2018

THE ALLOCATION OF STATE APPROPRIATIONS AND STUDENTS ACROSS DIFFERENT TYPES OF PUBLIC INSTITUTIONS OF HIGHER EDUCATION

Joshua L. Bush

University of Kentucky, jlbush2@gmail.com

Author ORCID Identifier:

 https://orcid.org/0000-0001-6879-7990

Digital Object Identifier: https://doi.org/10.13023/ETD.2018.168

THE ALLOCATION OF STATE APPROPRIATIONS AND
STUDENTS ACROSS DIFFERENT TYPES OF PUBLIC
INSTITUTIONS OF HIGHER EDUCATION

DISSERTATION

A dissertation submitted in partial fulfillment of the
requirements for the degree of Doctor of Philosophy in the
Graduate School at the University of Kentucky

By

Joshua L. Bush

Lexington, Kentucky

Director: Dr. Eugenia F. Toma Professor of Public Policy and Administration

Lexington, Kentucky

2018

ABSTRACT OF DISSERTATION

THE ALLOCATION OF STATE APPROPRIATIONS AND STUDENTS ACROSS DIFFERENT
TYPES OF PUBLIC INSTITUTIONS OF HIGHER EDUCATION

Public higher education has evolved over time under the control of each individual state. The public system in each state is made up of distinctive types of institutions that together provide higher education in different formats. Public institutions may largely be classified into three groups based on the level of education provided including community colleges, regional institutions, and research universities. While the institutions employed are largely the same in each state, the extent to which each is utilized and the support given reflect the individual characteristics of the state.

This dissertation examines appropriations and enrollments by state and year in three classifications of universities: research universities, regional universities, and community colleges. The appropriations and enrollments in regional and community settings are measured relative to the same for research universities. The explanatory variables are political, economic, and demographic variables relevant in state finance to the allocation of state budgets.

There are three empirical chapters. The first uses Granger causality concepts to examine whether appropriations and enrollment have strong predictive effects on each other in the following year. Enrollment has no such effect on appropriations, while there is a weak effect the other way. The second chapter studies relative appropriations, finding that the proportion of appropriations allocated to regional institutions has remained consistent, while states have proportionally shifted toward community colleges. The third chapter studies enrollment, which is very stable for regional universities and has shifted toward community colleges relative to research universities. Again, political and economic factors are somewhat different in these models.

Examining year effects net of economics and politics, there are no such effects on appropriations; but for enrollment, regional universities grew somewhat relative to research universities in the earlier years (1986 to 1993), and community colleges grew throughout the period with pauses. The Great Recession is clearly visible in community college enrollments, growing as usual during an economic downturn.

Author's signature   Joshua L Bush

Date   May 9, 2018

THE ALLOCATION OF STATE APPROPRIATIONS AND
STUDENTS ACROSS DIFFERENT TYPES OF PUBLIC
INSTITUTIONS OF HIGHER EDUCATION

By

Joshua L. Bush

Dr. Eugenia F. Toma

Director of Dissertation

Dr. Eugenia F. Toma

Director of Graduate Studies

May 9, 2018

Date

For Heather and Beatrix

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

Overview of dissertation

Introduction

Public higher education represents a substantial investment of resources across many stakeholders including state governments. According to the National Center for Education Statistics, in 2014, states allocated more than $76 billion dollars to public higher education institutions from general funds. On average, states set aside 10% of the budget to support public higher education (*STATE EXPENDITURE REPORT*, 2016). Those appropriations subsidize the more than 14.5 million students enrolled in public institutions representing 72% of all post-secondary students in the US (*Fast Facts*, 2017). Investment of that size and affecting a large number of citizens has raised awareness and interest in support for public institutions. Despite the increased attention given to public higher education, relatively little has focused on how resources are allocated among institutional types.

Within each state public higher education is provided at institutions that differ by mission, level of degree program, and service. In the majority of states there are three types of institution: community colleges, regional universities, and research universities. The diverse services provided by each type of institution indicate that the allocation of students and resources may have a significant impact on the results of public higher education within a state.

Organization of Dissertation

Following this introductory chapter, an overview of the problem is given. Chapter two also provides a historical background of public higher education and how the system

has changed to serve additional students. The research questions and conceptual framework are also presented. Chapter three presents the existing literature about state appropriations. The studies included reveal the range of academic fields that have considered higher education appropriations including economists, political scientists and higher education researchers each of whom expanded the possible explanations for variation in support. Chapter three also explores the differences between institutional types. Those differences include mission, student type, revenue sources, and how resources are expended. The variation in what each type of institution does and how it provides services illustrate why the allocation of students and appropriations is an important question.

Chapter four outlines the statistical methods used and describes the variables included. Because the consideration of more than two related dependent variables requires statistical methods not previously employed in this area, a description of the method and how it is implemented is included. Chapters five, six and seven present the results of the study. First in chapter five, a Granger Causality model is used to determine the relationship between enrollments and the allocation of appropriations. Chapters six and seven use compositional data analysis methods to model the relationship between the allocation of students and appropriations and demographic, economic, and political variables. Finally, chapter eight provides the conclusions and policy implications drawn from the results.

Chapter Two

State governments have long been responsible for subsidizing public higher education. In addition to serving as a financial resource, state governments also charter public institutions and provide governance. Through control over institutional charters and a major revenue stream, states determine the institutional composition of the public higher education system.

Public higher education systems are made up primarily of three types of institutions: community, regional, and research. There are substantial differences between institutional types in the level and the cost of education provided. Community colleges provide two-year degrees and certifications aimed at preparing students for the workplace at a relatively low cost. Regional institutions are the low-cost providers of four-year degrees along with limited graduate programs. While both community and regional institutions are primarily focused on education, research universities have a dual mission to provide the highest levels of graduate studies in addition to undergraduate education, while pursuing a research agenda. The result of a more diverse student population and research mission is a higher cost per student (Desrochers & Wellman, 2011).

It is the prerogative of each state to determine the extent to which each type of institution is utilized and how to allocate direct institutional appropriations. States must balance the desire to increase or maintain access to post-secondary education, while confronting escalating costs and the need to fund other state programs such as Medicare, corrections, and K-12 education. As a result, while the actual dollar amount of appropriations provided by the state directly to institutions has increased over time, these

resources have become a smaller proportion of the overall state budget and a smaller component of institutional revenues (Kane, Orszag, Apostolov, Inman, & Reschovsky, 2005).

Although all states face a common dilemma in providing access to higher education as educational costs continue to rise faster than available resources, the sovereignty of states relative to public post-secondary education has led to wide variation in the use of institutional types and the allocation of funding among them. It is unclear whether these decisions are based on systemic changes in public higher education priorities overall or simply decisions of a state. Given the differences in mission and outputs of various institutional types, disparities in allocation would be expected to have an impact on the level and quantity of post-secondary education available within a state.

Research in direct institutional appropriations has focused on the overall levels of support provided by state governments and has largely ignored the allocation among institutions of different types. To understand financing in public higher education and implications of these state policies, the distribution of appropriations must also be examined.

Statement of the Problem

Public higher education is supported by a number of stakeholders including the students and their families, government, and private donors (Johnstone, 2004). For many institutions, appropriations from state and local governments have become a diminishing source of revenues due to economic, demographic, and political pressures (Kane et al., 2005; McLendon, Hearn, & Mokher, 2009). In addition to reduced financial support

from the state government, institutions have been charged with increasing access to post-secondary education to as many students as possible (Heller, 2001).

To meet the demands of educating an increasingly diverse student population, states have incorporated several different types of institutions to form the public system. Significant overlap exists and each type of institution plays a unique role within the larger system offering specific academic programs to targeted student groups. Although the types of institutions differ substantially in mission, the allocation of appropriations among the three types has received little attention.

Instead, research on state appropriations to higher education has largely focused on the total amount of funding to all institutions or on funding for a single type or institution and has explored appropriations in several contexts including supply and demand (Clotfelter, 1976; Peterson, 1976), business and political cycles (Boylan, 2010; Humphreys, 2000), and the political climate within a state (Kane, Orszag, & Gunter, 2003; McLendon, Hearn, & Mokher, 2009; Tandberg, 2010; Trostel & Ronca, 2009). The findings of that research indicated variation in appropriations was associated with a number of demographic, economic, and political variables, although consensus has not been reached on the nature of those relationships.

Building upon earlier work, McLendon, Mokher, and Doyle (2009) considered the competition for state appropriations between different types of institutions. However, that study was limited to the variation in funding at research universities versus other types of four-year institutions in a one-year cross-section. They also articulated additional research directions, which would be beneficial to an understanding of the allocation of state resources to public higher education institutions.

This study expands on the extant literature in two important ways. First, it employs compositional data analysis techniques allowing for the inclusion of all three major types of public post-secondary institutions: community, regional, and research. The allocation of resources to each type of institution provides insight into the priorities of state decision makers. Second, changes over time are also considered. In addition to measuring differences between states, investigating how states altered appropriations policy over time is possible.

Historical Background

The history of post-secondary education in America predated independence. The first institutions of higher education were largely private and religion-based, providing each colony with educated ministers (Thelin, Edwards, Moyen, Berger, &Calkins, 2009). Higher education expanded rapidly in the first half of the 19th century, introducing new fields of study including engineering and science; however, a lack of governmental support resulted in the closing of many institutions. States, wary of the centralization of power experienced under English rule, sought to maintain control over institutions at a more local level. Charters for new institutions were provided in large numbers but were not accompanied by financial resources (Thelin et al., 2009).

The Morrill Act of 1862 paved the way for higher education to expand with resources provided by the federal government through grants of parcels of land, which could be sold or used by institutions. These "land-grant" universities also provided education in a wider range of fields including agricultural, mechanical, and military sciences, in addition to liberal arts (Thelin, 2011). The addition of public institutions broadened both the access to higher education and the subject matter available to

students. The early 20th century saw continued growth for higher education, along with many other industries, as well as the beginnings of standardization across institutions. While the growth was substantial, enrollments were largely limited to white men of means outside of some specialized institutions (Thelin et al., 2009).

The contribution of university research to the war effort in World War II led the government to continue funding research, providing additional support to higher education. In addition, the Servicemen's Readjustment Act of 1944 provided funds to allow soldiers returning from World War II the opportunity to participate in post-secondary education, greatly increasing the number of potential students. To meet the increased demand, junior colleges were opened. These institutions served as an initial step for many students who would then transfer to a four-year institution to complete coursework as well as professional training and certification in a number of fields (Thelin et al., 2009). To serve the growing number of students, legislators increased the size of state universities and chartered new institutions of varying type (Thelin, 2004).

The resulting shift in available space caused the percentage of students attending private colleges and universities to fall to approximately 30% of all students (Thelin, 2011). Since that time, enrollments have continued to grow (Figure 2.2). While overall growth has been significant, diversity in institutional types has not continued to increase (Birnbaum, 1983; Morphew, 2009). With the exception of a large increase in the number of for-profit institutions, the growth in higher education has come through expansion of the current institutional types (Morphew, 2009).

Research Question

This dissertation examines the allocation of state appropriations across public research, regional, and community institutions of higher education and identifies state characteristics that may impact the distribution of resources by institutional type. The allocations to different types of institutions are considered both in cross section and over time to identify trends.

The dependent variables considered in this study are the proportion of state appropriations to public higher education allocated to each institutional type and the proportion of public school students that attend each type. Explanatory variables include many of the economic, demographic, and political variables that have been associated with the overall level of appropriations in the extant literature.

Conceptual Framework

To explore the allocation of appropriations to the different types of public higher education institutions, I began with a framework similar to Tandberg (2010). That work was one of the first to attempt a theoretical model of state appropriations to higher education. His model posited that the decision on the level of appropriations was a function of the characteristics of the decision makers and of the decision situation including the demographics and economic environment of a state (Tandberg, 2010).

Tandberg (2010) included many of the state attributes associated with state appropriations in the extant literature within the decision situation. The attributes included were political, governmental institutions, higher education factors, economic, and demographic factors. The focus in that work was on the existence of interest groups and the role of lobbying in determining the overall appropriations. In that context, all

institutions were working for the common goal of increased support from the state, regardless of the institutional differences (Tandberg, 2010). While institutions constituted interest groups individually (Thomas & Hrebenar, 2004), there was no common interest for institutions when the policy decision shifted from the level of appropriations to the allocation of resources. Indeed, cooperation turned to competition to determine the resources available to each institution. While the decision under consideration involved a separate policy, the framework was useful in determining the factors that impacted the allocation of appropriations (see Figure 2.1).

Within that framework, the expected impact of the factors was based, in part, on an extension of the balance wheel hypothesis. Hovey (1999) first described higher education as the "balance wheel" of state budgets when he noted that during recessions appropriations were cut further than other state programs and during recoveries higher education benefited more than other programs. The more extreme cuts in funding level for higher education were explained by the unique ability to raise revenue from alternate sources. From the perspective of the legislature, faced with limited resources and a declining economy, shifting resources to programs that could not otherwise exist was preferable to subsidizing the cost of education. Then during recovery, Hovey (1999) noted that higher education represented an investment that both political parties could agree on, resulting in exceptional increases.

The same logic may be extended to the decision of how to distribute the appropriations to the different types of institution. Community colleges relied on state appropriations for nearly half (47%) of all revenues. Regional institutions received approximately one-third (32%) of revenues from the state, and research institutions got

less than a quarter (21%) (Desrochers & Wellman, 2011). The reliance on state funds for revenue at each type of institution is dependent on the ability of the institution to draw upon the alternatives available. Regional and research institutions are more likely to provide auxiliary services that provide additional revenue. For research institutions grants and contracts also provide alternative revenue sources. If the same logic was applied to allocating appropriations, the availability of alternative revenue streams for regional and research institutions should result in more support for community colleges, and to a lesser extent regional institutions, when appropriations were decreasing.

Significance of the Study

Financial support for higher education, and governmental support for public institutions in particular, has been cited as a mechanism to improve equality and social progress by extending the opportunity to engage in post-secondary education to all those who wish to pursue it (Heller, 2001; Ryan, 2004; Titus, 2006). The American system was uniquely constructed to offer students a wide variety of choice when deciding which institutional type provided the specific set of services desired (Thelin et al., 2009). State governments have each built and financially supported a system of public institutions to provide post-secondary education to a specific constituency. However, public resources were limited and choices had to be made.

Many studies of state appropriations to higher education have noted that funding has not kept pace with the increased costs of post-secondary education. State support to public institutions has fallen as a percentage of the overall state budget and as a percentage of institutional revenues (Kane et al., 2005). The decline in support has caused concern that access to post-secondary education will become limited (Kane,

2006). Available resources may be affected by many variables outside of the legislature's control; however, the decision on how to allocate funds remains a policy decision. With the exception of McLendon, Mokher, and Doyle (2009), the allocation of resources to the different types of institutions has been largely ignored by scholars.

The distribution of resources among the different types of public institutions may have a significant impact on equity among potential students. While access to post-secondary education is a primary goal for public institutions, not all students have the opportunity to attend selective research universities (Doyle, 2007). Prior to the G.I. Bill, higher education was largely reserved for students from wealthy families. Growth in public higher education was driven, in part, by a desire to provide access to a wider proportion of potential students and to provide equity in opportunity (Thelin, 2011). Therefore, the decision to support one type of institution at the expense of another was a choice to benefit a specific group of students. In addition, it has been shown that increases in state funding improved institutional performance (Zhang, 2008), so the decision to fund specific schools benefited a specific set of students.
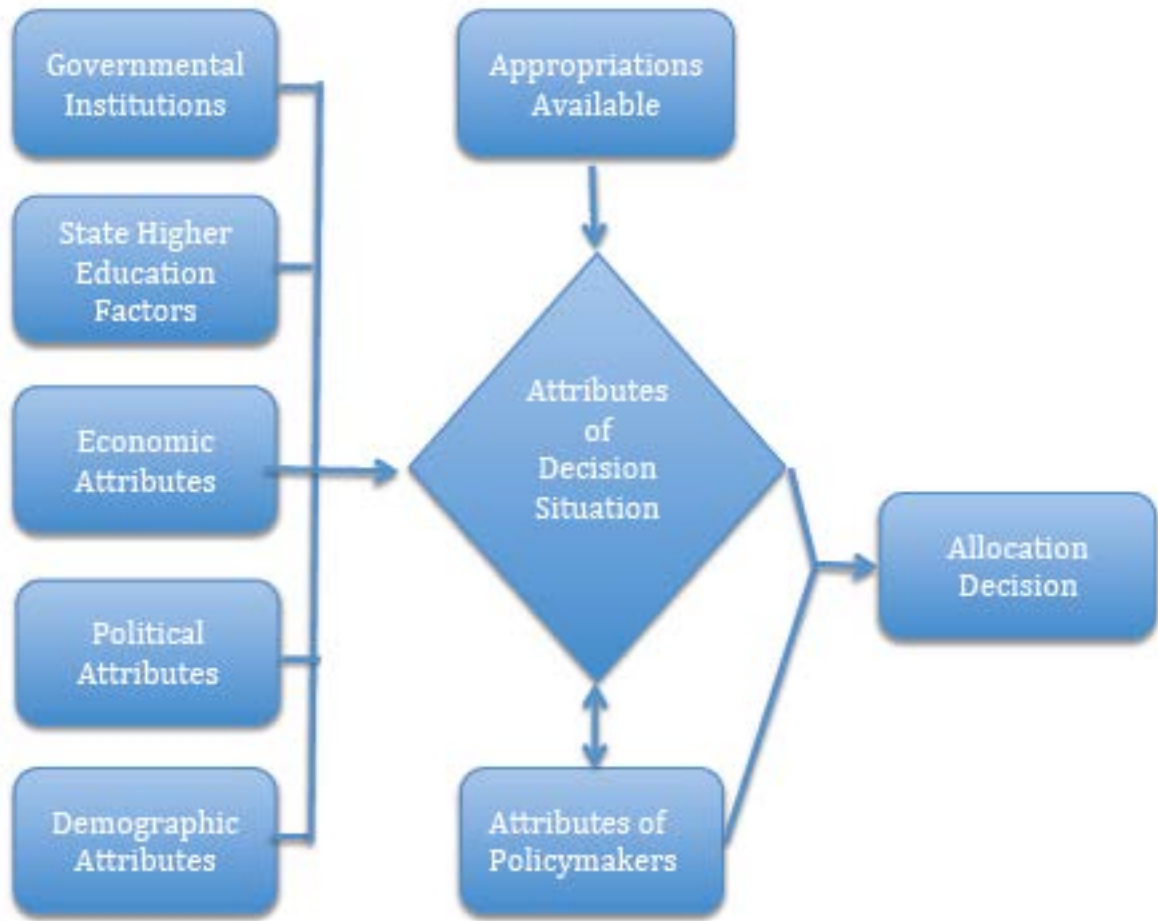
Figure 2.1. Appropriations decision model.
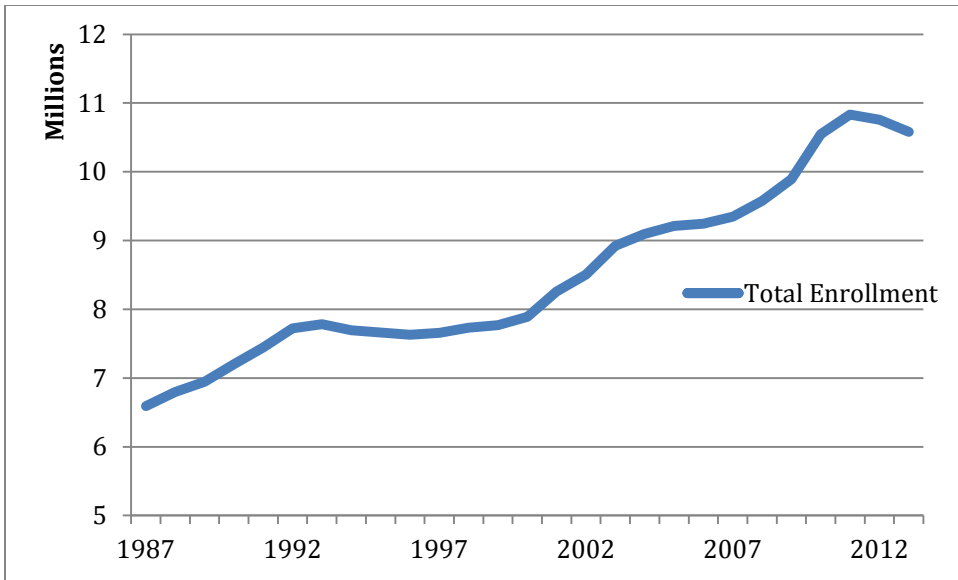
Figure 2.2 Total enrollment for public institutions.

Chapter Three

The study of state support for higher education through budget appropriations has brought together several different areas of research. The nature of appropriations, being determined by each state individually, has resulted in the variation that researchers can capitalize on to assess why there are differences. Early work conceived of appropriations and higher education in general within a supply and demand model. Other work focused on the impact of external cycles on state appropriations for higher education. In the early 2000s, research turned towards policy explanations of levels of funding using political variables (Conner & Rabovsky, 2011). Until recently, one common thread running throughout the literature was the focus on overall levels of appropriations to higher education without regard to how those resources were allocated to the actual institutions (McLendon, Mokher, & Doyle, 2009).

State Appropriations for Higher Education

Appropriations have provided a convenient gauge of state commitment to public higher education; however, the literature was split on how best to measure appropriations so that comparisons could be made across states and time. Studies have been performed using total appropriations (Toutkoushian & Hollis, 1998) and scaling appropriations by the number of students or population of a state (Nicholson-Crotty & Meier, 2003). Additionally, the percentage of a state's budget set aside for higher education (Delaney & Doyle, 2007; Doyle, 2007; Okunade, 2004; Rizzo, 2004) and the percentage of median income devoted to higher education have been studied (Archibald & Feldman, 2006; McLendon, Hearn, & Mokher, 2009). Those studies have used a wide array of

demographic, economic, bureaucratic, and political variables to explain differences in appropriation policies.

