0.030	-0.038
Remediation Program	-2.287	0.828	-0.092**
Unemployment Rate	-0.377	0.388	-0.033
Higher Education			
Appropriation	-0.302	0.068	-0.151***
Medicaid Appropriation	0.051	0.066	0.028
Corrections Appropriation	0.636	0.380	0.058

r-sq 0.59***

Adj r-sq 0.57***

^aReference category

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

Table C6

OLS Regression of Institutional Retention Rate, 2008

Variable	<i>B</i>	<i>SE B</i>	β
Intercept	89.789	3.567	0
Bachelor	-0.553	1.452	-0.014
Master	0.421	0.782	0.021
<i>Doctoral^a</i>			
% Minority/Ethnic			
Population	0.011	0.016	0.025
Small	-7.582	1.153	-0.311***
Medium	-2.655	0.787	-0.136**
<i>Large^a</i>			
Low Selectivity	-14.594	1.256	-0.641***
Medium Selectivity	-8.985	0.912	-0.453***
<i>High Selectivity^a</i>			
Instructional Expenditures	0.029	0.050	0.022
Research Expenditures	0.119	0.049	0.101*
Student Services			
Expenditures	0.018	0.101	0.006
Grant Expenditures	-0.259	0.094	-0.089**
Tuition Revenue	-0.030	0.036	-0.031
% Student Body Receiving			
Any Financial Aid	-0.085	0.030	-0.097**
Remediation Program	-2.181	0.730	-0.093**
Unemployment Rate	0.290	0.347	0.027
Higher Education			
Appropriation	-0.175	0.065	-0.087**
Medicaid Appropriation	0.143	0.060	0.080*
Corrections Appropriation	0.739	0.334	0.073*

r-sq 0.64***

Adj r-sq 0.63***

^aReference category

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

APPENDIX D: PARAMETRIC EQUATIONS

Parametric Equations Defining Fully Unconditional Model

The parametric equations defining the ANOVA model are given as:

$$\begin{aligned}\text{Level 1: } Y_{tij} &= \pi_{0ij} + e_{tij} \\ \text{Level 2: } \pi_{0ij} &= \beta_{00j} + r_{0ij} \\ \text{Level 3: } \beta_{00j} &= \gamma_{000} + u_{00j}\end{aligned}$$

where

Y_{tij} is the first year retention year rate at time t for institution-year i in state j .

π_{0ij} is the initial status of the institutional retention rate for institution-year i in state j , that is, the retention rate for institution ij for the 2003 cohort.

e_{tij} is a random measurement effect.

β_{00j} is the average initial first year retention rate across institution-years in state j .

r_{0ij} is a random institution-year effect, the deviation of the mean initial first year retention rate across institution-years i from the mean initial institutional retention rate in state j .

γ_{000} is the grand mean initial first year retention rate.

u_{00j} is a random state effect, the deviation of state j 's mean initial first year retention rate from the grand mean institutional retention rate.

Parametric Equations Defining Linear Growth Model

The parametric equations defining the linear growth model are given as:

$$\begin{aligned}\text{Level 1: } Y_{tij} &= \pi_{0ij} + \pi_{1ij}(\text{YEAR}) + e_{tij} \\ \text{Level 2: } \pi_{0ij} &= \beta_{00j} + r_{0ij} \\ &\quad \pi_{1ij} = \beta_{10j} + r_{1ij} \\ \text{Level 3: } \beta_{00j} &= \gamma_{000} + u_{00j} \\ &\quad \beta_{10j} = \gamma_{100} + u_{10j}\end{aligned}$$

where

Y_{tij} is the first year retention year rate at time t for institution-year i in state j .

π_{0ij} is the initial status of the institutional retention rate for institution-year i in state j , that is, the retention rate for institution ij for the 2003 cohort.

π_{1ij} is the slope of the growth rate of institutional retention across institution-years i in state j , that is, the change in the retention rate for institution ij from 2004-2008.

e_{ij} is a random measurement effect.

β_{00j} is the average initial first year retention rate across institution-years in state j .

β_{10j} is the average slope of the growth rate of first year retention rate across institution-years in state j .

r_{0ij} is a random institution-year effect, the deviation of the mean initial first year retention rate across institution-years i from the mean initial institutional retention rate in state j .

r_{1ij} is a random institution-year effect, the deviation of the mean slope of the growth rate of first year retention rate across institution-years i from the mean slope of the growth of the institutional retention rate in state j .

γ_{000} is the grand mean initial first year retention rate.