Using many of these studies as a starting point, McLendon, Mokher, and Doyle (2009) investigated the division of resources between different types of institutions, specifically, the appropriations allocated to research institutions versus other types of public four-year institutions. The findings suggested that appropriations were, at least in part, reflective of the types of students (graduate or undergraduate) and programs (STEM fields) offered at public four-year institutions (McLendon, Mokher, & Doyle, 2009). This initial study of the distribution of appropriations was an attempt to explain the observed preference for research institutions across states; however, when placed in the context of trends over time and additional types of institutions, further questions arose.

State appropriations have generally followed a cyclical pattern that mirrored the recession and recovery economic cycle of a state (Delaney & Doyle, 2011). Hovey (1999) described appropriations to higher education as the "balance wheel" of state budgets, being cut disproportionately in lean economic times and likewise benefiting during recovery. However, that pattern of increases and decreases did not extend equally to all types of institutions. In fact, since at least 1987, there has been a national trend eroding the *privileging* of research universities and instead favoring community colleges and, to a lesser degree, regional institutions. The increased relative proportion of appropriations for lower-cost institutional types, even while research universities continued to engage in more costly activities, indicated a shift in priorities for public higher education. Studying the differences in support for different types of four-year institutions was an important first step in this field of study; however, as with the overall

level of state appropriations, it was important to consider the entirety of the public system to gain perspective.

Each institutional type played a specific role within the larger public higher education system, and each relied on governmental support to differing degrees. Doctoral universities engaged in more resource intense types of activities such as graduate education and research but also had access to a wider array of revenue sources than other types of institution. Community colleges provided lower levels of education, generally two-year degrees and certificates, at relatively low cost but depended on appropriations for a large percentage of revenues. Regional institutions fell in the middle on both costs and availability of alternative revenues. The allocation of resources among the varied institutional types determined level and quantity of higher education within a given state.

Appropriations and the Business Cycle

As with all state funded programs, higher education appropriations were subject to the resources available, which, in turn, were determined by broader economic factors and political preferences. State constitutions required balanced budgets leading states to increase expenditures during economic expansion and to reduce spending during recessions (Adams, 1977). Higher education was unique among state programs in the ability to charge students tuition and to increase those charges to offset the loss of state funding. The availability of alternate revenue streams led policymakers to focus cuts on higher education to support other programs funded solely by the state and to return funding once economic conditions improved. The pro-cyclical nature of overall state

expenditures was exacerbated in higher education due to the ability to raise alternate sources of funding (Delaney & Doyle, 2011).

Further pressure was placed on institutions as enrollments run counter to the business cycle. The primary reason for this is the opportunity cost of market work foregone. Betts and McFarland (1995) found that enrollments at community colleges increased by 4%, when unemployment rates increased by 1% for all adults. That finding held true across the country and revealed another tie between the business cycle and higher education (Betts & McFarland, 1995). Leslie and Ramey (1986) found a similar relationship between enrollment and employment, including several institutional types, across regional areas.

Humphreys (2000) used real per capita income to relate the business cycle to appropriations to higher education. Humphreys concluded that drops in support during recessionary years was equal to the increases that occurred during expansions and that both of those responses were larger than those attributed to other areas of government spending. However, later work by Boylan (2010) disputed that finding and instead suggested that the responses were asymmetric. Boylan showed that the decreases experienced in down years were smaller than the increases that accompanied a growing economy, resulting in larger government expenditures over time.

The evidence for a relationship between the business cycle and state funding for higher education was strong. However, it did not incorporate the process by which the decisions were made. Political actors were integral to determining how resources were expended; and while they were also subject to economic conditions, their decisions were not based solely on economic considerations.

Political Attributes

Much of the current research on state appropriations for higher education has been focused on political factors. In particular, the competition between state funded programs such as Medicaid, corrections, K-12 education, and higher education have received intense scrutiny. Here again, the ability to raise funds through tuition sets higher education apart from other programs.

The choice faced by state governments was also impacted by mandates from the federal government. Okunade (2004) described a number of state programs that were growing at the expense of higher education including corrections, K-12 education, health care, and welfare. Kane et al. (2005) also found that Medicaid expenditures were crowding out appropriations to higher education. In addition, Rizzo (2004) showed that within the funds set aside for public education, the percentage going to higher education was falling. These findings of eroded support relative to other state programs have only increased the need for investigation of the relationship of political factors to state appropriations for higher education (Conner & Rabovsky, 2011).

Incorporating political measures into models of appropriations policy has added significantly to the literature, bringing a new perspective from political science. Variables such as partisan control over the legislature or gubernatorial office were shown to have a statistical impact on appropriations (Archibald & Feldman, 2006; Nicholson-Crotty & Meier, 2003; Weerts & Ronca, 2013). Those additional factors may now be included in more robust models of appropriations. McLendon, Hearn, and Moker (2009) described five possible explanations for changes in state funding for higher education: the

political system, economic conditions, demographics, higher education policy conditions, and governance.

The balance wheel model of appropriations to higher education was first put forth by Hovey (1999). In his model, higher education provided the flexibility required for legislatures to make budgets balance. When economic conditions resulted in insufficient revenues, support for higher education was shifted to other priority programs. The converse also held true during economic growth: Higher education benefited more than other programs. Delaney and Doyle (2007) tested the balance wheel model finding that higher education did in fact receive larger cuts and larger increases than other programs including K-12 education, corrections, and health.

The common thread running across the cited studies was a focus on overall appropriations measured in several different ways (Tandberg, n.d.). McLendon, Moker, and Doyle (2009) were the first to consider how appropriations were distributed to different types of institutions. Their work focused on the differences between states in the amount of appropriations directed towards research universities and non-research universities. As with overall appropriations, there were substantial differences between states in the amount provided; although, with one exception, states provided more support per FTE student to research universities.

The data for McLendon, Moker, and Doyle (2009) represented a cross-section of institutions during the 2003-2004 academic year. Many of the economic, demographic, and political variables previously identified in the literature were included in the model to explain the differences between states. The findings indicated that states sent more support to research universities, in part because they engaged in more costly activities

19

like research and graduate education; but the differences also arose because of political differences that benefited research institutions (McLendon, Mokher, & Doyle, 2009). The study also specified some possible extensions for future research including consideration of other types of institutions as well as how the relationships changed over time.

Democratic legislature. Throughout the appropriations literature, political party affiliation has been linked with higher education appropriations. Democratic control in the legislature has consistently been associated with increased spending on higher education (Archibald & Feldman, 2006; Koshal & Koshal, 2000; McLendon, Mokher, & Doyle, 2009; Okunade, 2004). Higher levels of appropriations, in total, should result in additional resources provided to research universities. A question regarding a preference for a given level of education remained. Democratic preferences for two- or four-year degrees were conditional on other factors within the state (Dar, 2010), though it is expected that access was the primary Democrat Party goal, resulting in larger allocations for community colleges and regional institutions.

Citizen ideology. In addition to the party affiliation of elected leaders, states may also be classified by the liberalism of the citizenry (Berry, Ringquist, Fording, & Hanson, 1998). Increased liberalism has been associated with increased levels of support for higher education (Archibald & Feldman, 2006; Tandberg, 2008). The availability of more appropriations increased the allocation for research universities.

Government Institutions

Governor's institutional powers. The role of the governor in the budget process and by extension allocation of appropriations varied throughout the states depending on

the institutional powers associated with the office (Beyle, 2003). Governors possessing more strength acted as a check against the legislature limiting overall spending (Bails & Tieslau, 2000) and were also in a position to make tradeoffs between higher education and other state programs to balance the budget (McLendon, Mokher, & Doyle, 2009). As noted previously, higher education spending was particularly vulnerable to those types of tradeoffs (Delaney & Doyle, 2007; Kane et al., 2003). When the "balance wheel" expectations are extended to institutional types; reductions in the available appropriations and a willingness to make tradeoffs indicate that increased institutional powers lead to a smaller relative allocation for research institutions.

Definitions of Variables

  Political variables. The influence of a political party within a given state has been shown to have an impact on the appropriations policy both at the legislative and gubernatorial levels. Previous studies have linked Democratic control of the legislature and the governor's office to increased overall appropriations levels (Archibald & Feldman, 2006; Knott & Payne, 2004; Nicholson-Crotty & Meier, 2003) and noted that Democrats were generally in favor of increased governmental spending (McLendon, Hearn, & Mokher, 2009; Nicholson-Crotty & Meier, 2003). Each party held a different view on the size and scope of government activities, with Democrats generally preferring greater levels of spending on social programs, including higher education, than Republicans (Archibald & Feldman, 2006; Okunade, 2004). Democratic control of legislatures has also been linked to increased support for less research intensive institutions favoring access over higher levels of education (McLendon, Mokher, & Doyle, 2009).

Public higher education variables. Just as each state has the opportunity to develop the public higher education system, it also must determine how to oversee the institutions. Governance has been shown to affect a number of policies related to higher education (Hearn, Griswold, & Marine, 1996; McLendon, Mokher, & Doyle, 2009). A wide range of power and responsibility delegated to the various governance entities existed, and it was the centralization of power that was used to classify the states into groups (McGuinness, 2003). States where the governance board had significant program and budgetary power were labeled consolidated, while those boards with a lesser role were coordinating boards; and two states, Michigan and Pennsylvania, employed planning boards, which were merely advisory. It was unclear which type of institution was favored by a given governance structure.

Another tool available to state policymakers to control the distribution of appropriations was funding formulas put in place for precisely that purpose. In academic year 2007, 27 states employed funding formulas for some portion of appropriations ("Funding Formula," 2006). Many states that employed formulas used enrollment or other measures to determine funding; however, recently a number of states integrated or planned to integrate performance measures such as graduation rates into the formula. While these formulas should determine the precise distribution of resources, they were subject to frequent change or removal. The complexity of these formulas also made it difficult to categorize the states in any meaningful way, beyond the fact that a formula was in place.

The final system variable considered was the prevalence of private higher education options within the state. During the drastic increase in participation in higher

education following WWII, public institutions were founded and expanded at a rapid rate to meet the demand (Thelin, 2004). In 2009, public institutions enrolled approximately 75% of all undergraduate students (Desrochers & Wellman, 2011). The distribution of private institutions was largely concentrated in the Northeastern and Midwestern states and provided an alternative to the public institutions.

Economic and demographic variables. Economic and demographic characteristics of states helped to determine the resources available to support as well as the need for public higher education. Previous studies have shown a relationship between state resources, measured as GDP and income, and larger expenditures on higher education and other public programs (Lowry, 2001a). Increases in the unemployment rate have been linked to decreased appropriations (Kane et al., 2005; Toutkoushian & Hollis, 1998). Increased unemployment may also indicate the need for job training of the type most often associated with community colleges. Likewise, prior studies have found a positive relationship between the number of potential students, population or some subset of population, and appropriations (Toutkoushian & Hollis, 1998). The distribution of appropriations was also likely to change, based on the number of potential students; states needing to serve more students were likely to turn towards lower-cost alternatives.

Higher education governance. Each state has implemented a governing board to oversee the public higher education system and assist in the budgeting process. The responsibilities and powers given to the board varied across the states. The strength of a board was determined by the level of power consolidation. On one end of the continuum were planning or coordinating boards, which had little power over institutions, while on the other end were consolidated boards providing centralized governance (McGuiness,

1997). Strong boards were likely to have the political strength to increase appropriations through budget requests, and higher levels of appropriations increased the allocation for research universities.

State Higher Education Factors

Funding formula. A number of states have, at various times, implemented a formula-based model for allocating appropriations. The formulas were usually restricted to an incremental portion of appropriations and typically used simple metrics like enrollment to determine the allocation, although some states have attempted to incorporate performance measures to compare benchmark institutions ("Funding Formula," 2006). In times of rising appropriations, formulas were useful to reward high performance; however, during recession or other dips in support, states often abandoned the formula. In general, having a funding formula in place resulted in high-performing institutions, which were often the selective research universities, increasing in relative support. However, the complexity of the formulas implemented across states as well as frequent changes prevent consideration of specific criteria and specification is therefore limited to noting whether or not a formula was in place during a given year.

Demographic and Economic Attributes

Both GDP and median income are measures of the wealth of a state and the potential resources available. As these measures increase, governmental revenues also rise and allow for increased funding of higher education (Humphreys, 2000; Lowry, 2001b). More appropriations are expected to result in a larger allocation for research universities. Unemployment is also an indicator of the statewide economy. Increases in unemployment are likely to result in reduced overall appropriations (Kane et al., 2005;

Toutkoushian & Hollis, 1998). In addition, community colleges are often seen as job training institutions, which are likely to be utilized as unemployment increases.

One final factor that has not been utilized in previous research is population density. Each type of public institution is intended to serve a specific group of students. Community colleges serve local students; regional institutions serve a portion of students across the state; and research universities serve entire states. States where density is low are unlikely to support a large number of small community colleges as the fixed costs of supporting many campuses would be inefficient. Instead, those states can support a small number of regional and research institutions where students can congregate. As density increases, appropriations are expected to shift towards community colleges.

Institutional Diversity in American Higher Education

The strength of higher education in the Unites States resulted from the wide range of institutions that were incorporated into the system, which has long been considered one of the hallmarks of the American system (Carnegie Commission on Higher Education, 1973). Institutions differ on a number of characteristics including governance (public or private), level of degree (associate's, master's, doctoral), size, cost (Morphew, 2009), and mission (Morphew & Hartley, 2006) among others. The inherent benefit of different types of institution within the higher education system is to provide students with the opportunity to select the most appropriate option to meet current needs and future goals, thereby increasing the odds of success. Increased diversity may also provide flexibility to the overall system allowing institutions to specialize in the fields demanded locally, while maintaining a wide range of programs across the system (Stadtman, 1980).

Birnbaum (1983) noted the potential for specialization and diversity to reduce the number of local students who left a state to pursue higher education and rarely returned to the home state to benefit the local economy, a phenomenon known as "brain drain." By providing a wide range of options and prices, states could keep more students from leaving to pursue higher education options not available in their home state. Allowing institutions to specialize could also contribute to keeping costs low by focusing on a limited number of programs or degree offerings rather than a few institutions attempting to provide students with the entire spectrum of academic possibilities (Morphew, 2009).

Institutional Mission

Mission statements are used across all manner of organizations as a tool to focus the activities undertaken on the overall goal and the manner in which the activities are conducted. Public institutions of higher education are no different, using the mission statement to formally declare the goals sought. The diversity among institutions is reflected in their mission statements; in fact, even when similar language is utilized, there remain stark differences in goals. For instance, many public institutions include a stated goal of serving the local area in the mission statement; however, the local area for a community college is often relatively small compared to the region of a state served by many master's institutions or entire states served by research universities.

Over time the mission of an institution may change to reflect the current environment. Community colleges, more than any other type of institution, have had to evolve in mission. Junior colleges were first chartered in the early 1900s as institutions for students to attend for the first two years of post-secondary work before transferring to a four-year institution as well as providing technical instruction for students interested in

moving directly to the workforce (Bailey & Averianova, 1998). A third role was added around the 1960s when continuing education for adults became more popular resulting in a change from junior to community college (Thelin et al., 2009).

Providing access to higher education to all who wish to participate remains one of the main purposes for supporting public institutions. Eaton (1994) described these institutions as "unparalleled in providing, sustaining, and expanding educational opportunity and accomplishment within society" (p. 5). Indeed, for many students from disadvantaged backgrounds, community colleges provide a low-cost option for entry into post-secondary education in which they would otherwise be unlikely to participate.

The role of community colleges continues to be providing access to the widest possible range of potential students whether they need remedial work, transfer credits, or job training. There is a cost associated with expanding the mission of the institution to include these disparate types of education. While access increases, spreading resources across multiple programs reduces the resources available for each individual program (Cohen & Brawer, 1996). The tradeoff between access and quality is stark at the community college level, as all students are welcomed; however, the level of education available is restricted to vocational training and two-year degrees.

Like community colleges, many regional institutions have missions primarily focused on educating the local population. These universities provided a relatively low cost option for students seeking higher levels of education including bachelor's and master's degrees. Mission statements for regional institutions focused on providing access to a diverse student population and a commitment to teaching liberal arts (Morphew & Hartley, 2006). A comparison of mission statements for community and

regional institutions revealed many similarities with the main difference being the level of education.

Research institutions, on the other hand, emphasize a commitment to research even above the provision of education (Morphew & Hartley, 2006). Serving the community/civic duty from the perspective of the research institution goes beyond educating the citizens to the provision of new knowledge. These institutions are also often involved with statewide initiatives such as extension offices that can carry research out to the community (Thelin, 2011).

Each institutional type plays a specific role within the public higher education system. Similarities in mission by institutional type make clear that community colleges are primarily tasked with increasing access to post-secondary education to as many potential students as possible. There is a tradeoff in the breadth of programs offered, from vocation specific training to liberal arts and remedial courses, and the depth of programs, which is limited to certificates and two-year degrees. Likewise, regional institutions focus on access to higher education; however, the focus is on four-year degrees and providing higher levels of education than can be found at community colleges. Research universities go one step further, providing graduate education and focusing on the production of knowledge. Each institutional type overlaps the others in certain areas, and mission drift may occur taking an institution away from the primary mission (Morphew, 2009); however, there are clear roles for each type within the public system. Those roles are reinforced by the sources of support for each type of institution and are reflected in the way resources are expended.

Institutional Revenues

Public higher education has historically been heavily subsidized by state government through budget appropriations, allowing institutions to charge students far less than the actual costs of education (Kane, 2006). Over time, state resources have failed to grow at the same rate as enrollments (Figure 3.2) or higher education costs. Higher education is unlike government entitlement programs; however, and the users are often required to pay, at least in part, for services rendered through tuition. Having the option to increase tuition and use budget dollars for other priorities makes higher education appropriations an attractive source of savings for state governments. This ability to rely on tuition caused Hovey (1999) to describe higher education as the "balance wheel" of state budgets, noting that in times of reduced state revenues, higher education appropriations fell faster than other spending categories and that as state revenues increased appropriations rose more quickly than other spending. This pattern was confirmed by Figure 3.2 as recessions in the early 1990s and 2000s resulted in falling average appropriations, only to rise again during the recovery period ("State Higher Education Finance FY 2011," 2012). In addition to business cycle pressures faced by states, studies have shown that competition from other government programs like Medicare, corrections, and K-12 education has resulted in a smaller portion of the state budget being allocated to higher education (Archibald & Feldman, 2006; Kane et al., 2005; Okunade, 2004).

Reduced appropriations were likely to affect institutional types differently, since different institutional types had alternate sources of revenues. For example, on average in academic year 2009, research universities received 25.1% of operating revenue from

state appropriations; regional institutions received 35.5% of revenues directly from the state; and community colleges received 51.1% (Desrochers & Wellman, 2011). A lower percentage of revenues arising from state appropriations reflected an institution's access to other revenue streams, such as the ability to charge higher tuition prices, auxiliary enterprises, and extramurally supported research. Alternatively, policymakers considered factors such as institutional enrollment when determining the proper allocation of appropriations. Before investigating the impact of appropriations policy on each institutional type, it was important to know if distributions reflected intentional choices.

Financial support for public colleges and universities is provided by several groups of stakeholders including the government, students and their families, and individual or institutional donors (Johnstone, 2004). Institutions may also engage in activities that provide revenue such as operating hospitals or other auxiliary enterprises not solely focused on providing education (Slaughter & Rhoades, 2004). These stakeholders provide the resources necessary to carry out the mission of each institution. However, the degree to which an institution relies on a given stakeholder may shape the priorities and the activities an institution may pursue (Slaughter & Leslie, 1997). Resource dependency theory, in the higher education context, suggests that organizational goals and activities are impacted by the level of support provided by each cost-sharing entity (Fowles, 2010; Liefner, 2003; Titus, 2006). Therefore, systemic differences in the way public higher education institutional types are funded also result in diverse activities and goals for each type of institution.

To understand the differences in institutional support, the revenue for each type is presented in Table 3.1. As defined by the Delta Cost Project (Desrochers & Wellman,

2011), revenue streams can be separated into several categories: (1) net tuition, which can be defined as the amount paid by students and their families to attend; (2) state and local appropriations that are not earmarked for a specific purpose; (3) grants and contracts that require specific work and may arise from government or private entities; (4) auxiliary enterprises that charge a fee for service; and (5) private gifts and the related investment and endowment income. The degree to which institutions rely on each of these revenue streams will, at least in part, focus the activities pursued and may help explain changes over time.

For all types of public institutions, revenues provided by state and local governments have fallen as a percentage of overall revenues (Table 3.1). The reduction in support in relative terms rose as the increase in costs continued to outpace appropriations growth as well as inflation and household incomes (Toutkoushian, 2001). As reliance on appropriations waned, institutions have turned towards alternative revenue sources. While the proportion of revenues provided by all sources other than state and local support have grown, the largest increase has come from tuition revenue (Table 3.1). Since 1985, the proportion of public institution revenue provided by tuition has grown from less than 25% to more than 40% (Figure 3.3.

The overall trend in revenues clearly showed a reduced reliance on state and local appropriations and increased reliance on tuition. However, the extent to which an institution must rely on tuition is also determined by the other streams of revenue available. For example, research universities lost $2,550/FTE student in appropriations between 2000 and 2010; those revenue losses were offset by increases greater than $3,000 in both tuition and grants and contracts in addition to a $2,250 increase in

auxiliary enterprises ending the decade with nearly $6,000 more revenue per student, an increase of 18% (Table 3.1). Master's institutions were also able to end the period with more revenues per student despite lower appropriations. For these institutions, where research infrastructure and auxiliary enterprises were more limited, the tuition increases ($2,250) were large enough to completely offset lost appropriations (-$1,870). At community colleges, revenues on a per FTE basis fell between 2000 and 2010. Lower appropriations (-$1,380) were only partially made up by increases in tuition ($945), grants and contracts ($175), and auxiliary enterprises ($60).

Each of the public institutional types faced falling per student appropriations revenue; their ability to replace those revenues was dependent upon the availability of alternative revenue streams and the ability to increase prices. Therefore, the reliance on state and local appropriations varied across institutional types. In addition, in reaction to an institutional shift toward a certain revenue stream and away from another, the institution also had to adjust how resources were spent (Fowles, 2010).

Institutional Expenditures

Expenditures are particularly useful for providing evidence of institutional activities and give a measure of how the institutional adheres to the stated mission. Desrochers and Wellman (2011) calculated spending category averages, including education related and research related, over time by institutional type.

Unlike research universities, both regional and community colleges pursued missions focused narrowly on providing educational services. The expenditure data revealed that regional institutions expended 69.6% of operating outlays on education and related costs in academic year 2009, up 2.5% from ten years prior (Figure 3.1). Some

research activities were also undertaken; however, only 4.5% of expenditures were committed to those undertakings on average (Desrochers & Wellman, 2011). Likewise, community colleges spent a large majority of resources on education, 79.0% in academic year 2009, up less than 1% over the previous ten-year period (Desrochers & Wellman, 2011). The focus of regional and community institutions on education was clear from the large percentage expenditures devoted to that activity as well as the commitment over time (Figure 3.1).

Spending patterns at research universities also reflected the stated purpose with 44.0% of total expenditures dedicated to education and related costs, while 29.2% went towards research in 2009 (Desrochers & Wellman, 2011). In fact, in the prior ten-year period, education expenditures in research institutions declined by 0.8%, whereas research expenditures increased by 9.1%, suggesting a significant increase in research activity while maintaining a relatively equal percentage of expenditures related to education.

The outlays of public institutions of higher education may be separated into several categories. The Delta Cost Project has calculated grouped expense categories, which attempted to combine both direct and indirect costs for each category. Expenditures are classified into education and related, research and related, public service and related, scholarships, and auxiliary services spending (Desrochers & Wellman, 2011; Hurlburt & Kirshstein, 2012). By examining the distribution of resources to each of these categories, it is possible to compare the priorities of each institutional type.

The overall spending per student at each type of institution shows that research institutions spend more than double the amount that regional universities spend and

nearly three times more than community colleges (Table 3.2). The total dollars spent is one measure of the resources that are available to an institution. To compare the relative weight given to each category of spending the percentage of resources spent on a given grouped expense will be used.

Education and related expenses have been calculated as an approximation of the true value of resources dedicated to the educational mission of the institution (Desrochers & Wellman, 2011). These resources include instruction, student services, and the proportion of general support and maintenance costs associated with those activities (Desrochers & Wellman, 2011). Education and related costs at research universities made up 43% of total operating expenditures in 2010. Master's and community institutions both dedicated more than 70% of operating expenditures on those costs (Table 3.2). The divergence in how resources are expended may be explained, in part, by the expanded mission of research institutions to engage in knowledge creation through research activities.

Research universities are mandated to provide the highest levels of education as well as engage in research activities that may benefit those beyond the campus as outlined in their mission statements (Morphew & Hartley, 2006). The emphasis on research activities is apparent from the research expenditures that made up 22% of operating expenditures in 2010 (Table 3.2). At regional and community institutions, spending on research made up less than 5% of operating expenditures. The allocation of resources within each institutional type illustrates the priorities of each institution and is also reflective of the revenue sources available.

The American public higher education system has developed over time to pursue a two-fold goal of providing widespread access to post-secondary education to a diverse student population while maintaining high quality. Rather than attempt to maximize each of these goals within each institution, several different types of institution are utilized. Each institution serves a specific role within the overall system determined by its mission (Morphew & Hartley, 2006) and receives support from state and local governments (Thelin, 2004).

Table 3.1 *Revenue by source and institutional type per full time equivalent (FTE) student.*

Public Research	2000	2010	$ Difference	% Difference
Net Tuition	5,469 (17%)	8,611 (22%)	3,142	57%
State & Local Appropriations	10,682 (32%)	8,132 (21%)	-2,550	-24%
Grants & Contracts	5,248 (16%)	8,389 (22%)	3,141	60%
Auxiliary Enterprises	9,193 (28%)	11,445 (29%)	2,252	24%
Private Gifts, Investments, Endowment	2,369 (7%)	2,338 (6%)	-31	-1%
Total Operating Revenue	32,961 (100%)	38,915 (100%)	5,954	18%
Public Master's				
Net Tuition	4,114 (24%)	6,360 (34%)	2,246	55%
State & Local Appropriations	7,725 (45%)	5,859 (32%)	-1,866	-24%
Grants & Contracts	1,586 (9%)	2,158 (12%)	572	36%
Auxiliary Enterprises	3,276 (19%)	3,725 (20%)	449	14%
Private Gifts, Investments, Endowment	464 (3%)	362 (2%)	-102	-22%
Total Operating Revenue	17,165 (100%)	18,464 (100%)	1,299	8%
Public Community College				
Net Tuition	2,324 (19%)	3,269 (27%)	945	41%
State & Local Appropriations	7,095 (57%)	5,712 (47%)	-1,383	-19%
Grants & Contracts	1,646 (13%)	1,821 (15%)	175	11%
Auxiliary Enterprises	1,252 (10%)	1,310 (11%)	58	5%
Private Gifts, Investments, Endowment	222 (2%)	158 (1%)	-64	-29%
Total Operating Revenue	12,539 (100%)	12,270 (100%)	-269	-2%

Table. 3.2 *Expenditures by use and institutional type per full time equivalent (FTE) student.*

Public Research	2000	2010	$ Difference	% Difference
Education & Related	14,756 (44%)	15,951 (43%)	1,195	8%
Research & Related	6,905 (21%)	8,271 (22%)	1,366	20%
Public Service & Related	2,517 (8%)	2,753 (7%)	236	9%
Net Scholarships & Fellowships	2,194 (7%)	1,396 (4%)	-798	-36%
Auxiliary Enterprises	6,836 (21%)	8,800 (24%)	1,964	29%
Total Operating Expenditures	33,208 (100%)	37,171 (100%)	3,963	12%
Public Master's				
Education & Related	11,723 (66%)	12,240 (71%)	517	4%
Research & Related	591 (3%)	642 (4%)	51	9%
Public Service & Related	949 (5%)	927 (5%)	-22	-2%
Net Scholarships & Fellowships	1,950 (11%)	1,307 (8%)	-643	-33%
Auxiliary Enterprises	2,573 (14%)	2,018 (12%)	-555	-22%
Total Operating Expenditures	17,786 (100%)	17,134 (100%)	-652	-4%
Public Community College				
Education & Related	10,484 (77%)	9,501 (73%)	-983	-9%
Research & Related	91 (1%)	96 (1%)	5	5%
Public Service & Related	650 (5%)	504 (4%)	-146	-22%
Net Scholarships & Fellowships	1,552 (11%)	1,622 (12%)	70	5%
Auxiliary Enterprises	894 (7%)	1,365 (10%)	471	53%
Total Operating Expenditures	13,671 (100%)	13,088 (100%)	-583	-4%

Table 3.3. *Shares of Education and Related Spending by Institutional Type*

State	Research				Regional				Community College			
	Net tuition	Subsidy	Total	Student share	Net tuition	Subsidy	Total	Student share	Net tuition	Subsidy	Total	Student share
AL	8,358	11,356	19,714	42%	5,639	6,396	12,035	47%	2,854	8,287	11,141	26%
AK	5,126	20,283	25,409	20%	5,168	14,910	20,078	26%	2,077	13,853	15,930	13%
AZ	7,109	6,311	13,420	53%					2,463	6,949	9,412	26%
AR	5,685	5,411	11,096	51%	3,561	5,671	9,232	39%	2,557	6,995	9,552	27%
CA	8,268	14,144	22,412	37%	4,953	7,499	12,452	40%	1,025	7,338	8,363	12%
CO	11,214	3,863	15,077	74%	8,266	2,579	10,845	76%	5,708	4,002	9,710	59%
CT	9,624	17,935	27,559	35%	6,260	9,849	16,109	39%	3,651	9,435	13,086	28%
DE	14,039	8,027	22,066	64%	8,904	11,348	20,252	44%	4,910	6,113	11,023	45%
FL	4,785	7,183	11,968	40%	3,718	6,883	10,601	35%	2,894	7,025	9,919	29%
GA	6,611	5,862	12,473	53%	4,320	6,368	10,688	40%	3,052	6,950	10,002	31%
HI	6,471	14,948	21,419	30%					2,338	11,087	13,425	17%
ID	5,186	8,154	13,340	39%	5,542	4,709	10,251	54%	3,653	9,635	13,288	27%
IL	9,592	9,133	18,725	51%	7,136	7,664	14,800	48%	2,535	5,526	8,061	31%
IN	9,589	8,424	18,013	53%	5,690	3,999	3,999	142%	3,550	3,026	6,576	54%
IA	8,450	7,682	16,132	52%	5,612	6,246	11,858	47%	3,819	6,508	10,327	37%
KS	6,911	6,575	13,486	51%	5,226	5,833	11,059	47%	2,600	8,581	11,181	23%
KY	8,565	8,928	17,493	49%	6,394	4,990	11,384	56%	1,599	6,175	7,774	21%
LA	4,726	7,296	12,022	39%	3,882	7,559	11,441	34%	3,046	7,017	10,063	30%
ME	8,069	5,296	13,365	60%	8,411	4,578	12,989	65%	3,519	8,905	12,424	28%
MD	7,468	8,071	15,539	48%	7,177	6,523	13,700	52%	4,342	8,276	12,618	34%
MA	10,205	6,312	16,517	62%	6,690	5,815	12,505	53%	4,563	6,056	10,619	43%
MI	10,364	6,187	16,551	63%	8,491	3,943	12,434	68%	4,088	6,472	10,560	39%
MN	11,141	14,375	25,516	44%	6,477	4,541	11,018	59%	5,389	5,775	11,164	48%
MS	6,020	5,786	11,806	51%	4,227	10,038	14,265	30%	1,893	6,779	8,672	22%
MO	8,743	7,077	15,820	55%	5,239	5,778	11,017	48%	3,278	5,246	8,524	38%
MT	7,827	3,408	11,235	70%	5,681	5,630	11,311	50%	4,209	8,145	12,354	34%

Table 3.3. *Continued*

| State	Research				Regional				Community College			
	Net tuition	Subsidy	Total	Student share	Net tuition	Subsidy	Total	Student share	Net tuition	Subsidy	Total	Student share
NE	5,484	6,238	11,722	47%	4,202	6,458	10,660	39%	2,366	8,262	10,628	22%
NH	11,644	3,181	14,825	79%	9,283	3,060	12,343	75%	6,321	4,554	10,875	58%
NJ	12,490	5,057	17,547	71%	10,140	5,161	15,301	66%	4,376	3,394	7,770	56%
NM	4,709	7,520	12,229	39%	3,715	8,426	12,141	31%	1,786	8,255	10,041	18%
NY	5,610	15,421	21,031	27%	5,707	8,244	13,951	41%	4,109	6,626	10,735	38%
NC	6,115	11,723	17,838	34%	4,685	9,364	14,049	33%	1,710	10,726	12,436	14%
ND	7,627	7,024	14,651	52%	6,240	5,248	11,488	54%	4,252	7,076	11,328	38%
OH	9,947	5,908	15,855	63%	7,380	4,366	11,746	63%	5,156	4,114	9,270	56%
OK	7,427	5,962	13,389	55%	4,585	4,430	9,015	51%	2,432	5,354	7,786	31%
OR	8,458	3,733	12,191	69%	5,391	4,984	10,375	52%	3,883	9,643	13,526	29%
PA	14,479	6,065	20,544	70%	8,449	5,659	14,108	60%	4,783	5,193	9,976	48%
RI	11,813	1,828	13,641	87%	7,270	2,317	9,587	76%	4,053	4,865	8,918	45%
SC	11,214	3,863	15,077	74%	9,303	4,946	14,249	65%	5,289	5,105	10,394	51%
SD	5,782	6,183	11,965	48%					5,519	5,223	10,742	51%
TN	6,737	11,115	17,852	38%	5,334	4,740	10,074	53%	3,604	4,459	8,063	45%
TX	7,148	5,636	12,784	56%	5,579	6,209	11,788	47%	2,758	6,404	9,162	30%
UT	5,129	8,760	13,889	37%	4,541	4,552	9,093	50%	2,903	11,600	14,503	20%
VT	17,797	4,395	22,192	80%	11,260	(433)	10,827	104%	7,386	509	7,895	94%
VA	9,602	6,305	15,907	60%	5,524	6,638	12,162	45%	2,962	5,346	8,308	36%
WA	10,192	14,134	24,326	42%	6,017	7,684	13,701	44%	2,826	7,466	10,292	27%
WV	9,227	3,863	13,090	70%	5,033	5,676	10,709	47%	2,206	5,685	7,891	28%
WI	7,625	6,865	14,490	53%	5,492	5,503	10,995	50%	3,471	14,452	17,923	19%
WY	4,310	14,021	18,331	24%					1,853	11,811	13,664	14%
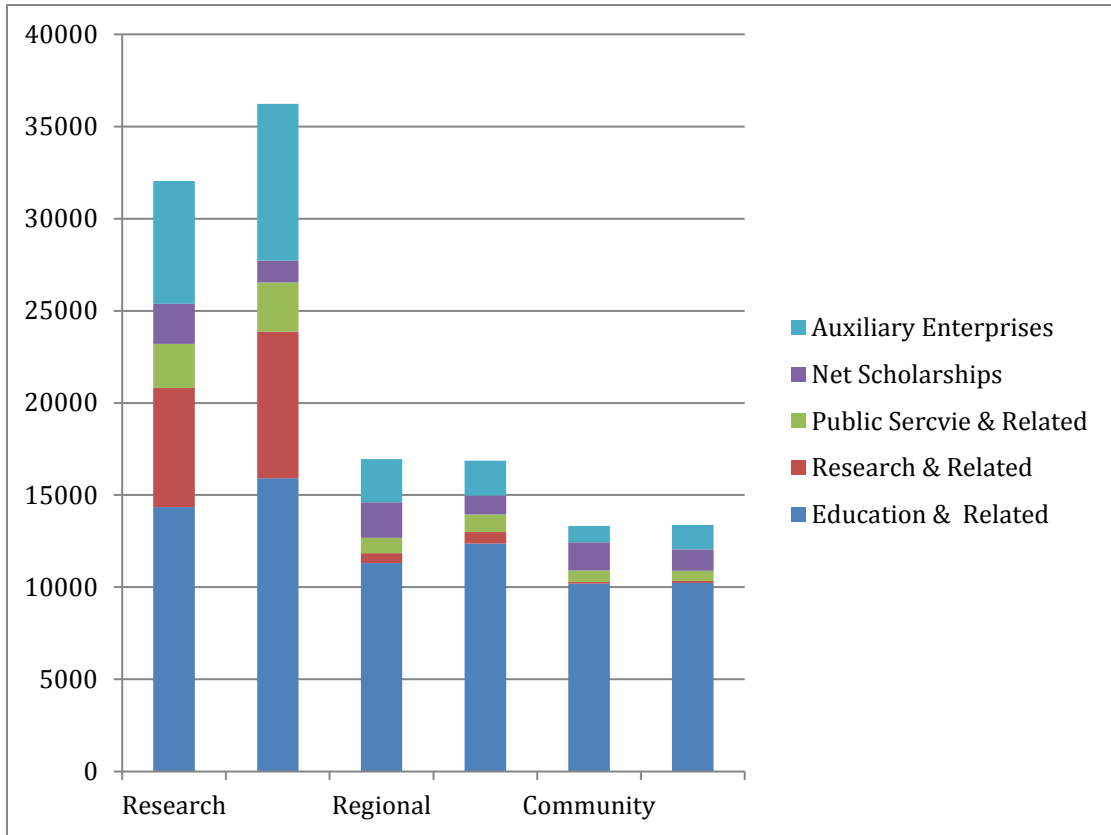
Figure 3.1. Expenditures per FTE by institutional type for 1999 and 2009 (in 2009 $).
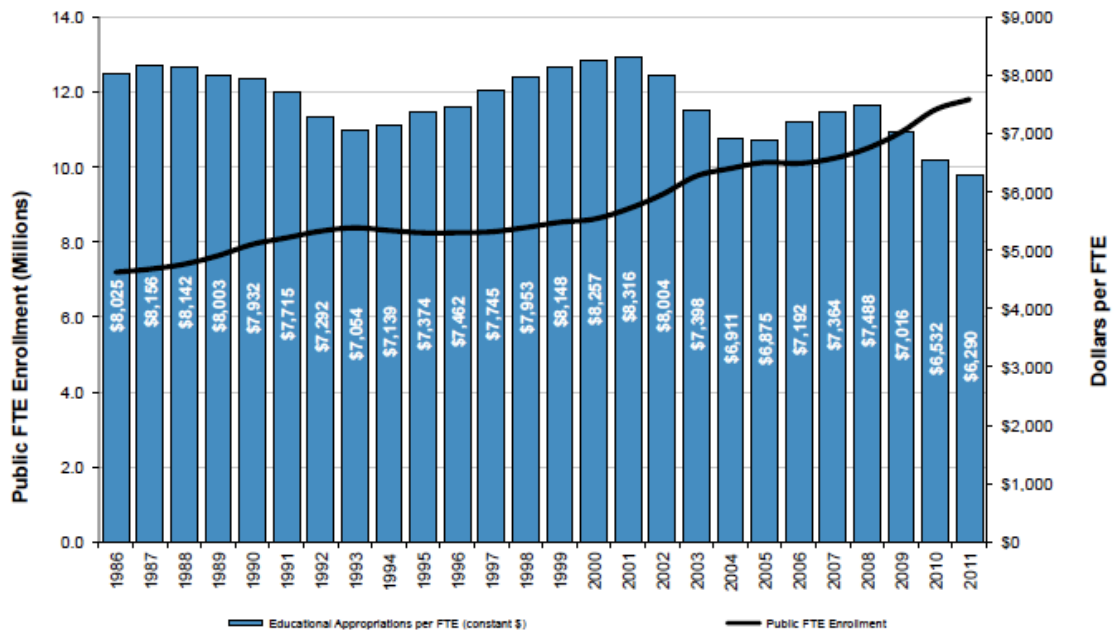
Note: Constant 2011 dollars adjusted by SHEEO Higher Education Cost Adjustment. Educational Appropriations include ARRA funds. (HECA)
Source: SHEEO

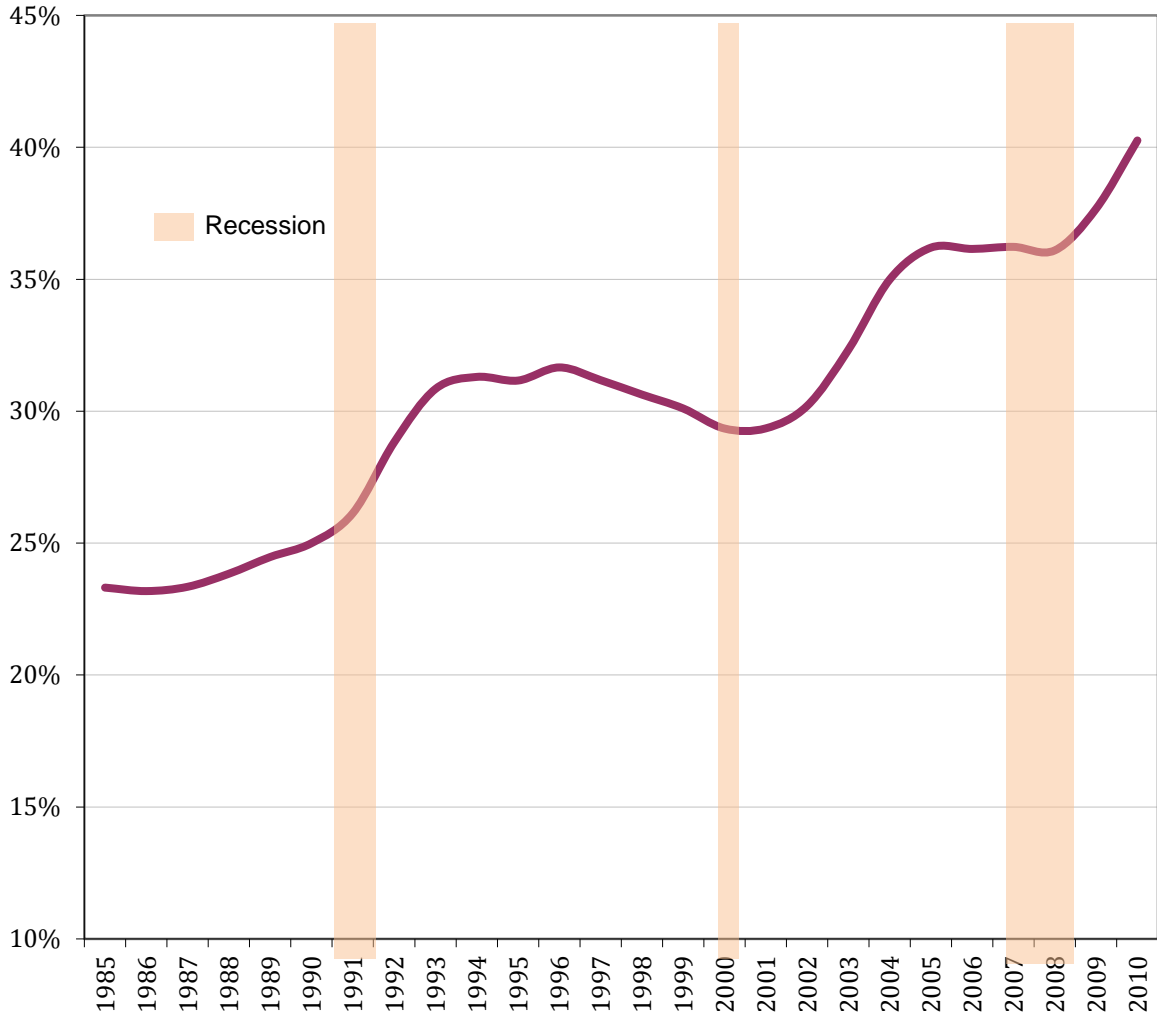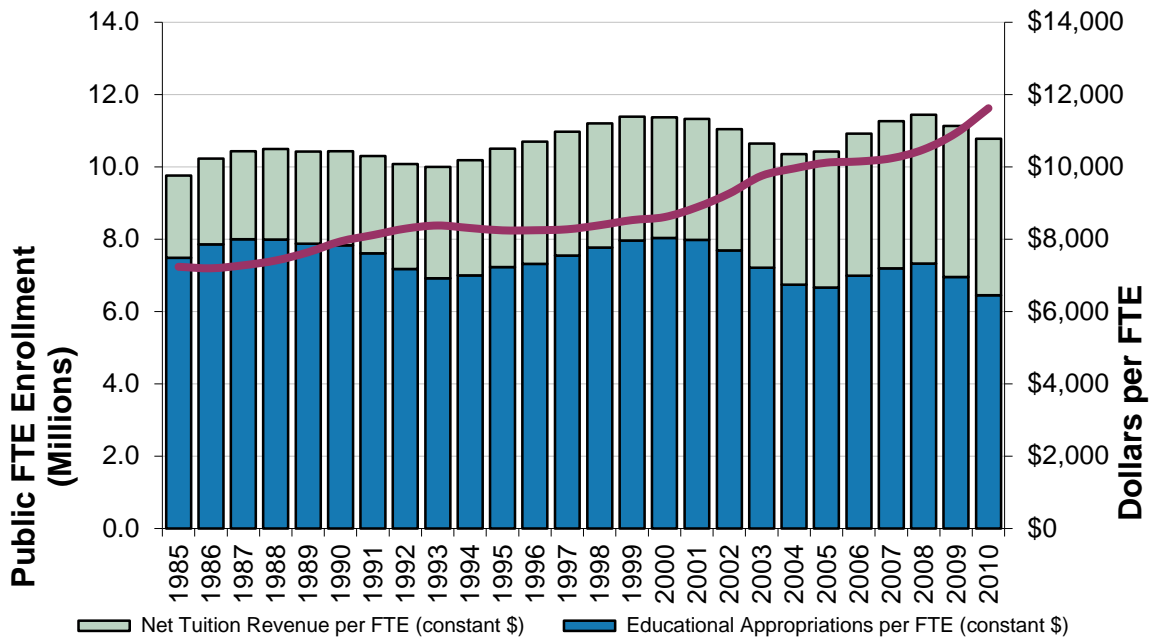*Figure 3.2.* Public FTE enrollment and educational appropriations per FTE.