γ_{100} is the grand mean slope of first year retention rate.

u_{00j} is a random state effect, the deviation of state j 's mean initial first year retention rate from the grand mean institutional retention rate.

u_{10j} is a random state effect, the deviation of state j 's mean slope first year retention rate growth from the grand mean institutional retention rate growth.

Parametric Equations Defining Institutional Level ANCOVA

The parametric equations defining the institutional level analysis of covariance (held unconditional at Level 3) are given as:

$$\text{Level 1: } Y_{ij} = \pi_{0ij} + \pi_{1ij}(\text{YEAR}) + e_{ij}$$

$$\begin{aligned} \text{Level 2: } \pi_{0ij} = & \beta_{00j} + \beta_{01j}(\text{BACHELOR}) + \beta_{02j}(\text{MASTER}) + \beta_{03j}(\text{TOTMIN}) + \\ & \beta_{04j}(\text{SMALL}) + \beta_{05j}(\text{MEDIUM}) + \beta_{06j}(\text{LOWSEL}) + \\ & \beta_{07j}(\text{MEDSEL}) + \beta_{08j}(\text{MEANINST}) + \beta_{09j}(\text{MEANRES}) + \\ & \beta_{010j}(\text{MEANSTSV}) + \beta_{011j}(\text{MEANGRNT}) + \\ & \beta_{012j}(\text{MEANTUIT}) + \beta_{013j}(\text{MEANAID}) + \\ & \beta_{014j}(\text{MEANREMD}) + r_{0ij} \end{aligned}$$

$$\begin{aligned} \pi_{1ij} = & \beta_{10j} + \beta_{11j}(\text{BACHELOR}) + \beta_{12j}(\text{MASTER}) + \beta_{13j}(\text{TOTMIN}) + \\ & \beta_{14j}(\text{SMALL}) + \beta_{15j}(\text{MEDIUM}) + \beta_{16j}(\text{LOWSEL}) + \\ & \beta_{17j}(\text{MEDSEL}) + \beta_{18j}(\text{MEANINST}) + \beta_{19j}(\text{MEANRES}) + \\ & \beta_{110j}(\text{MEANSTSV}) + \beta_{111j}(\text{MEANGRNT}) + \\ & \beta_{112j}(\text{MEANTUIT}) + \beta_{113j}(\text{MEANAID}) + \end{aligned}$$

$$\beta_{114j}(\text{MEANREMD}) + r_{1ij}$$

Level 3: $\beta_{00j} = \gamma_{000} + u_{00j}$

$$\beta_{01j} = \gamma_{010}$$

$$\beta_{02j} = \gamma_{020}$$

$$\beta_{03j} = \gamma_{030}$$

$$\beta_{04j} = \gamma_{040}$$

$$\beta_{05j} = \gamma_{050}$$

$$\beta_{06j} = \gamma_{060}$$

$$\beta_{07j} = \gamma_{070}$$

$$\beta_{08j} = \gamma_{080}$$

$$\beta_{09j} = \gamma_{090}$$

$$\beta_{010j} = \gamma_{0100}$$

$$\beta_{011j} = \gamma_{0110}$$

$$\beta_{012j} = \gamma_{0120}$$

$$\beta_{013j} = \gamma_{0130}$$

$$\beta_{014j} = \gamma_{0140}$$

$$\beta_{10j} = \gamma_{100} + u_{10j}$$

$$\beta_{11j} = \gamma_{110}$$

$$\beta_{12j} = \gamma_{120}$$

$$\beta_{13j} = \gamma_{130}$$

$$\beta_{14j} = \gamma_{140}$$

$$\beta_{15j} = \gamma_{150}$$

$$\beta_{16j} = \gamma_{160}$$

$$\beta_{17j} = \gamma_{170}$$

$$\beta_{18j} = \gamma_{180}$$

$$\beta_{19j} = \gamma_{190}$$

$$\beta_{110j} = \gamma_{1100}$$

$$\beta_{111j} = \gamma_{1110}$$

$$\beta_{112j} = \gamma_{1120}$$

$$\beta_{113j} = \gamma_{1130}$$

$$\beta_{114j} = \gamma_{1140}$$

where

Y_{tij} is the first year retention year rate at time t for institution-year i in state j .

π_{0ij} is the initial status of the institutional retention rate for institution-year i in state j , that is, the retention rate for institution ij for the 2003 cohort.

π_{1ij} is the slope of the growth rate of institutional retention across institution-years i in state j , that is, the change in the retention rate for institution ij from 2004-2008.

e_{ij} is a random measurement effect.

β_{00j} is the average initial first year retention rate across institution-years in state j .
 β_{01j} is the effect of institutional scope (baccalaureate-granting institution as compared to a doctoral-granting institution) on the initial status of first year retention.
 β_{02j} is the effect of institutional scope (terminal master's degree-granting institution as compared to a doctoral degree-granting institution) on the initial status of first year retention.
 β_{03j} is the effect of an institution's racial/ethnic population on the initial status of first year retention.
 β_{04j} is the effect of institutional size (small versus large) on the initial status of first year retention.
 β_{05j} is the effect of institutional size (medium versus large) on the initial status of first year retention.
 β_{06j} is the effect of institutional selectivity (low versus high) on the initial status of first year retention.
 β_{07j} is the effect of institutional selectivity (medium versus high) on the initial status of first year retention.
 β_{08j} is the regression slope of initial status first year retention on mean instructional expenditure across institution-years i in state j .
 β_{09j} is the regression slope of initial status first year retention on mean research expenditures across institution-years i in state j .
 β_{010j} is the regression slope of initial status first year retention on mean student services expenditures across institution-years i in state j .
 β_{011j} is the regression slope of initial status first year retention on mean grant expenditures across institution-years i in state j .
 β_{012j} is the regression slope of initial status first year retention on mean tuition revenues across institution-years i in state j .
 β_{013j} is the regression slope of initial status first year retention on mean percentage of student population receiving any financial aid across institution-years i in state j .
 β_{014j} is the regression slope of initial status first year retention on mean remediation across institution-years i in state j .

r_{0ij} is a random institution-year effect, the deviation of the mean initial first year retention rate across institution-years i from the mean initial institutional retention rate in state j .

β_{10j} is the average slope of the growth rate of first year retention rate across institution-years in state j .
 β_{11j} is the effect of institutional scope (baccalaureate-granting institution as compared to a doctoral-granting institution) on the linear growth of first year retention.
 β_{12j} is the effect of institutional scope (terminal master's degree-granting institution as compared to a doctoral degree-granting institution) on the linear growth of first year retention.
 β_{13j} is the effect of an institution's racial/ethnic population on the linear growth of first year retention.
 β_{14j} is the effect of institutional size (small versus large) on the linear growth of first year retention.

β_{15j} is the effect of institutional size (medium versus large) on the linear growth of first year retention.

β_{16j} is the effect of institutional selectivity (low versus high) on the linear growth of first year retention.

β_{17j} is the effect of institutional selectivity (medium versus high) on the linear growth of first year retention.

β_{18j} is the regression slope of linear growth first year retention on mean instructional expenditure across institution-years i in state j .

β_{19j} is the regression slope of linear growth first year retention on mean research expenditures across institution-years i in state j .

β_{110j} is the regression slope of linear growth first year retention on mean student services expenditures across institution-years i in state j .

β_{111j} is the regression slope of linear growth first year retention on mean grant expenditures across institution-years i in state j .

β_{112j} is the regression slope of linear growth first year retention on mean tuition revenues across institution-years i in state j .

β_{113j} is the regression slope of linear growth first year retention on mean percentage of student population receiving any financial aid across institution-years i in state j .

β_{114j} is the regression slope of linear growth first year retention on mean remediation across institution-years i in state j .

r_{1ij} is a random institution-year effect, the deviation of the mean slope of the growth rate of first year retention rate across institution-years i from the mean slope of the growth of the institutional retention rate in state j .

γ_{000} is the grand mean initial first year retention rate.

γ_{010} is the average effect of institutional scope (baccalaureate-granting institution as compared to a doctoral-granting institution) on the initial status of first year retention in state j .

γ_{020} is the average effect of institutional scope (terminal master's degree-granting institution as compared to a doctoral degree-granting institution) on the initial status of first year retention in state j .

γ_{030} is the average effect of an institution's racial/ethnic population on the initial status of first year retention in state j .

γ_{040} is the average effect of institutional size (small versus large) on the initial status of first year retention in state j .

γ_{050} is the average effect of institutional size (medium versus large) on the initial status of first year retention in state j .

γ_{060} is the average effect of institutional selectivity (low versus high) on the initial status of first year retention in state j .

γ_{070} is the average effect of institutional selectivity (medium versus high) on the initial status of first year retention in state j .

γ_{080} is the average regression slope of initial status first year retention on mean instructional expenditure in state j .

γ_{090} is the average regression slope of initial status first year retention on mean research expenditures in state j .

γ_{0100} is the average regression slope of initial status first year retention on mean student services expenditures in state j .

γ_{0110} is the average regression slope of initial status first year retention on mean grant expenditures in state j .

γ_{0120} is then average regression slope of initial status first year retention on mean tuition revenues in state j .

γ_{0130} is the average regression slope of initial status first year retention on mean percentage of student population receiving any financial aid in state j .