Figure 3.3. Net tuition as a percent of public higher education revenue.

Note: *Net tuition revenue used for capital debt service is included in net tuition revenue, but excluded from total educational revenue in calculating the above figures.*

Source: *State Higher Education Executive Officers - SHEF Report*

Note: Constant 2010 dollars adjusted by SHEEO Higher Education Cost Adjustment (HECA). Educational Appropriations include ARRA funds.
Source: SHEEO

Figure 3.4. Public FTE enrollment, appropriations, and net tuition.
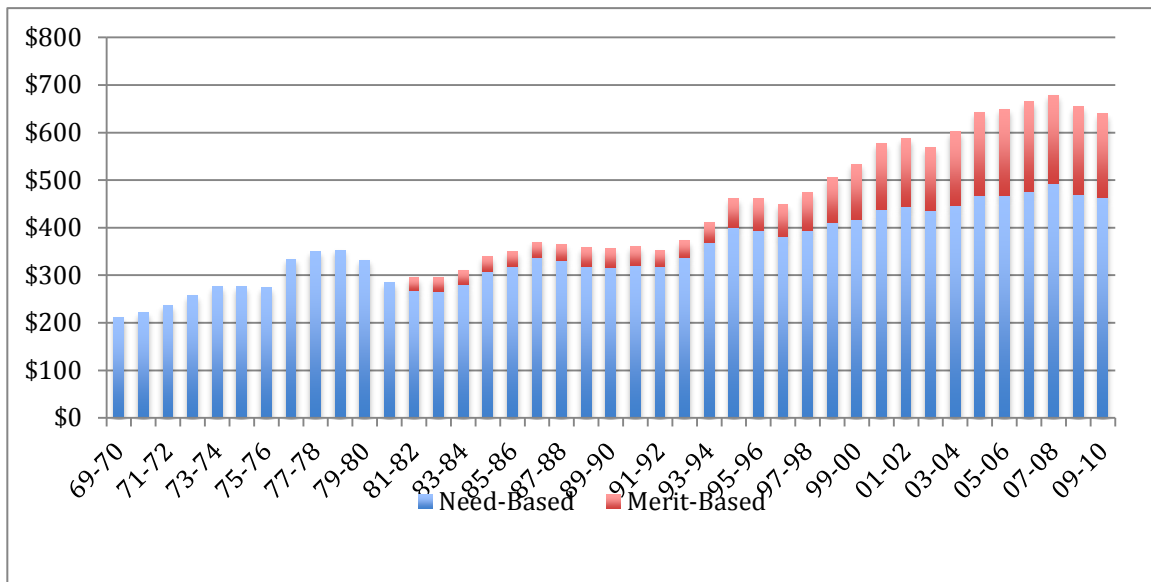

Figure 3.5. State grants per FTE by type.
Source: CollegeBoard Trends in Student Aid, 2011

Chapter Four

This study examines state public higher education finance policy, specifically, the allocation of budget appropriations among institutional types from 1988 to 2008 to determine if systematic changes in the allocation of appropriations by institutional type occurred. The policy decision related to the allocation of the state resources provided to support public higher education has generally been a secondary consideration to the overall amount appropriated. Prior work related to appropriations has revealed a number of variables that are related to the level of support as well as theories as to why those variables matter. The "balance wheel" theory (Hovey, 1999), posited that support for public higher education experienced larger cuts than other public programs during times of economic hardship due, in part, to the availability of alternative revenue sources, namely tuition collected from students. In good economic times the increases to appropriations for higher education would also be larger than other public programs. That pattern, over time, was confirmed by Doyle and Delaney (2009), where they note that economic downturn does indeed result in cuts to public higher education but that the increases during economic growth are not of equal size. This framework for describing appropriations for higher education is extended here to the allocation of the appropriations to different institutional types.

Among the types of institutions employed by states to create the public system each differs in ability to raise funds from alternative sources. Community colleges rely primarily on state support and tuition; students are likely to reside off-campus and spending less time engaged at the institution. Regional and research institutions provide other services to students, room and board for example, that provide additional revenue

streams. Four-year institutions also often provide professional education and advanced degrees that command a higher tuition price. Research institutions also receive support from research activities that are not found at high levels in the other types of institutions. From this perspective, the allocation of support to public higher education institutions mirrors the legislature's allocation decision for the entire budget.

Like the state budget, the allocation of resources among institutions is a political decision that reflects the characteristics of the state and the people making the decision. Previous work in the area of appropriations provides a strong foundation to expand the consideration of allocations to each type of institution. The same influences that cause the overall level of support to fall should also cause the relative support at research universities to fall and conversely variables associated with increases in overall support should also be associated with more relative support at those institutions. This study includes many of the variables previously identified as being associated with appropriations.

Data Collection

Data from the Delta Cost Project (1988–2008) were used to investigate allocation of budget appropriations among institutional types. A collection of variables from a variety of sources was maintained as a longitudinal data set by Dr. Edward Jennings of the Martin School of Public Policy and Administration at the University of Kentucky, with secondary data obtained from publicly available sources or culled from the existing literature on state higher education policy.

Definition of appropriation proportion (dependent variable). The dependent variable(s) for all analyses used the proportion of state and local appropriations provided

44

to community colleges, regional, and research institutions. This proportion used

appropriation data included in the Delta Cost Project matched data set (Desrochers &

Wellman, 2011). For each academic year, the total appropriations provided to

institutions were summed by state, $A_s(y) = \sum_i \sum_{j=1}^{J} a(y)_{ij}$, where i represented the type

of institution (1= research, 2= regional, and 3=community) and j represented a specific

institution in a particular state s for a year y. The proportion for each type was calculated

by dividing the annual appropriation total for a particular institutional type (i) by the total

annual appropriations for the state,

$$P_{si}(y) = \frac{\sum_{j=1}^{J} a(y)_{ij}}{A_s(y)}.$$

Only appropriations for the specified institutional types were considered, so that the sum

of the proportions within any state equaled one, $P_{s1}(y) + P_{s2}(y) + P_{s3}(y) = 1$.

Additional variables of interest. Beyond the primary dependent and explanatory

variables, the average tuition revenue per FTE, population size, percentage of union jobs,

Gross Domestic Product (GDP), unemployment rates, and political characteristics were

also considered in analyses.

Average tuition revenue per FTE was calculated for each academic year (y) by

summing net tuition dollars for institutions within a state for each institutional type and

then divided by $FTE_{si}(y)$ or the total FTE students reported for each institution type,

$$T_{si}(y) = \frac{\sum_{j=1}^{J} t(y)_{ij}}{FTE_{si}(y)},$$

where $t(y)_{ij}$ represented the net tuition dollars for the jth institution for the ith institutional

type in academic year y.

Population size was obtained from Census Bureau from state annual population estimates (http://www.census.gov/popest/archives). Union membership density per state was measured annually and compiled from Bureau of Labor Statistics and Current Population Survey Reports; annual data on state unemployment also came from the Bureau of Labor statistics. GDP for each state was obtained from each year from the Bureau of Economic Analysis.

Political variables included strength and political party of the governor, the party in control of each house of the legislature, and the ideology of the citizenry and the government. Strength of the governor was based on a composite index that measured the governor's overall institutional power through six different indicators. Each indicator was measured on a 5-point scale, and the mean for the six indicators comprised the overall institutional score. A "5" signified a very powerful governor, while a "1" signified a very weak governor. The indicators included whether there were other separately elected state offices, the tenure potential of the governor, appointment power, budget power, veto power, and gubernatorial party control of the legislature. Data from this measure were available annually and came from Thad Beyle (2012). The political party control (Republican, Democrat, or split) of the Senate and House chambers of each state were provided annually from Paul Klarner (2013). The ideology of the citizenry and government measures, from Rich Fording, were collected annually from each state and used the scores developed by Berry et al. (1998).

General statistical considerations. Continuous variables were summarized with descriptive statistics (n, mean, standard deviation), and categorical variables were described with counts and percentages. Change scores were calculated as the difference

46

during the period (1987-2013). Line graphs were used to visualize trends over time.

These were provided by state and by institutional type (mean). To assess the between-

state variability that existed in the allotment of appropriations between institutional types,

data were also subset to include only one year (2013). Linear regression was used to

investigate factors related to the appropriation proportion; these were performed

separately for each institutional type. Finally, for investigating changes over time, cross-

sectional time series was used, with state included as a fixed effect. SAS v9.3 and

STATA v10 were used for all statistical analyses.

Compositional data analysis. The division of total appropriations into institutional types

results in three outcomes (proportions) that sum to one. In contrast, a multinomial

distribution results when each subject (state) has a discrete number of possible outcomes

(e.g. research, regional, community). While the probability of these outcomes sum to one,

for each subject (state) only one of the possible choices is observed. Therefore, in a

multinomial logistic regression, the outcome is categorical with a discrete number of

options or levels. The goal of this study is not to determine what institutional type is

favored or selected by each state but to understand how funding is allocated

proportionally to each type. By considering the proportion of funding allocated to the

three institutional types, the rate of appropriations can be treated as a continuous variable.

A set of three linearly dependent variables cannot be used in a multinomial logistic

regression without first creating categories such that each state would be assigned a

funding priority (research, regional, community, or equally distributed, see Appendix B

for further explanation). Because the goal of this study is to understand how funding is

distributed across the three types and not to select a specific type, compositional data analysis is appropriate.

Given that the dependent variable was calculated as the total appropriations to all types of institutions divided by appropriations to each individual institutional type, the traditional regression analyses were limited as they did not account for the appropriations being partitioned into three units that summed to one. However, data where the values were constrained to a sum, where they existed as relative to a whole, were defined as compositional and were analyzed using methods for compositional data (Aitchison, 1982). This method of analysis was particularly well suited to understanding the relative change of several components and exploring the relationship between them.

Methods for compositional data have often been utilized for budget share analysis (financial, time, and geological/chemical configurations) (Aebischer, Robertson, & Kenward, 1993; Aitchison, 1982; Fry, Fry, & McLaren, 2000; Rayens & Srinivasan, 1991). As an example, shares of household spending defined by expenditures allotted to a set of defined categories quantified the relative importance of each category to the household budget (Fry et al., 2000). Traditional analyses that focused on the actual or absolute frequencies associated with the components were insufficient to capture the dependencies between categories. While visualizations of the data were easily made using ternary plots (Cox, 2004), the restraint to a unit sum also constrained the variance-covariance matrix, violating the assumptions required of most traditional statistical tests designed for unconstrained data. Moreover, the correlations between proportions for a multinomial problem were difficult to interpret or portray accurately. In contrast, compositional data analysis provided a mechanism to better understand the relative

48

frequency with which different components occurred and to investigate how the proportions changed with respect to each other (Faes et al., 2011).

State and local appropriations were spread across several subgroups of institutional type given by A_k for k = research (1), regional (2), and community (3). Total appropriations were calculated as $A = \sum_{k=1}^{3} A_k$. The proportion going to each type defined the composition of appropriations

$$P_k = \frac{A_k}{A}$$

for k = 1, 2, 3, where $\sum_{k=1}^{3} P_k = 1$. The individual components calculated in this manner were not independent; an increase in one necessitated a decrease for one of the other types. Standard analysis were not designed for data constrained in this way (Aitchison, 1982; Faes et al., 2011).

The approach to analyzing the proportion of appropriations utilized an additive log ratio transformation of the data to remove the constraint, allowing for the appropriate application of more traditional analytical methods (Fry et al., 2000). Aitchison (1982) demonstrated that with, for example, three proportions that summed to one, the log of ratios resulting from dividing two of the proportions by the third resulted in new, transformed, and linearly independent variables. Here, these new variables were obtained by dividing the proportion of appropriations for regional institutions and community colleges by the proportion of appropriations for research institutions within a state for a given academic year; the ratios were then log-transformed,

$$r_2(y) = ln\left(\frac{P_{s2}(y)}{P_{s1}(y)}\right) \text{ and } r_3(y) = ln\left(\frac{P_{s3}(y)}{P_{s1}(y)}\right),$$

where $P_{si}(y)$ represented the proportion of appropriations for research (1) and regional (2) institutions and community colleges (3), respectively. While the choice of which

proportion did not impact the results (Faes et al., 2011), research institutions were chosen in this case because all states supported at least one research institution in all years, therefore, avoiding the possibility of having a zero in the denominator of the proportion calculation. For states with a proportion of zero for any particular year and institutional type, the zero was replaced by 0.01 (Fry et al., 2000).

The new variables $r_2(y)$ and $r_3(y)$ were then linearly independent and were used as dependent variables in standard regression analyses. Given the properties of logs, the ratios actually represented differences in the log proportions, i.e. $r_i = ln(P_{si}(y)) - ln(P_{s1}(y))$.

Therefore, positive regression coefficient estimates indicated greater proportions in community or regional (lower cost educational options) relative to research institutions, and negative regression coefficient estimates indicated relatively higher proportions to research. The result of this combined analysis was presented by dependent variable (r_2: regional vs. research and r_3: community vs. research). Scatterplots were used to visualize the changes in the log-ratios over time as well as the relationship between log ratios. Furthermore, within-state, linear regressions were used as an exploratory analysis of the changes in these ratios over time in addition to the ANOVA, linear regression, and cross-sectional time series analyses.

In addition to the stated mission, institutional priorities are driven by the providers of resources (Fowles, 2010; Slaughter & Leslie, 1997). For all institutions, revenues were derived from multiple sources; however, research universities were able to diversify revenue streams so that no one category made up more than 30% of overall revenues, while regional and community colleges relied mostly on tuition and appropriations (Table

3.1). Concentrated revenues should result in those institutional types focusing on activities valued by those providers.

Indeed, regional and community institutions expended more than three quarters of all resources on providing education and public service, the activities associated with students and their families who paid tuition and state and local governments that provided appropriations. Research institutions, on the other hand, received a significant amount of support from grants and contracts and spent a similar percentage of resources on those activities. The differing activities at each institutional type illustrated the specific role each played in the system. Therefore, the allocation of state and local government appropriations to each type of institution provided insight into the priorities of the legislature.

Table 4.1. *State Commitment to Public Higher Education, Fiscal Year 2010 (SHEF Data)*

State	FTE Enrollment	Appropriations[1]	Net Tuition Revenue[1]	Total Education Revenue[1]
Alabama	203,976	$6,361	$6,216	$12,009
Alaska	20,271	$12,606	$4,427	$17,033
Arizona	251,574	$6,322	$4,737	$10,773
Arkansas	121,359	$7,144	$4,572	$10,968
California	1,926,353	$5,941	$1,777	$7,718
Colorado	182,908	$3,781	$5,533	$9,314
Connecticut	85,033	$8,450	$5,882	$14,332
Delaware	32,417	$5,643	$9,392	$14,952
Florida	596,008	$5,922	$2,678	$8,599
Georgia	370,732	$7,319	$2,010	$9,312
Hawaii	39,857	$7,451	$2,973	$10,424
Idaho	49,251	$7,746	$2,746	$10,492
Illinois	401,303	$8,120	$4,023	$12,144
Indiana	265,277	$4,325	$5,878	$10,203
Iowa	127,128	$5,276	$5,769	$11,045
Kansas	137,374	$5,191	$4,241	$9,432
Kentucky	154,247	$7,532	$5,352	$12,884
Louisiana	178,931	$6,995	$2,649	$9,644
Maine	37,517	$6,215	$7,663	$13,878
Maryland	233,533	$7,163	$6,641	$13,803
Massachusetts	165,244	$6,006	$4,950	$10,956
Michigan	431,604	$4,822	$7,975	$12,797
Minnesota	215,009	$5,645	$5,145	$10,789
Mississippi	123,092	$7,942	$5,084	$13,025
Missouri	187,162	$6,074	$4,038	$10,112
Montana	38,909	$4,293	$4,426	$8,719
Nebraska	84,922	$6,731	$4,147	$10,878
Nevada	68,799	$7,800	$2,918	$10,718
New Hampshire	39,614	$2,884	$7,413	$10,297

Table 4.1. *Continued*

State	FTE Enrollment	Appropriations[1]	Net Tuition Revenue[1]	Total Education Revenue[1]
New Jersey	268,066	$7,136	$7,194	$14,330
New Mexico	98,710	$7,589	$1,749	$9,338
New York	571,414	$7,783	$3,785	$11,567
North Carolina	420,956	$9,007	$2,152	$11,159
North Dakota	37,736	$6,520	$6,221	$12,741
Ohio	443,353	$4,293	$5,180	$9,473
Oklahoma	142,024	$8,400	$4,206	$12,607
Oregon	160,595	$4,538	$4,730	$9,268
Pennsylvania	371,286	$5,159	$8,577	$13,736
Rhode Island	32,067	$4,817	$9,093	$13,909
South Carolina	166,783	$5,477	$6,468	$11,369
South Dakota	32,323	$4,809	$6,261	$10,496
Tennessee	190,286	$7,477	$4,119	$11,457
Texas	863,475	$8,897	$4,539	$13,435
Utah	118,446	$5,328	$3,679	$9,007
Vermont	21,778	$2,754	$12,046	$14,397
Virginia	312,598	$5,096	$5,886	$10,937
Washington	254,867	$5,831	$2,303	$8,134
West Virginia	78,798	$6,155	$6,488	$11,869
Wisconsin	237,403	$6,499	$3,993	$10,492
Wyoming	25,587	$13,090	$1,846	$14,936
US	**11,617,955**	**$6,451**	**$4,321**	**$10,732**

[1] Per FTE

Table 4.2. *Distribution of FTE Students by Institutional Type, Academic Year 2008*

	Research		Regional		Community College	
	FTE Students	Percentage of FTE Students	FTE Students	Percentage of FTE Students	FTE Students	Percentage of FTE Students
Alaska	18,474	97%			539	3%
Alabama	64,326	36%	65,334	36%	50,639	28%
Arkansas	24,756	25%	42,655	43%	32,447	32%
Arizona	93,282	46%	11,638	6%	99,786	49%
California	236,764	17%	334,611	24%	796,882	58%
Colorado	81,705	48%	44,698	26%	43,436	26%
Connecticut	25,046	30%	30,451	36%	28,337	34%
Delaware	18,716	60%	3,323	11%	9,248	30%
Florida	225,396	48%	72,597	15%	174,390	37%
Georgia	85,763	33%	87,934	34%	86,306	33%
Hawaii	16,505	46%	3,694	10%	15,510	43%
Iowa	49,733	42%	11,335	10%	56,604	48%
Idaho	20,208	44%	17,690	39%	7,882	17%
Illinois	125,172	36%	51,038	15%	169,842	49%
Indiana	123,540	57%	44,890	21%	48,366	22%
Kansas	56,018	45%	23,285	19%	44,573	36%
Kentucky	40,893	27%	59,695	39%	53,243	35%
Louisiana	59,271	38%	59,493	38%	37,074	24%
Massachusetts	50,225	36%	36,154	26%	54,238	39%
Maryland	49,338	27%	64,603	35%	69,275	38%
Maine	27,508	77%	885	2%	7,295	20%
Michigan	168,963	45%	77,963	21%	132,238	35%
Minnesota	41,927	23%	66,736	36%	77,227	42%
Missouri	52,120	31%	59,221	35%	56,136	34%
Mississippi	49,064	45%	11,222	10%	48,786	45%
Montana	22,582	65%	7,262	21%	4,680	14%