γ_{0140} is the average regression slope of initial status first year retention on mean remediation in state j .

u_{00j} is a random state effect, the deviation of state j 's mean initial first year retention rate from the grand mean institutional retention rate.

γ_{100} is the grand mean slope of linear growth of first year retention rate.

γ_{110} is the average effect of institutional scope (baccalaureate-granting institution as compared to a doctoral-granting institution) on the linear growth of first year retention in state j .

γ_{120} is the average effect of institutional scope (terminal master's degree-granting institution as compared to a doctoral degree-granting institution) on the linear growth of first year retention in state j .

γ_{130} is the average effect of an institution's racial/ethnic population on the linear growth of first year retention in state j .

γ_{140} is the average effect of institutional size (small versus large) on the linear growth of first year retention in state j .

γ_{150} is the average effect of institutional size (medium versus large) on the linear growth of first year retention in state j .

γ_{160} is the average effect of institutional selectivity (low versus high) on the linear growth of first year retention in state j .

γ_{170} is the average effect of institutional selectivity (medium versus high) on the linear growth of first year retention in state j .

γ_{180} is the average regression slope of linear growth first year retention on mean instructional expenditure in state j .

γ_{190} is the average regression slope of linear growth first year retention on mean research expenditures in state j .

γ_{1100} is the average regression slope of linear growth first year retention on mean student services expenditures in state j .

γ_{1110} is the average regression slope of linear growth first year retention on mean grant expenditures in state j .

γ_{1120} is then average regression slope of linear growth first year retention on mean tuition revenues in state j .

γ_{1130} is the average regression slope of linear growth first year retention on mean percentage of student population receiving any financial aid in state j .

γ_{1140} is the average regression slope of linear growth first year retention on mean remediation in state j .

u_{10j} is a random state effect, the deviation of state j 's mean slope first year retention rate growth from the grand mean institutional retention growth rate

Parametric Equations Defining State Level ANCOVA

The parametric equations defining the linear growth model are given as:

$$\begin{aligned} \text{Level 1: } Y_{tij} &= \pi_{0ij} + \pi_{1ij}(\text{YEAR}) + e_{tij} \\ \text{Level 2: } \pi_{0ij} &= \beta_{00j} + r_{0ij} \\ &\pi_{1ij} = \beta_{10j} + r_{1ij} \\ \text{Level 3: } \beta_{00j} &= \gamma_{000} + \gamma_{001}(\text{UNEMPLOYMENT}) + \gamma_{002}(\text{HIGHER ED \$}) + \\ &\gamma_{003}(\text{MEDICAID \$}) + \gamma_{004}(\text{CJS \$}) + u_{00j} \\ \beta_{10j} &= \gamma_{100} + \gamma_{101}(\text{UNEMPLOYMENT}) + \gamma_{102}(\text{HIGHER ED \$}) + \\ &\gamma_{103}(\text{MEDICAID \$}) + \gamma_{104}(\text{CJS \$}) + u_{10j} \end{aligned}$$

where

Y_{tij} is the first year retention year rate at time t for institution-year i in state j .

π_{0ij} is the initial status of the institutional retention rate for institution-year i in state j , that is, the retention rate for institution ij for the 2003 cohort.

π_{1ij} is the slope of the growth rate of institutional retention across institution-years i in state j , that is, the change in the retention rate for institution ij from 2004-2008.

e_{tij} is a random measurement effect.

β_{00j} is the average initial first year retention rate across institution-years in state j .

β_{10j} is the average slope of the growth rate of first year retention rate across institution-years in state j .

r_{0ij} is a random institution-year effect, the deviation of the mean initial first year retention rate across institution-years i from the mean initial institutional retention rate in state j .

r_{1ij} is a random institution-year effect, the deviation of the mean slope of the growth rate of first year retention rate across institution-years i from the mean slope of the growth of the institutional retention rate in state j .

γ_{000} is the grand mean initial first year retention rate.

γ_{001} is the regression slope of initial status retention rate on economic health in state j ;

γ_{002} is the regression slope of initial status retention rate on higher education appropriations in state j ;

γ_{003} is the regression slope of initial status retention rate on Medicaid appropriations in state j ;

γ_{004} is the regression slope of initial status retention rate on corrections appropriations in state j ;

u_{00j} is a random state effect, the deviation of state j 's mean initial first year retention rate from the grand mean institutional retention rate.

γ_{100} is the grand mean slope of first year retention rate.