Table 4.2. *Continued*

	Research		Regional		Community College	
	FTE Students	Percentage of FTE Students	FTE Students	Percentage of FTE Students	FTE Students	Percentage of FTE Students
North Carolina	118,008	40%	62,131	21%	117,846	40%
North Dakota	26,179	74%	3,533	10%	5,520	16%
Nebraska	32,308	49%	12,292	19%	21,443	32%
N. Hampshire	25,170	77%			7,403	23%
New Jersey	6,869	3%	115,855	50%	106,933	47%
New Mexico	46,786	56%	10,865	13%	25,599	31%
Nevada	35,489	54%	21,475	33%	8,378	13%
New York	76,722	15%	289,588	56%	147,343	29%
Ohio	242,648	68%	16,678	5%	97,540	27%
Oklahoma	41,828	32%	46,959	36%	40,575	31%
Oregon	55,011	47%	13,282	11%	48,069	41%
Pennsylvania	145,757	47%	94,995	31%	68,255	22%
Rhode Island	13,655	45%	7,012	23%	9,836	32%
South Carolina	44,725	33%	39,043	28%	53,292	39%
South Dakota	16,779	60%	6,737	24%	4,466	16%
Tennessee	77,535	47%	36,493	22%	50,671	31%
Texas	308,257	42%	128,266	17%	305,957	41%
Utah	41,741	41%	39,641	39%	21,576	21%
Virginia	121,517	46%	51,282	19%	92,643	35%
Vermont	11,061	56%	8,708	44%		
Washington	61,474	28%	36,633	17%	121,409	55%
Wisconsin	63,747	31%	79,383	38%	65,202	31%
West Virginia	25,673	37%	37,991	55%	5,965	9%
Wyoming	10,549	46%			12,486	54%

Source: Author's calculations based on Delta Cost Project data

Table 4.3. *State Appropriations by Institutional Type, Academic Year 2008*

State	Research Appropriations		Regional Appropriations		Community College Appropriations	
	Total ($)	Percent[1]	Total ($)	Percent[1]	Total ($)	Percent[1]
Alabama	921,521,811	52%	475,717,232	27%	362,577,246	21%
Alaska	325,237,093	97%			10,208,164	3%
Arizona	1,083,426,650	59%			752,995,586	41%
Arkansas	269,817,773	37%	270,393,090	37%	189,335,683	26%
California	2,988,963,362	26%	2,526,464,451	22%	6,028,389,179	52%
Colorado	11,761,345	12%			88,837,115	88%
Connecticut	328,176,623	42%	234,214,185	30%	222,613,394	28%
Delaware	130,666,300	56%	36,492,165	16%	66,862,500	29%
Florida	2,323,909,664	64%	458,480,806	13%	866,645,060	24%
Georgia	1,066,950,757	52%	507,453,568	25%	477,494,113	23%
Hawaii	259,747,192	63%	39,824,153	10%	111,433,511	27%
Idaho	215,076,371	57%	111,608,165	29%	52,131,189	14%
Illinois	1,100,273,364	46%	337,216,273	14%	966,966,631	40%
Indiana	990,755,014	69%	227,564,108	16%	218,637,201	15%
Iowa	615,646,180	62%	95,363,638	10%	280,490,043	28%
Kansas	532,489,560	52%	146,093,400	14%	347,822,855	34%
Kentucky	510,656,161	47%	344,580,371	32%	221,886,523	21%
Louisiana	593,578,365	50%	405,734,247	34%	198,782,639	17%
Maine	207,658,165	81%	8,835,474	3%	40,509,745	16%
Maryland	548,296,114	39%	313,075,725	22%	547,411,882	39%
Massachusetts	617,271,382	51%	265,449,463	22%	319,803,816	27%
Michigan	1,295,371,679	50%	354,747,678	14%	918,774,360	36%
Minnesota	661,322,554	48%	339,184,504	24%	387,898,000	28%
Mississippi	421,398,222	56%	89,109,160	12%	240,421,060	32%
Missouri	462,280,835	42%	334,624,047	31%	294,264,453	27%
Montana	115,664,649	62%	46,077,412	25%	25,493,349	14%

Table 4.3. *Continued*

State	Research Appropriations		Regional Appropriations		Community College Appropriations	
	Total ($)	Percent[1]	Total ($)	Percent[1]	Total ($)	Percent[1]
Nebraska	297,670,402	57%	76,430,281	15%	145,631,995	28%
Nevada	399,424,964	68%	123,597,000	21%	61,178,000	10%
New Hampshire	96,000,000	75%			31,667,092	25%
New Jersey	71,117,000	5%	938,844,746	68%	379,776,341	27%
New Mexico	560,726,347	58%	158,396,275	16%	249,910,232	26%
New York	1,321,984,303	29%	2,422,077,792	53%	792,322,282	17%
North Carolina	1,729,959,317	50%	660,681,958	19%	1,044,330,341	30%
North Dakota	180,027,620	79%	20,123,387	9%	26,797,400	12%
Ohio	1,469,005,621	70%	83,971,377	4%	544,350,091	26%
Oklahoma	377,779,300	44%	263,207,633	31%	212,411,982	25%
Oregon	337,720,140	38%	84,425,616	9%	469,078,453	53%
Pennsylvania	743,877,799	49%	453,687,693	30%	314,678,007	21%
Rhode Island	75,389,594	45%	44,346,721	26%	47,820,290	29%
South Carolina	387,210,489	50%	158,973,131	20%	235,626,032	30%
South Dakota	115,742,057	74%	28,453,093	18%	12,399,361	8%
Tennessee	815,677,964	66%	192,383,300	16%	232,664,858	19%
Texas	2,901,557,945	50%	837,424,852	14%	2,085,206,431	36%
Utah	455,152,542	58%	189,566,149	24%	139,329,921	18%
Vermont	44,623,000	63%	26,074,342	37%		
Virginia	977,224,567	57%	351,913,470	20%	392,033,504	23%
Washington	633,949,386	41%	221,801,167	14%	698,360,845	45%
West Virginia	201,342,044	53%	158,610,479	41%	23,272,503	6%
Wisconsin	515,628,346	31%	330,299,950	20%	841,477,023	50%
Wyoming	184,671,759	57%			139,407,698	43%

Source: Delta Cost Project data

[1]Percent of state total
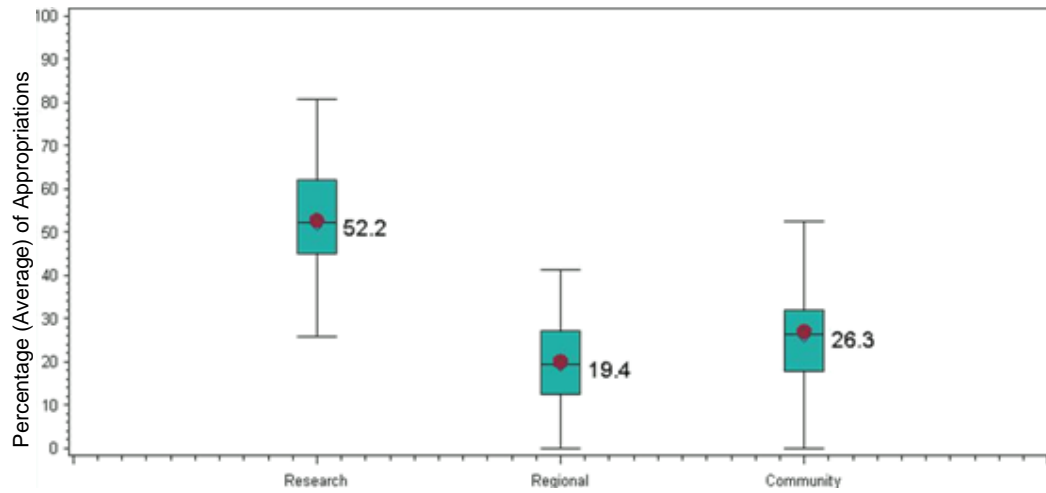
Figure 4.1. Distribution of average appropriation proportions by institutional type (2007).

Chapter Five

Legislatures, or those governing bodies within states empowered by the legislature, have not publicized the underlying principles on which the allocation decision is based. Without stipulated guidelines it is impossible to know if there is some fundamental rule that the decision makers are following. Perhaps the most likely driver of appropriations is enrollment at a particular institution. Leslie and Ramey (1986) confirm that it was a widely held belief in the 1960s and 70s that state support was based largely on enrollments. However, that link was due in large part to incremental budgeting that resulted in more support at the same time more students were considering post-secondary education driving enrollment growth. Over time that link between growing appropriations and enrollments was found to weaken and by the late 1970s to have completely dissolved (Leslie & Ramey, 1986). In order to confirm that appropriations are not simply a reflection of enrollment in the period under consideration a Granger Causality model is used.

Granger causality, as originally specified, was an analysis focused on determining the direction of predictability between two related variables and whether or not feedback was occurring between the variables (Granger, 1969). Using lagged measures of the relative enrollment and appropriations data, this type of analysis can be used to provide information regarding the impact of prior levels of support and enrollment on future levels. More specifically, the analysis showed if relative enrollments at each type of institution were driving the amount of relative appropriations allocated by the state or conversely, if appropriations levels help to predict enrollments.

Granger causality is a weaker test of causation than alternative identification tests. The predictive value of one variable on another does not preclude the existence of another variable that causes both things. In this case, using Granger causality allowed for the exploration of the possibility that past levels of relative enrollment and relative appropriations predict current levels.

Of primary concern is the possibility that policymakers base appropriations decisions on enrollments as had been suggested was the case during an earlier period (Leslie & Ramey, 1986). The results of the Granger causality test suggest that past levels of relative enrollment do not predict the relative appropriations at community and research institutions (Table 5.1). When considering relative appropriations and enrollment at regional and research universities, past enrollment levels also did not predict relative appropriations (Table 5.2).

A second analysis was also performed to assess if relative appropriations could be used to predict relative enrollments. Here one marginally significant finding was found (p=0.090), between the past levels of relative appropriations between community colleges and research universities and relative enrollment (Table 5.3). That finding may suggest that relative funding affects future enrollments. However, the marginal nature of the result and the lack of a relationship found for research and regional institutions (Table 5.4) suggest a more prosaic interpretation: this could be just random sampling error.

The use of Granger Causality models in this context was intended to estimate the relationship between relative state support and relative enrollments at each type of institution. A lack of strong, statistically significant support for one of the variables predicting the other suggests that there are other variables that are driving the

proportional support and enrollments. The following chapters consider some of those alternative variables that have been previously linked to appropriations to institutions of public higher education.

Although the emphasis here is on the lagged cross-effects, there is strong evidence of autocorrelation in each variable, with autocorrelation parameter near 1.0 in all cases, but no evidence of even a contemporaneous relationship between the two dependent variables used in the analysis. That is reassuring in assessing the results of the analysis of each one by itself. On the other hand, it is surprising that the relationship between relative enrollments and relative funding might be so weak.

Table 5.1. *Granger Causality results, community college relative to research institutions for appropriations*

Effect	Estimate	Standard Error	*p*-value
Community to Research Appropriations Lagged	0.9735	0.0164	<0.001
Community to Research Enrollment	-0.1430	0.1053	0.175
Community to Research Enrollment Lagged	0.1533	0.1063	0.150
Intercept	-0.0378	0.0184	0.040

Table 5.2. *Granger Causality results, regional relative to research institutions for appropriations*

Effect	Estimate	Standard Error	*p*-value
Regional to Research Appropriations Lagged	0.9606	0.0262	<0.001
Regional to Research Enrollment	-0.0589	0.0967	0.542
Regional to Research Enrollment Lagged	0.0487	0.0977	0.619
Intercept	0.0097	0.0199	0.626

Table 5.3. *Granger Causality results, community college relative to research institutions for enrollments*

Effect	Estimate	Standard Error	*p*-value
Community to Research Enrollment Lagged	0.9889	0.0044	<0.001
Community to Research Appropriations	-0.0048	0.0038	0.208
Community to Research Appropriations Lagged	0.0064	0.0038	0.090
Intercept	0.0117	0.0031	<0.001

Table 5.4. *Granger Causality results, regional relative to research institutions for enrollments*

Effect	Estimate	Standard Error	*p*-value
Regional to Research Enrollment Lagged	0.9572	0.0142	<0.001
Regional to Research Appropriations	-0.0419	0.0348	0.229
Regional to Research Appropriations Lagged	0.0368	0.0353	0.296
Intercept	-0.0203	0.0121	0.093

<center>**Chapter Six**</center>

Appropriations Results

   The allocation of state resources to institutions of higher education is the tangible

reflection of the value placed on post-secondary education by legislatures. Over time that

value has been eroded, in relative terms, due to increased support for other state programs

(Kane et al., 2005) as well as political and economic conditions (Archibald & Feldman,

2006; Dar, 2010; Doyle & Delaney, 2009; Hearn & Holdsworth, 2002). Diminished

support for higher education has been linked to both declining quality within public

higher education (Kane & Orszag, 2003) and reduced access to post-secondary education

(Kane, 1994, 2006). The actual loss in each of those areas is likely to hinge on the

allocation of resources to different types of institutions.

   This chapter explores the allocation of appropriations to research, regional, and

community institutions over time. While the trend of restricted growth, relative to other

state spending, in the support of public higher education has been well documented, how

those resources are divided among institutions has not. Separating institutions by the

level of education provided allows for an investigation of the trade off made by the

legislature. If resources are shifted towards community colleges then the legislature

prefers access to level and conversely, if research university appropriations increase

relative to the other types, level is preferred.

   Descriptive analyses. The total appropriations reported in 2013 for each of the

states varied from $67,724,793 (VT) to $9,624,081,221 (CA); appropriations per FTE

ranged from $591 (CO) to $18,755 (AK). In addition to amounts of appropriations

allotted to each state, states varied as to how these appropriations were distributed

<center>64</center>

between the three types of institutions: research, community colleges, and regional (Figure 6.1).

Overall, research institutions (57%, SD=15.5%) tended to have higher proportions of appropriations than community colleges (22%, SD=11.4%) or regional institutions (21%, SD=13.4%). While the proportion allotted to regional institutions has remained stable over time, rates for research institutions and community colleges have started to converge (Figure 6.1). In fact, from 1987 to 2013, the appropriation percentage to research institutions dropped an average of eight points (SD= 6.6), while community colleges gained an average of nine points (SD = 9.6). Some states made large changes in appropriations over this period. Illinois, for example, reduced the proportion of appropriations to research institutions by 16 percentage points, while community colleges increased by 18 percentage points over the same period. Other states, like North Dakota, demonstrated essentially no change from 1987 to 2013 in the proportion of appropriations.

Additionally, states varied in the level of appropriations with only six states dividing up appropriations approximately equally among the three institutional types, and eight states favored one of the institutional types by allocating more than 70% of the monies to a particular institutional type. Hence, although research institutions tended to have a higher proportion of the appropriation, the distribution of these funds varied from state to state (Figure 6.2).

To better understand changes in appropriation proportions over time and between states, a compositional data analysis was performed. The log-ratios for community

colleges and regional institutions were calculated using research institutions as the reference.

Cross-sectional time series panel data. Positive resulting estimates suggested that an increase in the variable moved appropriations towards community or regional relative to research institutions. In contrast, negative estimates indicated inverse relationships with the relative funding, where increases in the variable suggested appropriation rates that favored research and not community colleges or regional institutions.

Allocation of appropriations for regional versus research institutions was associated with political variables (Democratic control of the lower legislative house, government ideology, governor's party, and the institutional powers of the governor), median income and population density (Table 6.1). Democratic control of the lower legislative house and Democratic governor party suggested greater proportions of appropriations allocated to research relative to regional institutions. Higher median incomes were also associated with increased research monies relative to regional institutions. In contrast, higher levels of government liberalism, stronger institutional powers for the office of the governor, and increased population density were all associated with greater allocation of funding for regional relative to research institutions.

The difference between regional and research institutions is largely a question of quality; while both types provide primarily four-year degrees, research universities place much more emphasis on research and graduate programs than regional institutions. The findings suggest that Democrats, when in control of either the lower house of the legislature or governor's office, prefer to support the four-year institutions that produce

the highest levels of education. The same control had previously been linked with increased appropriations in total (Archibald & Feldman, 2006). Considering the balance wheel perspective of higher education where increased resources lead to a disproportionate increase in the appropriations for higher education in spite of the availability of alternative resource streams (Hovey, 1999), this finding fits well. Research universities are best suited to replace lost state appropriations due to diversified revenue streams but receive more support when available resources are increased. Higher median incomes have a similar impact increasing the available resources and reinforce the support for research universities benefiting disproportionately when overall state resources grow.

The allocation of funds to community colleges relative to research were impacted in a statistically significant manner by citizen ideology, population density, median income, Democratic control of the lower house of the legislature, and the unemployment rate (Table 6.2). Specifically, as citizen liberalism increases, community college funding increased relative to research institutions. On the other hand, Democratic control of the lower house of the legislature and increases to median income were associated with a higher relative proportion of appropriations going to research universities.

From the balance wheel perspective these findings echo what was found when looking at the relationship between research and regional universities. When resources grow, as measured by median incomes, appropriations move towards research universities and away from community colleges. The converse of these findings, that when state resources are restricted appropriations are allocated away from research

universities and towards community colleges, also supports a balance wheel conception for state support of public higher education.

In both relationships population density was a significant factor that favors non-research institutions. This finding seems to be an artifact of the evolving nature of the public system. States generally support one or two research institutions, one of which is the flagship university. Other institutions were chartered to serve the population in a localized manner. Therefore, states where density is high tend to have more institutions and they are often chartered as non-research institutions.

Cross-sectional time series for panel data (annual analysis.) Academic years were added into the cross-sectional models to contrast regional and community college appropriations relative to research institutions over time. Examining year effects net of economics and politics, there were no such effects on appropriations, i.e. no statistically significant year effects. However, the graphical representation of the resulting estimates demonstrated how funding allocations were impacted by external economic and political factors (Figure 6.3). Interestingly, during the recent recession, approximately 2008, funding allocation to community colleges relative to research institutions increased, while a similar shift was not observed in regional funding.

Table 6.1 *Regional versus Research Appropriations using Compositional Analysis*

Democratic Control of Lower House	-0.2757***
	(0.0666)
Demoratic Control of Upper House	-0.0678
	(0.0684)
Democratic Governor	-0.3451***
	(0.0957)
Governor's Institutional Powers	0.1654**
	(0.0743)
Government Ideology	0.0109***
	(0.0030)
Citizen Ideology	0.0041
	(0.0027)
State GDP	0.000000174
	(1.82E-06)
Median Income	-0.0000401***
	(2.87E-06)
Population Density	0.0062***
	(0.0013)
Unemployment Rate	-0.017
	(0.0109)

Notes: Standard errors are in parenthesis. * Indicates significance level $p \leq 0.1$.

** Indicates significance level $p \leq 0.05$. *** Indicates significance level $p \leq 0.01$.

Table 6.2 *Community versus Research Appropriations using Compositional Analysis*

Democratic Control of Lower House	-0.2007**
	(0.0958)
Demoratic Control of Upper House	-0.1214
	(0.0988)
Democratic Governor	-0.1096
	(0.1363)
Governor's Institutional Powers	0.019
	(0.1056)
Government Ideology	0.0002
	(0.0042)
Citizen Ideology	0.0112***
	(0.0039)
State GDP	-0.0000000699
	(2.67E-07)
Median Income	-0.0000474***
	(4.06E-06)
Population Density	0.0107***
	(0.0019)
Unemployment Rate	-0.0268*

Notes: Standard errors are in parenthesis. * Indicates significance level $p \leq 0.1$.

** Indicates significance level $p \leq 0.05$. *** Indicates significance level $p \leq 0.01$.
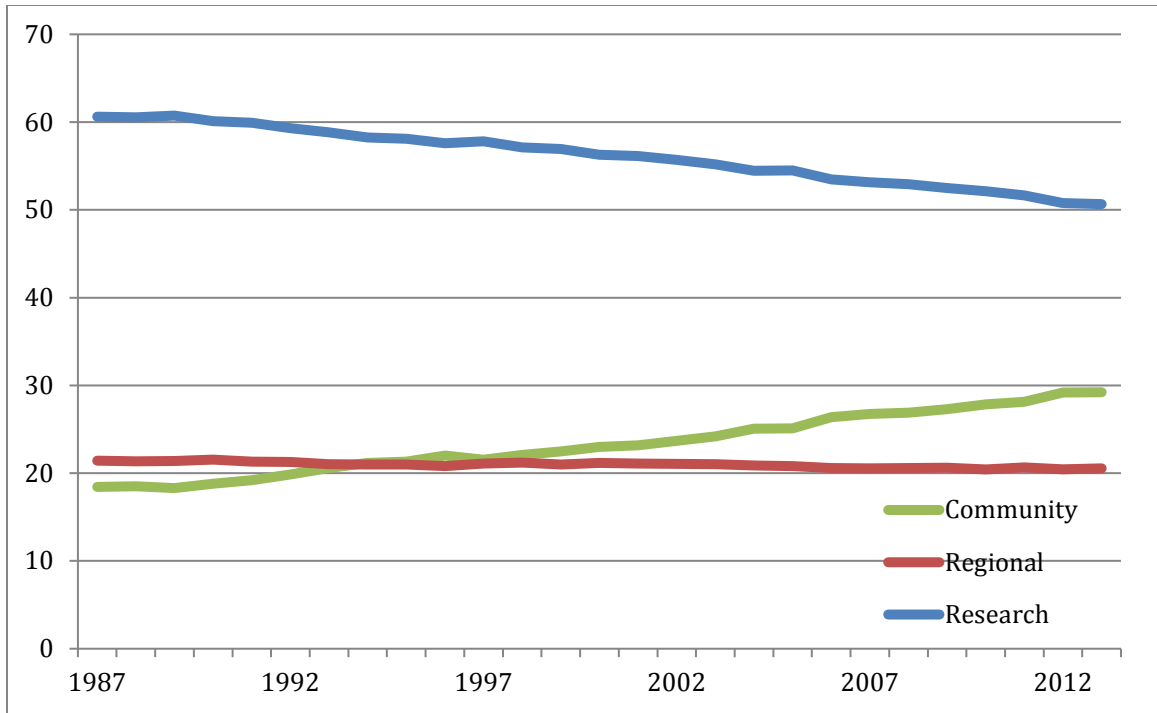
Figure 6.1. Proportion of appropriations by institutional type
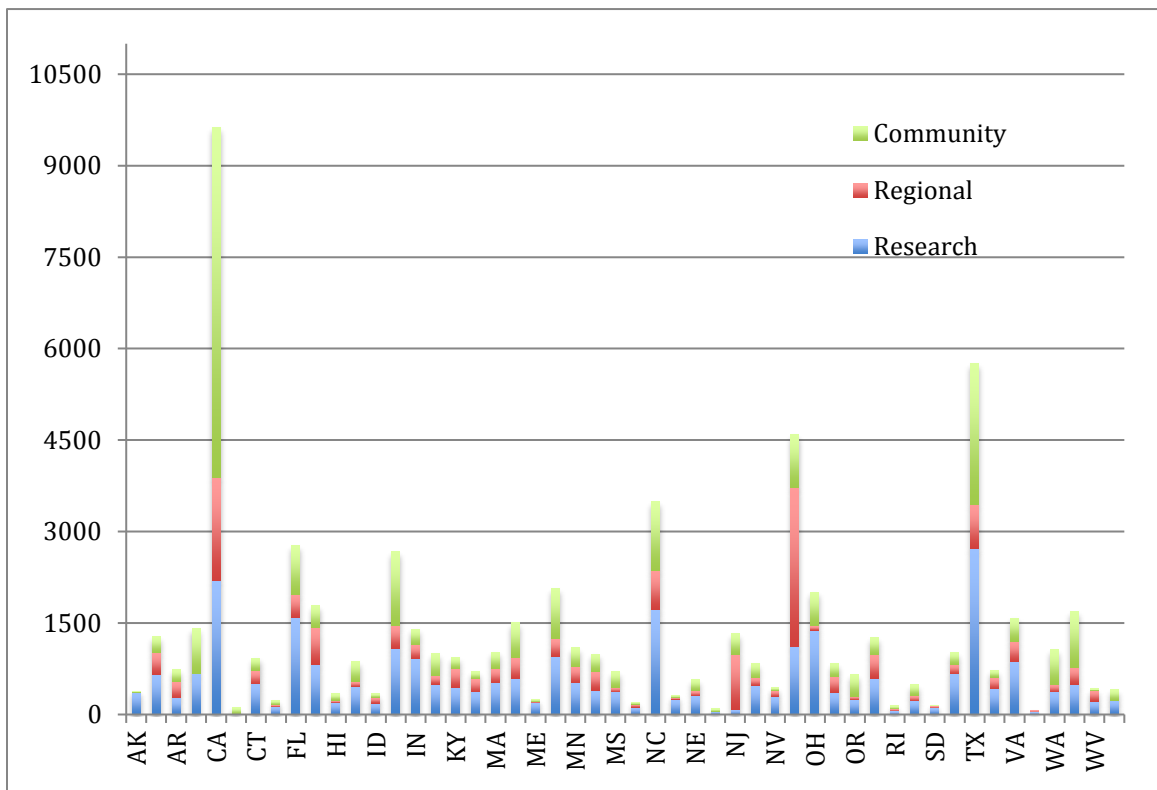
Figure 6.2. Appropriations by state and type, 2013 in millions of dollars.
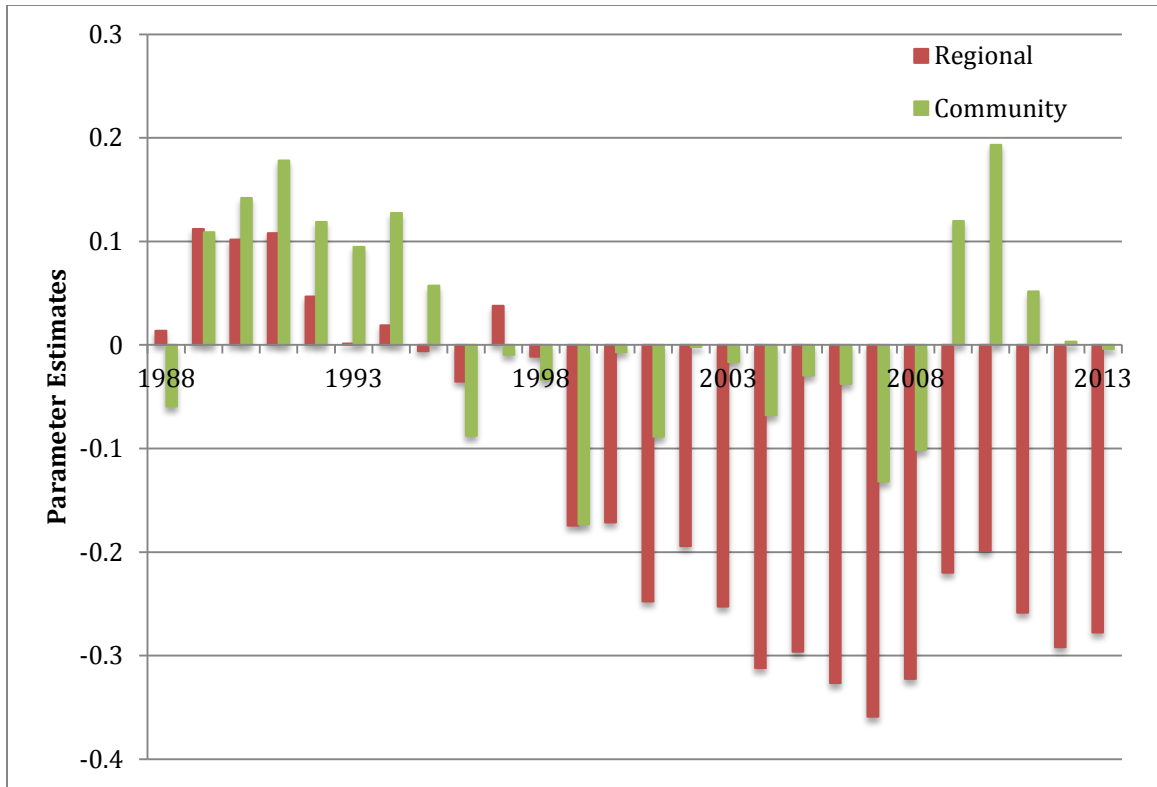
Figure 6.3. Annual estimates of allocations relative to research institutions.

Chapter Seven

Enrollment Results

States charter institutions and in many cases determine the programs that will be provided at each; however, the choice of where a student will enroll in postsecondary education remains largely in the hands of students and institutions. Seats may be limited at competitive universities allowing the institution to selectively choose students but many regional and community colleges have open enrollment providing access to any student willing to pay. In this chapter the relationship between relative enrollments and the demographic, economic, and political variables previously identified are explored to determine if they also impact the allocation of students. The choice of which institution to attend has been linked with the tuition price of the institution (Kane, 1994; Leslie & Brinkman, 1987) and the tuition price is determined, in part, by the level of appropriations (Hovey, 1999). This chapter considers the impact of variables on the allocation of students.

Descriptive analyses. The total enrollments reported in 2013 for each of the states varied from 20,319 (AK) to 1,392,611 (CA). In addition to differences in the number of students served at public institutions, states also varied in how these students were distributed between the three types of institutions: research, community colleges, and regional (Figure 7.1).

Overall, research (43%, SD=16.8%) institutions tended to have higher proportions of public student enrollments than community colleges (33%, SD=13.2%) or regional (25%, SD=14.2%) institutions. As with appropriations, the proportion enrolled at regional institutions has remained stable over time, while the proportion of students

enrolled at research institutions and community colleges converged over the majority of the study period until the most recent few years (Figure 7.1). Between 1987 and 2013, the enrollment percentage to research institutions dropped on average 5.5 points (SD= 1.7), while community colleges gained an average of 6 points (SD = 2.0). All states experienced increased enrollments at public institutions over the study period. The allocation of those additional students determined, in part, the differences between states. For example, the two states that added the most students, California and Texas, 468,335 and 424,561 students respectively, employed very different strategies. In California, the proportion of students allocated to each type of institution remained largely unchanged indicating that each type grew at the same rate. In Texas, on the other hand, the proportion of public students attending a community college increased to 43%, an increase of eight points. Increasing the proportion of students served at community colleges was the most prominent strategy; 40 states increased enrollment proportions at community colleges. Four states kept the proportion of students the same over the study period (proportions changed by less than 1% at each type of institution). Six other states, including Alabama, Michigan, and West Virginia, enrolled a higher proportion of students at 4-year institutions. States also varied in the level of enrollment at the three institutional types (Figure 7.2).

To better understand changes in enrollment proportions over time and between states, a compositional data analysis was performed. The log-ratios for community colleges and regional institutions were calculated using research institutions as the reference. That process mirrored the procedure used for appropriations.

Cross-sectional time series panel data. Positive resulting estimates suggested that an increase in the variable moved enrollments toward community or regional relative to research institutions. In contrast, negative estimates indicated inverse relationships with the relative enrollment, where increases in the variable suggested relative enrollment rates that favored research and not community colleges or regional institutions.

The allocation of students for regional versus research institutions was associated with political variables (Democratic control of the lower legislative house and citizen ideology), economic variables (GDP, the unemployment rate, and median income), and population density. Democratic control of the lower legislative house, a higher unemployment rate, and higher median income were associated with greater proportions of students allocated to regional relative to research institutions. In contrast, higher levels of citizen liberalism and increased population density were associated with greater allocation of students for research relative to regional institutions.

For the allocation of students to community colleges relative to research institutions changes were associated with citizen ideology, government ideology, governor's political party, Democratic control of the upper house of the legislature, median income, and the unemployment rate. Specifically, higher state-level citizen and governmental liberalism decreased community college enrollment relative to research institutions. Democratic control of the upper house of the legislature and higher GDP levels were also associated with more students enrolled at research institutions relative to community colleges. Greater relative enrollments for community colleges compared to research universities were observed with Democratic control of the governor's office as well as increased unemployment and median income.

The political findings, with respect to enrollments, are mixed; Democratic control of the lower house favors regional institutions while Democratic control of the upper house favors research over community colleges. The implication is that Democratic control supports access to four-year institutions at the expense of two-year programs. Democratic control has previously been linked with more support for higher education, so it is unsurprising to find that control would also favor higher levels of enrollment.

Economic measures included in the analysis also have a significant impact on the allocation of students. As state GDP increases more students attend research institutions. In chapter 6, it was shown that increased resources are related to a shift in resources towards research universities indicating that those institutions benefit from both more appropriations and more students during economic growth. However, median income increases are associated with the relative enrollments of non-research institutions increasing. That result may arise from the normal consumption of higher education where families choose to purchase more education as their incomes grow. The conflicting results from statewide growth and median income require further investigation.

The unemployment rate also showed a statistically significant impact on the allocation of students. As unemployment rose more students chose non-research institutions. This finding is also expected as being unemployed reduces the opportunity cost of attending college and those facing economic uncertainty are likely to opt for the lower cost options.

Cross-sectional time series panel data (annual analysis). Academic years were added into the cross-sectional models to contrast regional and community college enrollments relative to research institutions over time, using 1987 as the comparison.

Examining year effects net of economics and politics, time was statistically significant due to the large enrollment increases (Figure 7.3). The graphical representation of the resulting estimates demonstrated how enrollments were impacted by external economic and political factors. For example, there was a trend that suggested that during the study period, enrollments increased substantially at community colleges relative to research institutions peaking during the height of the most recent recession and then the trend reversed.

Table 7.1 *Regional versus Research Enrollments using Compositional Analysis*

Democratic Control of Lower House	0.0234**
	(0.0098)
Demoratic Control of Upper House	-0.002
	(0.0102)
Democratic Governor	-0.0007
	(0.0142)
Governor's Institutional Powers	-0.0004
	(0.0110)
Government Ideology	-0.0006
	(0.0004)
Citizen Ideology	-0.0007*
	(0.0004)
State GDP	-0.0000000905***
	(2.71E-08)
Median Income	0.00000287***
	(4.25E-07)
Population Density	0.0005**
	(0.0002)
Unemployment Rate	0.0063***
	(0.0016)

Notes: Standard errors are in parenthesis. * Indicates significance level $p \leq 0.1$.

** Indicates significance level $p \leq 0.05$. *** Indicates significance level $p \leq 0.01$.

Table 7.2 *Community versus Research Enrollments using Compositional Analysis*

Democratic Control of Lower House	0.0152
	(0.0182)
Demoratic Control of Upper House	-0.0383**
	(0.0185)
Democratic Governor	0.0479*
	(0.0258)
Governor's Institutional Powers	-0.0245
	(0.0195)
Government Ideology	-0.0021***
	(0.0007)
Citizen Ideology	-0.002***
	(0.0007)
State GDP	-1.39E-07***
	(4.94E-08)
Median Income	0.00001***
	(7.41E-07)
Population Density	-0.0005
	(0.0004)
Unemployment Rate	0.0172***
	(0.0029)

Notes: Standard errors are in parenthesis. * Indicates significance level $p \leq 0.1$.

** Indicates significance level $p \leq 0.05$. *** Indicates significance level $p \leq 0.01$.
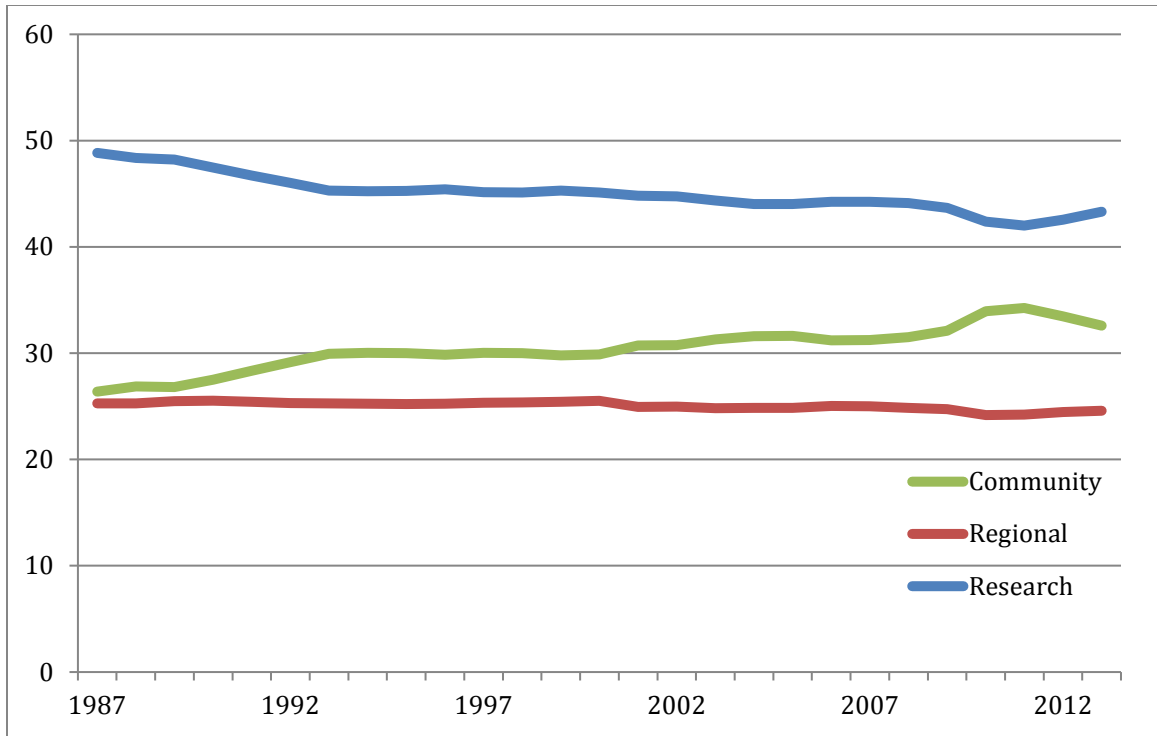
Figure 7.1. Proportion of enrollment by institutional type.
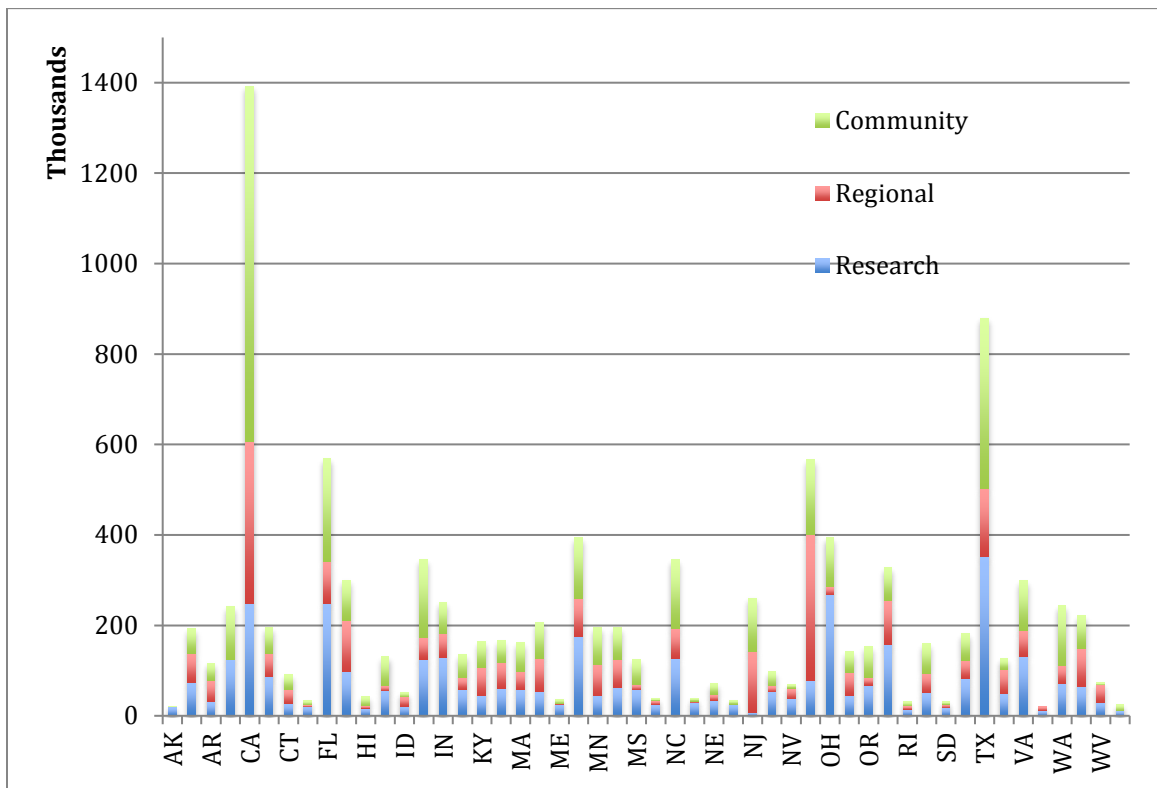
Figure 7.2. Enrollment by state and institutional type (2013).
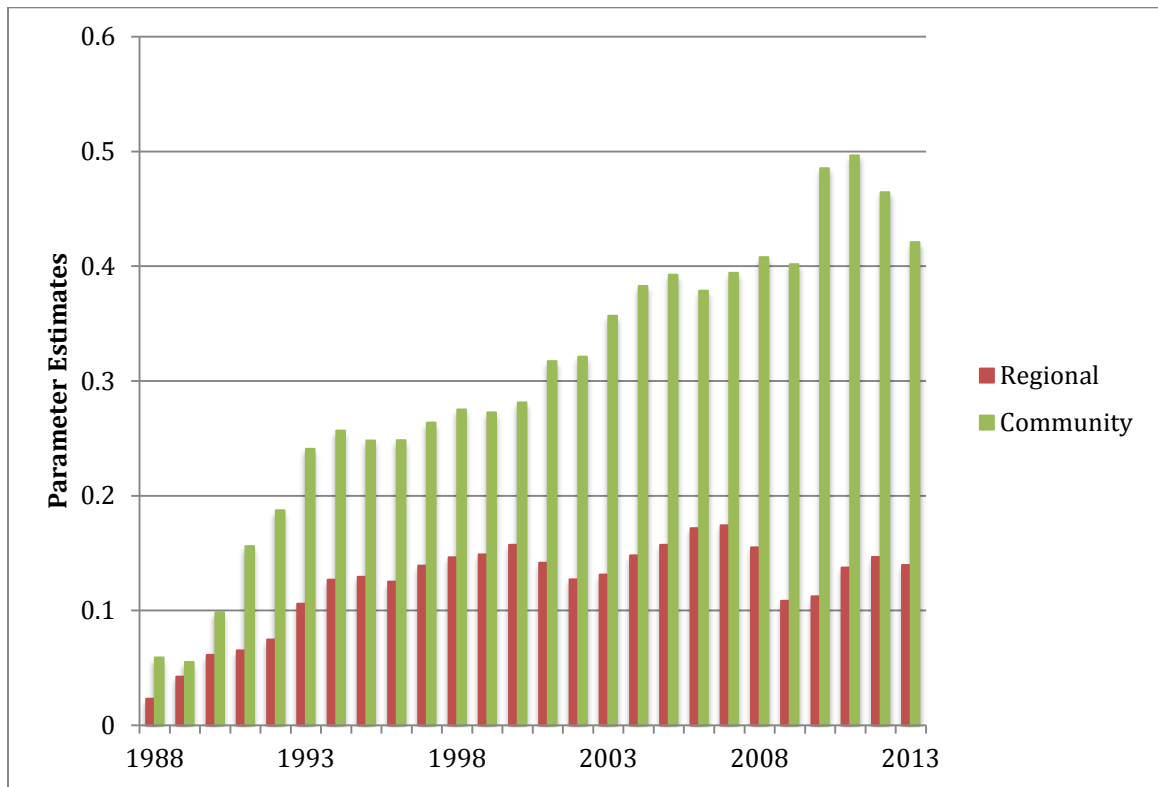
Figure 7.3. Annual estimates of enrollments relative to research institutions

Chapter Eight

The purpose of this dissertation was to examine how states allocate appropriations to the public college and university system and the corresponding allocation of students. Chapter 2 provided a statement of the two-fold issue to be studied, namely, how states allocated students and financial support among types of public higher education institutions. Characteristics that impacted the allocation were described along with the framework of decision-making.