γ_{101} is the regression slope of the linear growth retention rate on economic health in state j ;

γ_{102} is the regression slope of the linear growth retention rate on higher education appropriations in state j ;

γ_{103} is the regression slope of the linear growth retention rate on Medicaid appropriations in state j ;

γ_{104} is the regression slope of the linear growth retention rate on corrections appropriations in state j ;

u_{10j} is a random state effect, the deviation of state j 's mean slope first year retention rate growth from the grand mean institutional retention rate growth.

Parametric Equations Defining Combined Model

The parametric equations defining the combined model are given as:

$$\text{Level 1: } Y_{tij} = \pi_{0ij} + \pi_{1ij}(\text{YEAR}) + e_{tij}$$

$$\begin{aligned} \text{Level 2: } \pi_{0ij} = & \beta_{00j} + \beta_{01j}(\text{BACHELOR}) + \beta_{02j}(\text{MASTER}) + \beta_{03j}(\text{TOTMIN}) + \\ & \beta_{04j}(\text{SMALL}) + \beta_{05j}(\text{MEDIUM}) + \beta_{06j}(\text{LOWSEL}) + \\ & \beta_{07j}(\text{MEDSEL}) + \beta_{08j}(\text{MEANINST}) + \beta_{09j}(\text{MEANRES}) + \\ & \beta_{010j}(\text{MEANSTSV}) + \beta_{011j}(\text{MEANGRNT}) + \\ & \beta_{012j}(\text{MEANTUIT}) + \beta_{013j}(\text{MEANAID}) + \\ & \beta_{014j}(\text{MEANREMD}) + r_{0ij} \end{aligned}$$

$$\begin{aligned} \pi_{1ij} = & \beta_{10j} + \beta_{11j}(\text{BACHELOR}) + \beta_{12j}(\text{MASTER}) + \beta_{13j}(\text{TOTMIN}) + \\ & \beta_{14j}(\text{SMALL}) + \beta_{15j}(\text{MEDIUM}) + \beta_{16j}(\text{LOWSEL}) + \\ & \beta_{17j}(\text{MEDSEL}) + \beta_{18j}(\text{MEANINST}) + \beta_{19j}(\text{MEANRES}) + \\ & \beta_{110j}(\text{MEANSTSV}) + \beta_{111j}(\text{MEANGRNT}) + \\ & \beta_{112j}(\text{MEANTUIT}) + \beta_{113j}(\text{MEANAID}) + \\ & \beta_{114j}(\text{MEANREMD}) + r_{1ij} \end{aligned}$$

$$\text{Level 3: } \beta_{00j} = \gamma_{000} + \gamma_{001}(\text{UNEMPLOYMENT}) + \gamma_{002}(\text{HIGHER ED \$}) + \gamma_{003}(\text{MEDICAID \$}) + \gamma_{004}(\text{CJS \$}) + u_{00j}$$

$$\beta_{01j} = \gamma_{010}$$

$$\beta_{02j} = \gamma_{020}$$

$$\beta_{03j} = \gamma_{030}$$

$$\beta_{04j} = \gamma_{040}$$

$$\begin{aligned}
\beta_{05j} &= \gamma_{050} \\
\beta_{06j} &= \gamma_{060} \\
\beta_{07j} &= \gamma_{070} \\
\beta_{08j} &= \gamma_{080} \\
\beta_{09j} &= \gamma_{090} \\
\beta_{010j} &= \gamma_{0100} \\
\beta_{011j} &= \gamma_{0110} \\
\beta_{012j} &= \gamma_{0120} \\
\beta_{013j} &= \gamma_{0130} \\
\beta_{014j} &= \gamma_{0140}
\end{aligned}$$

$$\beta_{10j} = \gamma_{100} + \gamma_{101}(\text{UNEMPLOYMENT}) + \gamma_{102}(\text{HIGHER ED \$}) + \gamma_{103}(\text{MEDICAID \$}) + \gamma_{104}(\text{CJS \$}) + u_{10j}$$

$$\begin{aligned}
\beta_{11j} &= \gamma_{110} \\
\beta_{12j} &= \gamma_{120} \\
\beta_{13j} &= \gamma_{130} \\
\beta_{14j} &= \gamma_{140} \\
\beta_{15j} &= \gamma_{150} \\
\beta_{16j} &= \gamma_{160} \\
\beta_{17j} &= \gamma_{170} \\
\beta_{18j} &= \gamma_{180} \\
\beta_{19j} &= \gamma_{190} \\
\beta_{110j} &= \gamma_{1100} \\
\beta_{111j} &= \gamma_{1110} \\
\beta_{112j} &= \gamma_{1120} \\
\beta_{113j} &= \gamma_{1130} \\
\beta_{114j} &= \gamma_{1140}
\end{aligned}$$

(definitions of the various measures are as per prior partial models).