Institutions within the public system were classified into three types: research, regional, and community colleges. Chapter 3 discussed the differences in mission, resources, and expenditures between research, regional, and community colleges. The type of institution was integral to understanding the quality of education provided as well as the cost. Prior research largely neglected considering how resources were allocated from the institutional perspective, focusing instead on overall support or enrollment. Chapter 3 also identified factors associated with state financial support and overall enrollment within this institutional perspective.

Chapter 4 outlined the data used for analyses as well as the compositional data paradigm, where the contributions of states to public institutions of higher education were viewed as a unit-sum. Granger Causality analyses were used to determine whether enrollments or appropriations predicted each other. The presence of such relationships would suggest that states made complex funding and allocation decisions jointly. In the absence of a strong relationship between enrollment and appropriations, other alternative explanatory variables could be evaluated in separate equations. Chapter 5 reported the

findings from Granger Causality analyses; enrollments did not Granger cause appropriations and the converse had only a weak statistical relationship.

Therefore, to further investigate factors related to appropriation decision-making, results from compositional data analysis were described in Chapter 6. These analyses identified several explanatory variables related to the distribution of appropriations among public institution types. In combination with findings from previous research on the overall level of appropriations, these results provided insights into state priorities. For example, Democratic control of the legislature was previously linked with increased appropriations (Archibald & Feldman, 2006). In this study, an association between legislative control and appropriation allocations was also found. With Democratic control, a greater proportion of resources were allocated to research universities, the highest quality public institutions. Likewise, state wealth, as measured by median income, was previously linked to greater appropriations in total (Delaney & Doyle, 2007). Here, an increase in the proportion of appropriations provided to research universities was also identified. This finding appears to be a further application of the balance wheel hypothesis first applied to public higher education by Hovey (1999). Funding for higher education, a state program with an external revenue stream, would be cut more than other programs during recession and funding would grow faster than other programs during times of growth. Extending that theory to institutional types can be accomplished by considering the alternative revenue sources available to each type of institution: research institutions rely least on state appropriations; regional institutions receive a higher percentage of revenues from the state and; community colleges rely the most on appropriations. So it was expected that when more resources were available a

higher relative appropriation would go to research universities and during recession more would be provided to regional and community colleges.

A parallel analysis was conducted to determine if enrollments were similarly associated with state characteristics. Chapter 7 described the relationships between the political, economic, and demographic variables and the proportion of students enrolled by public institution types. For example, a more liberal citizenry resulted in a greater proportion of students attending research universities. Higher median incomes, on the other hand, resulted in a higher relative proportion of students enrolling in regional and community institutions when compared to research universities. That finding suggests that as families grow their income they participate more in public higher education; however, the opposite was true for increases in state GDP that resulted in a higher proportion of students choosing research universities. The finding of variables related to relative enrollments suggested that enrollments were influenced by factors outside the control of public decision-makers.

Policy Implications

A great deal of attention has been given to state level appropriations. Public higher education is unique among state programs in having an alternative source of revenue, namely tuition. The balance wheel hypothesis showed that states used alternative revenue streams to lower appropriations when state resources were squeezed (Doyle & Delaney, 2009).

States pursue two goals for public higher education. The first, to maintain high quality, is often measured by the amount of resources expended. The second, to increase access to as many students as possible, is often measured as the tuition price to attend an institution. These goals go hand in hand. When appropriations are reduced without an

equal reduction in expenditures, either (a) expenditures must be reduced, thereby, lowering perceived quality and/or (b) tuition must rise which reduces access. As state budgets are constrained and programs are in competition for funding, previous investigations of higher education funding have focused on the decisions between supporting higher education or some other program in the context of overall state support. However, by considering allocations within institutional types, it is possible to more fully understand the consequences of resource decisions and the potential for allocations to determine the level and access of a state's public higher education simultaneously.

A plot of the relative appropriations for public institution types demonstrated that, over time, states shifted appropriations away from research universities and towards community colleges (Figure 6.1).   For many states, the shift towards funding community colleges away from research universities was similar; however, substantial variation existed (Appendix A).

While considerable effort has been expended to explain the factors that determine the total resources devoted to public higher education, the allocation of those resources within the public higher education system was rarely addressed, even though the implications were significant. In an environment of declining total appropriations, decisions to increase relative appropriations to community colleges mitigated the potential reductions of access, while decreases to community colleges relative to research reduced potential losses in quality.

Appendix A
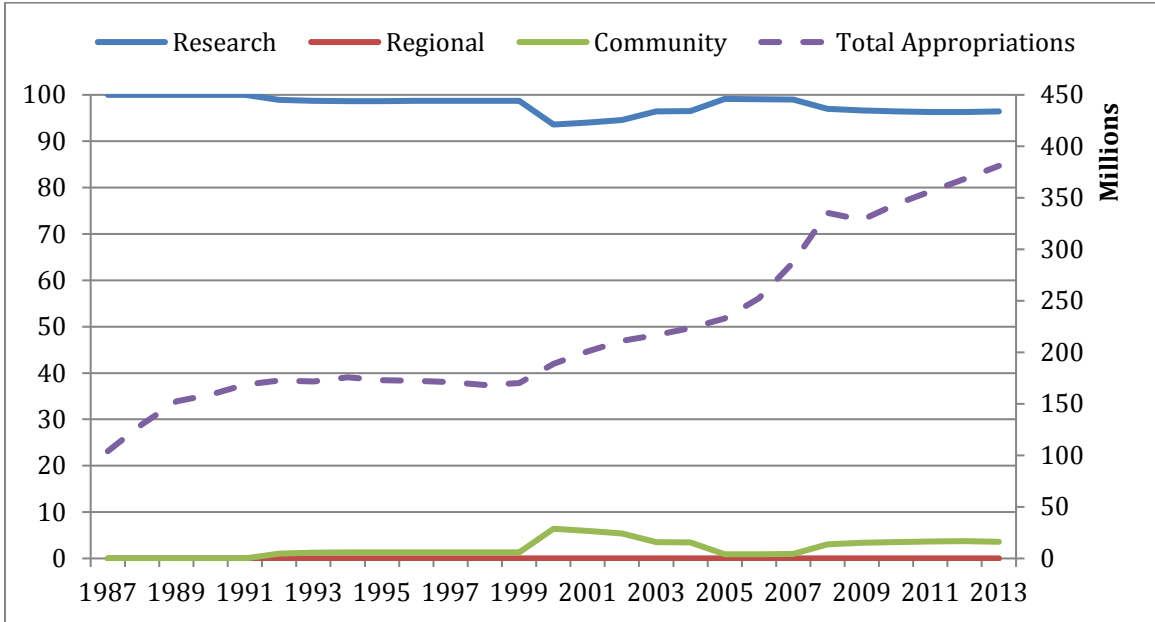
Figure A1. Relative appropriations (left axis) by type and total appropriations (right axis) for Alaska.
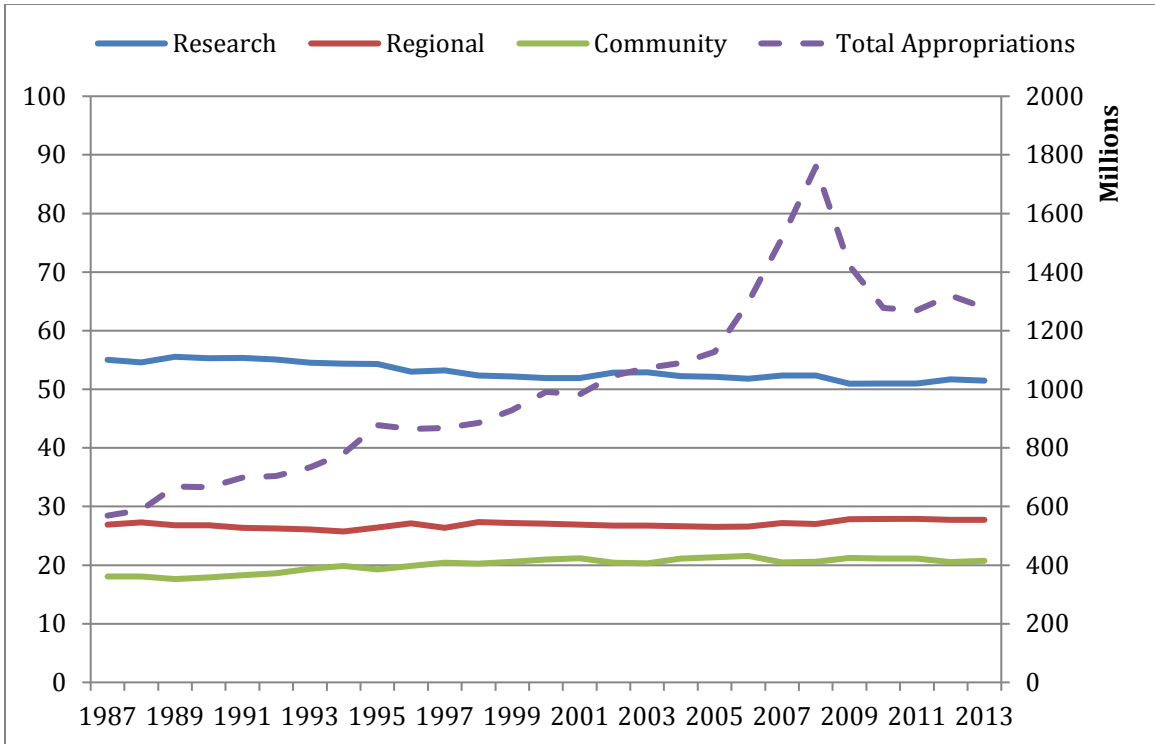
Figure A2. Relative appropriations (left axis) by type and total appropriations (right axis) for Alabama.
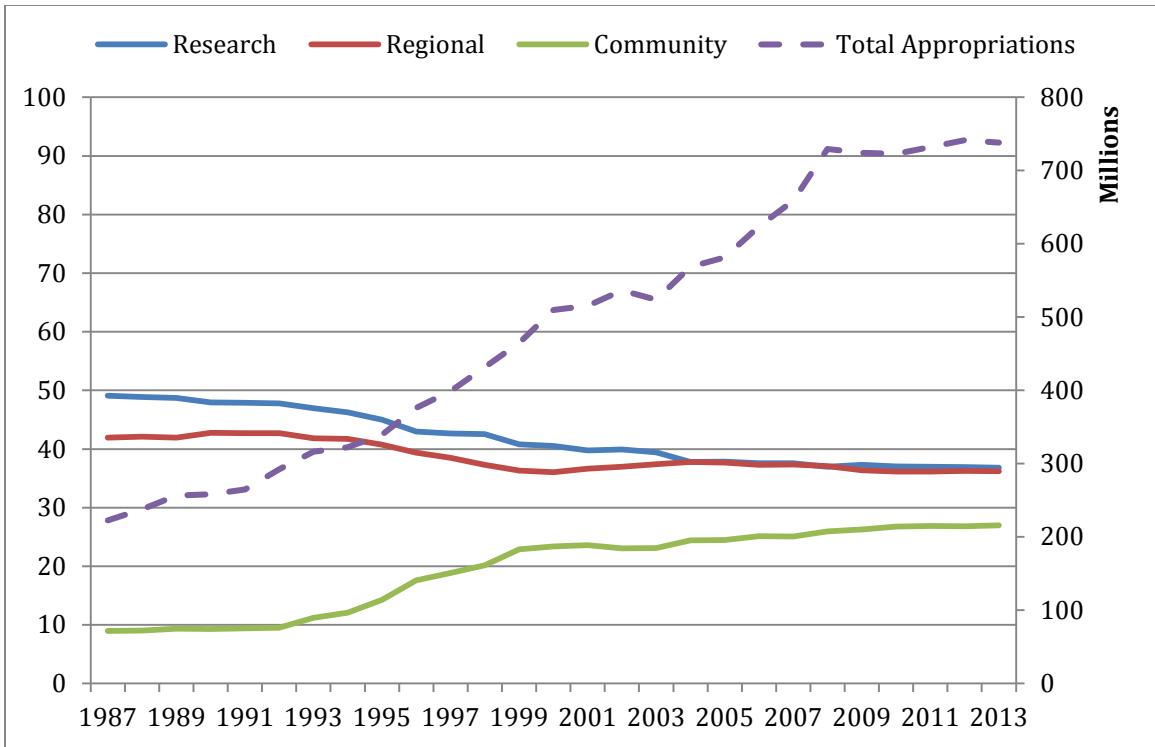
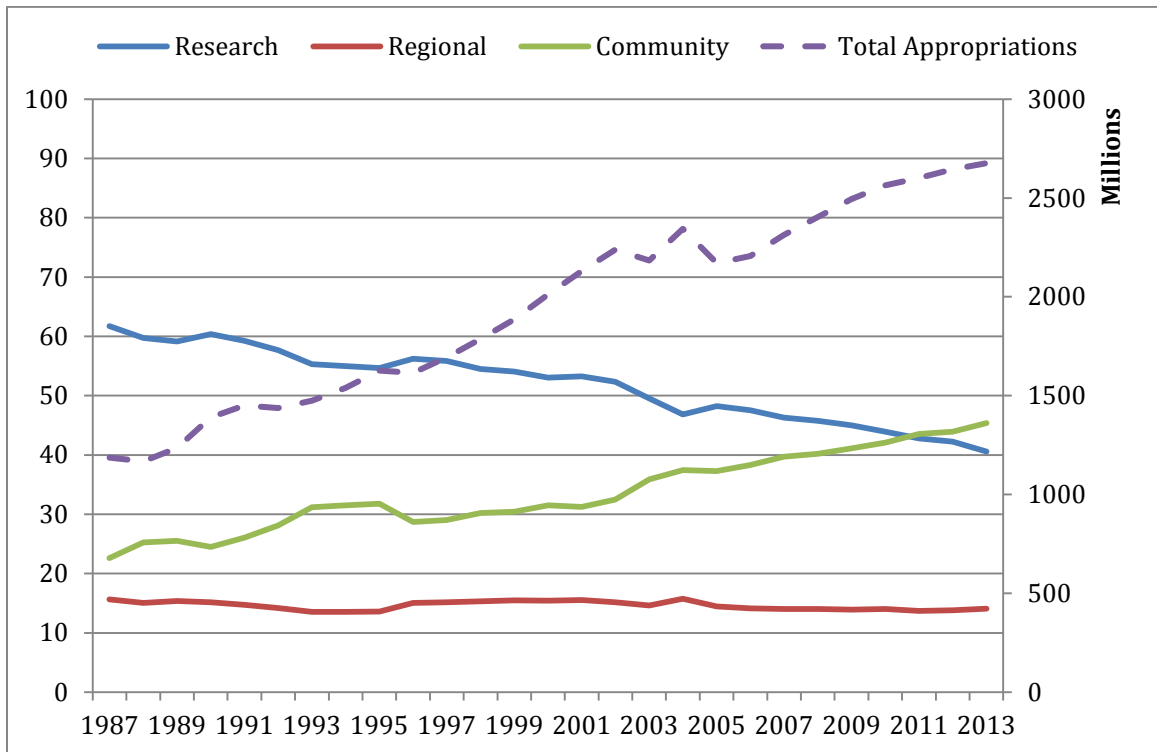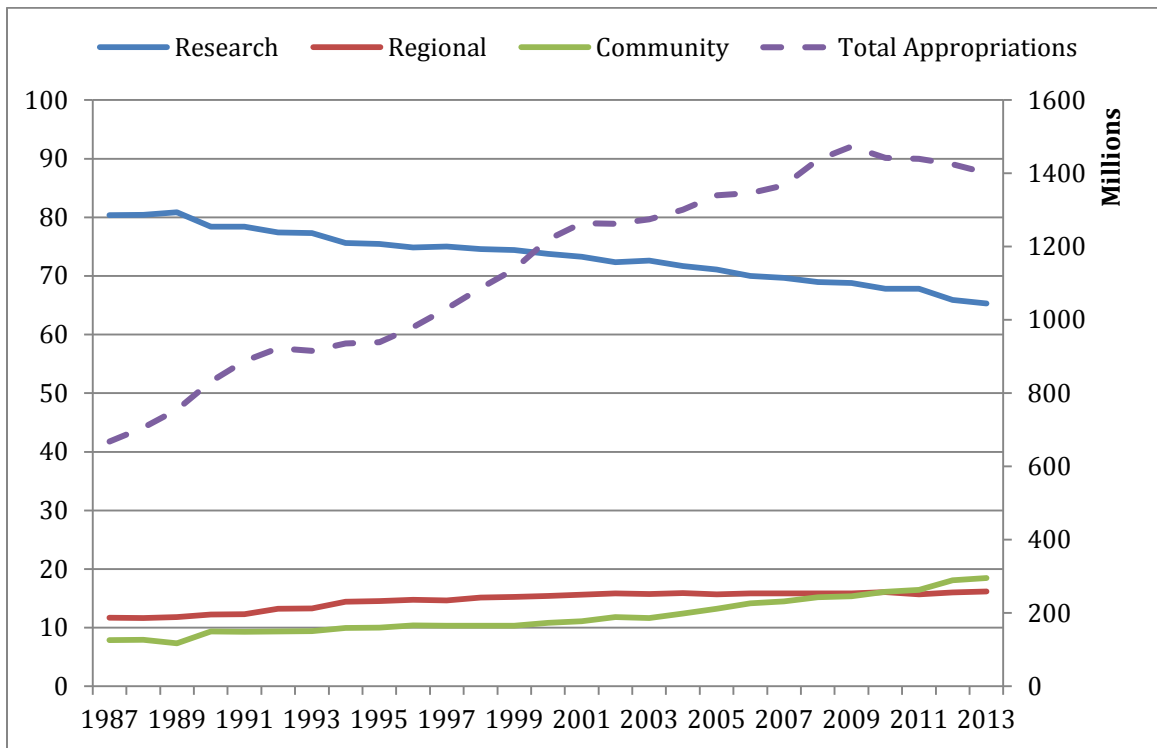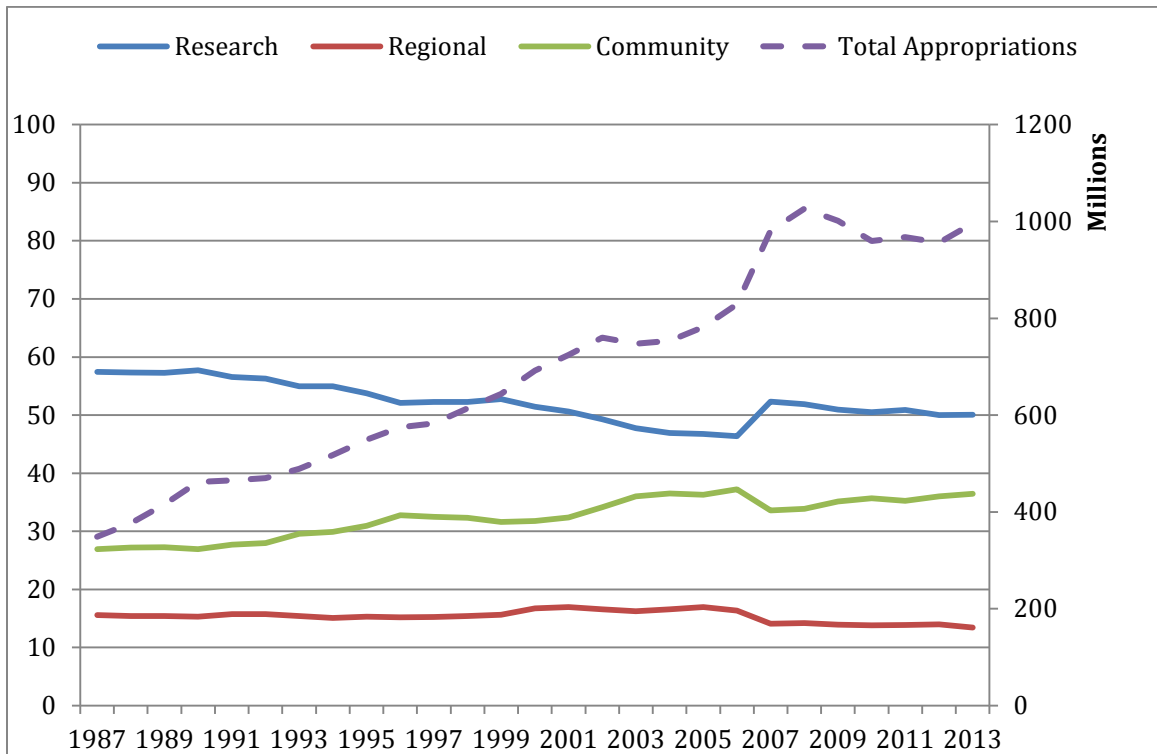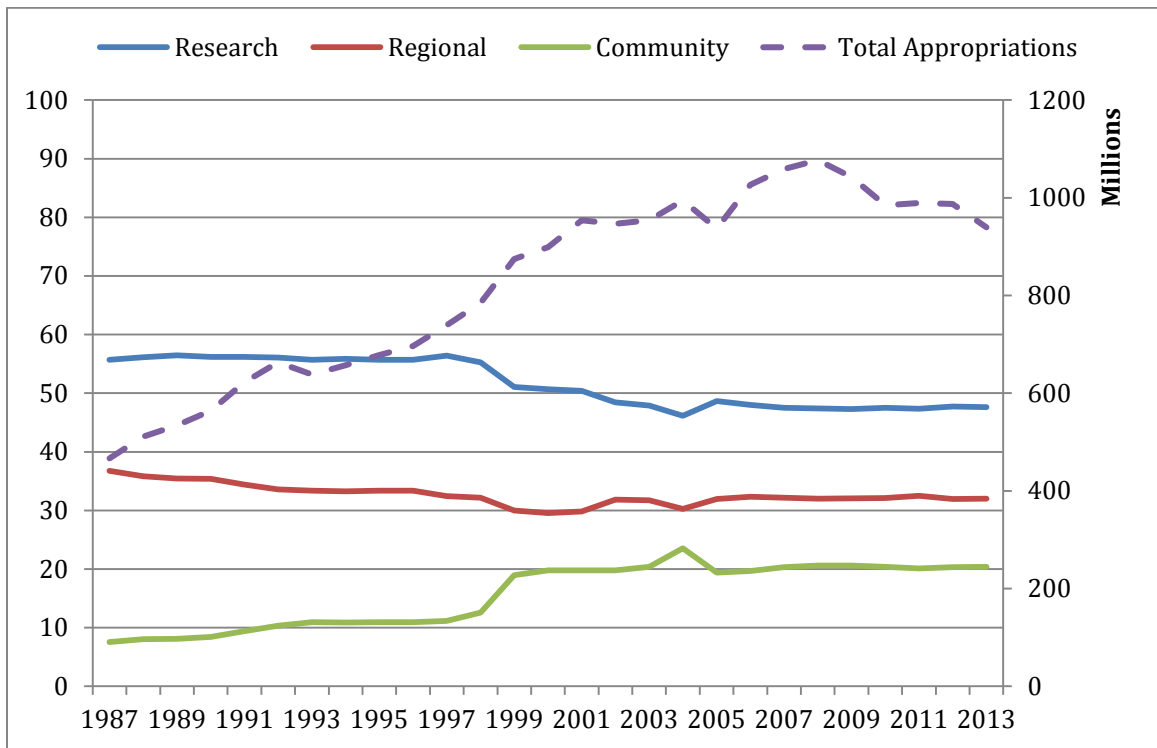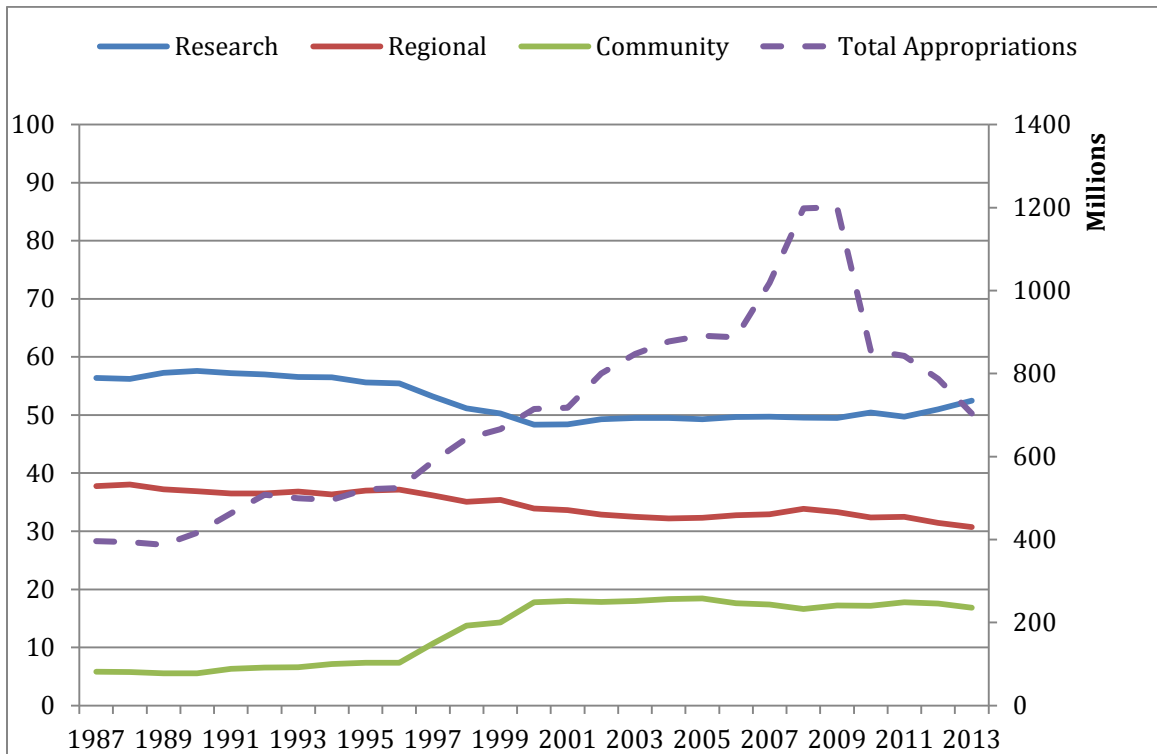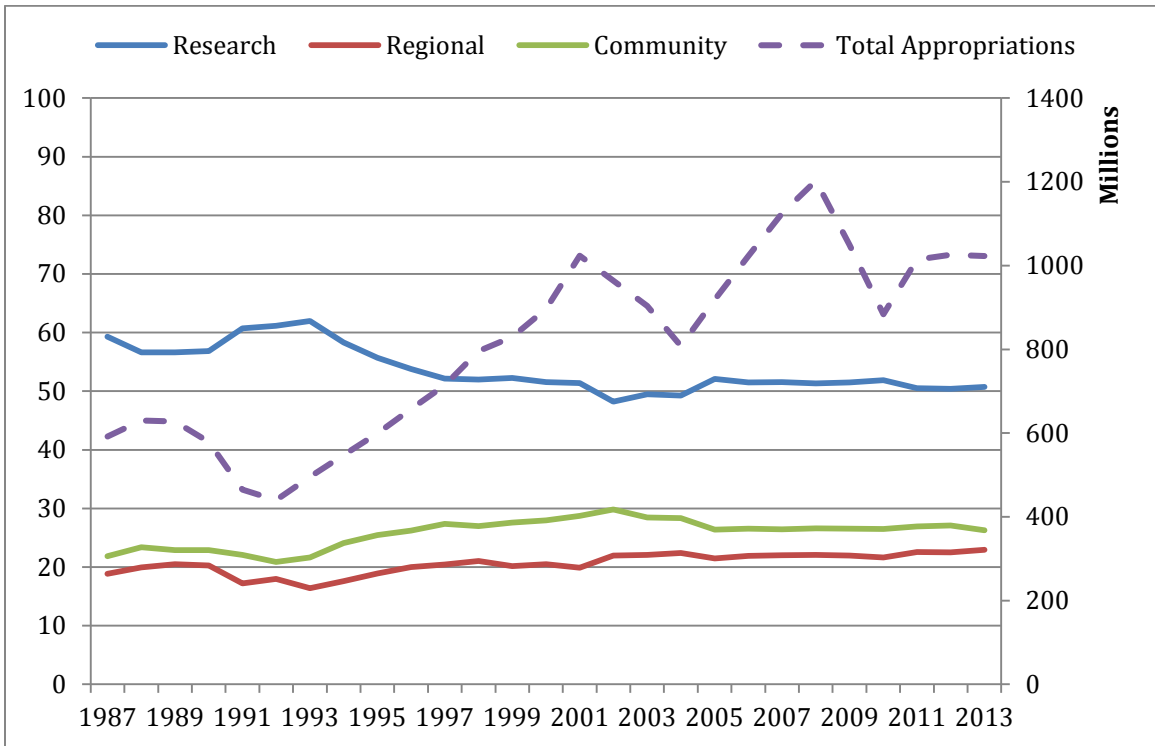*Figure A3*. Relative appropriations (left axis) by type and total appropriations (right axis) for Arkansas.
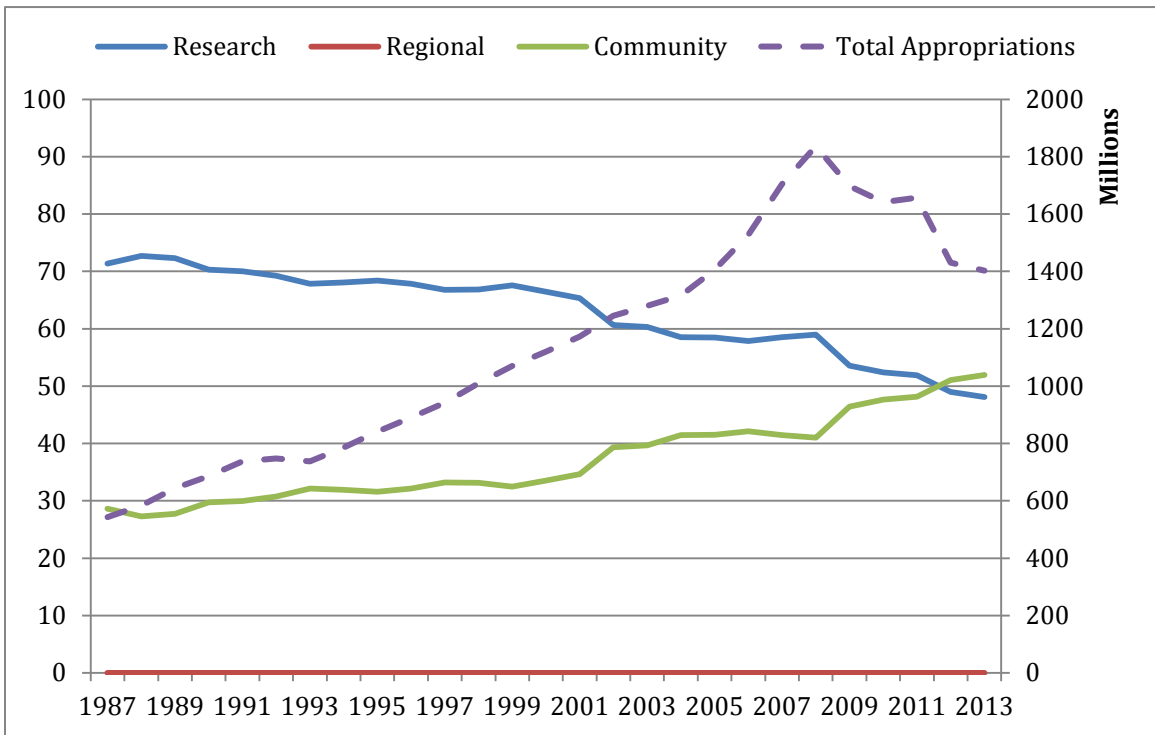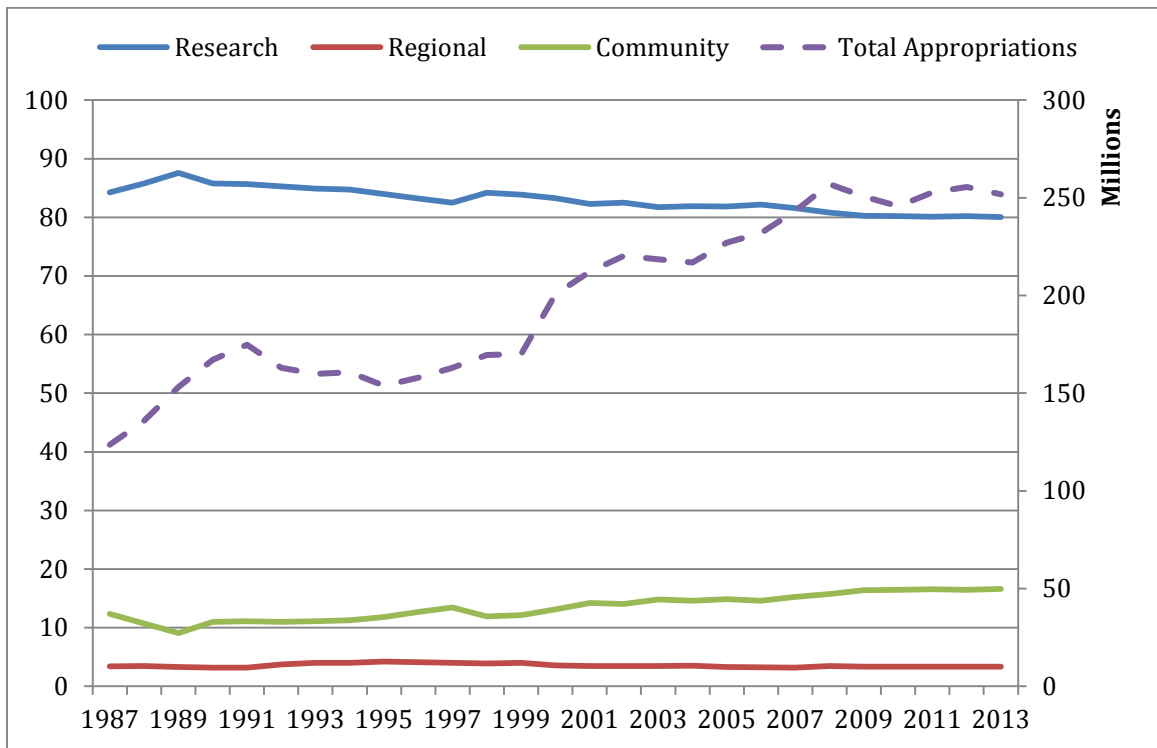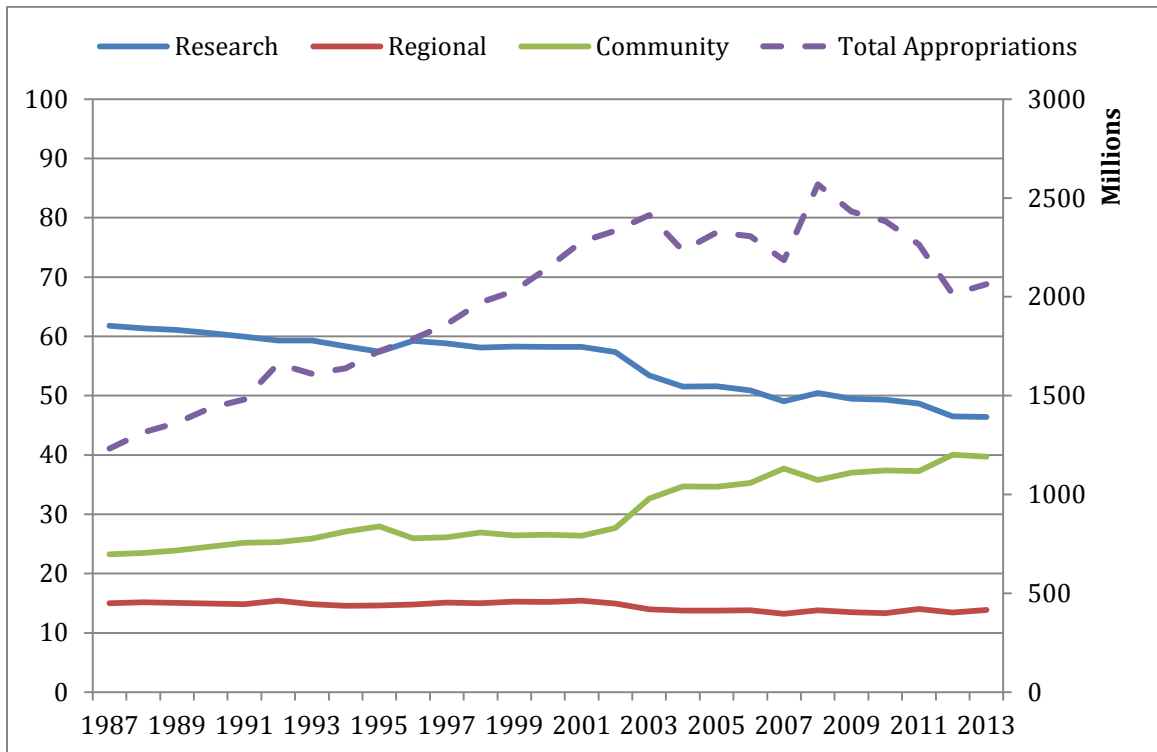

Figure A4. Relative appropriations (left axis) by type and total appropriations (right axis) for Arizona.
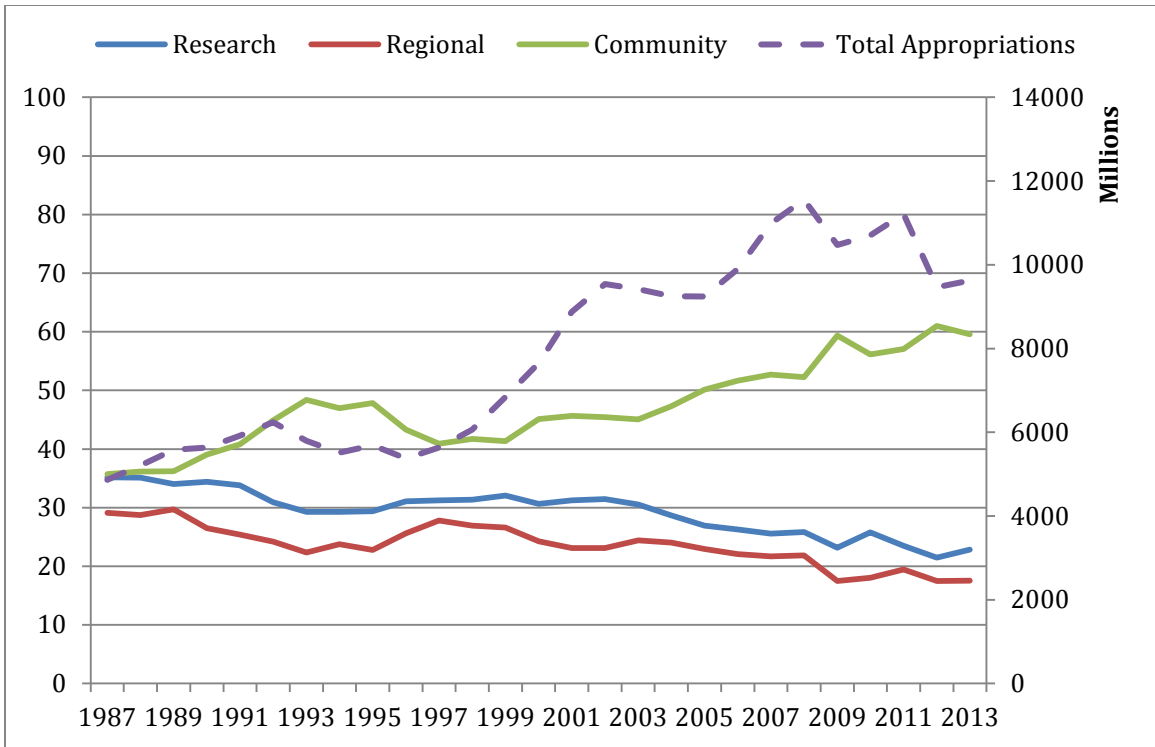
Figure A5. Relative appropriations (left axis) by type and total appropriations (right axis) for California.
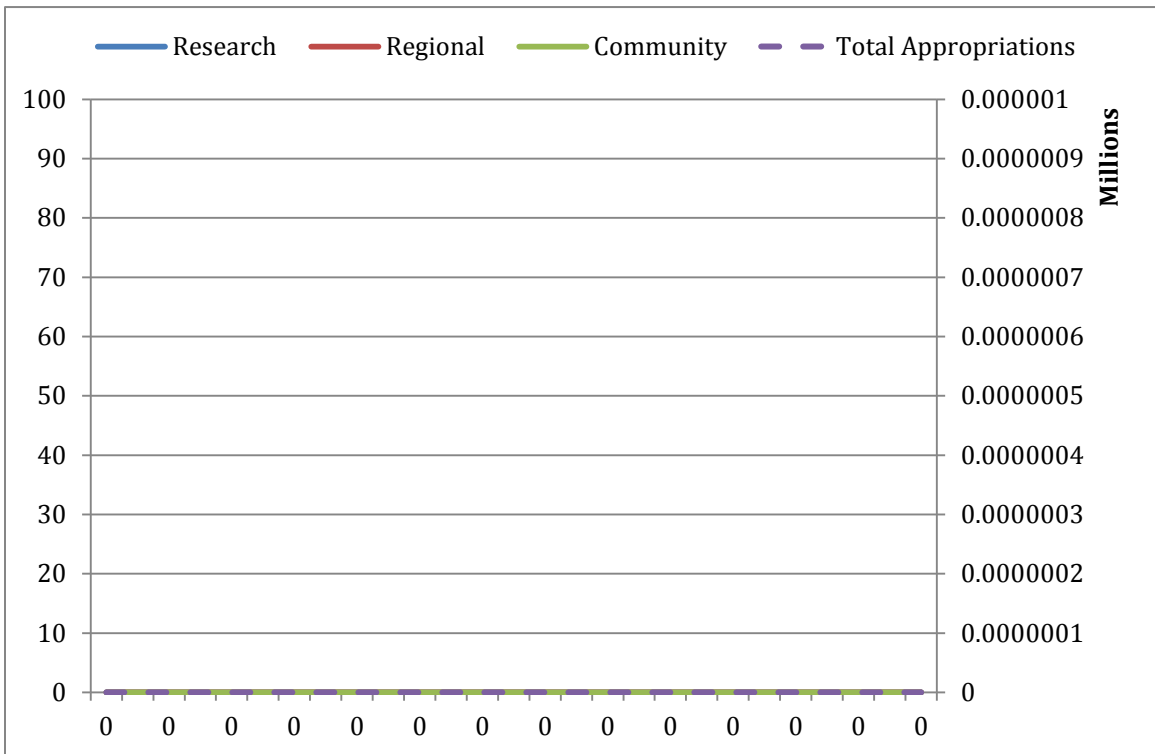
Figure A6. Relative appropriations (left axis) by type and total appropriations (right axis) for Colorado. A voucher program was implemented in 2007.
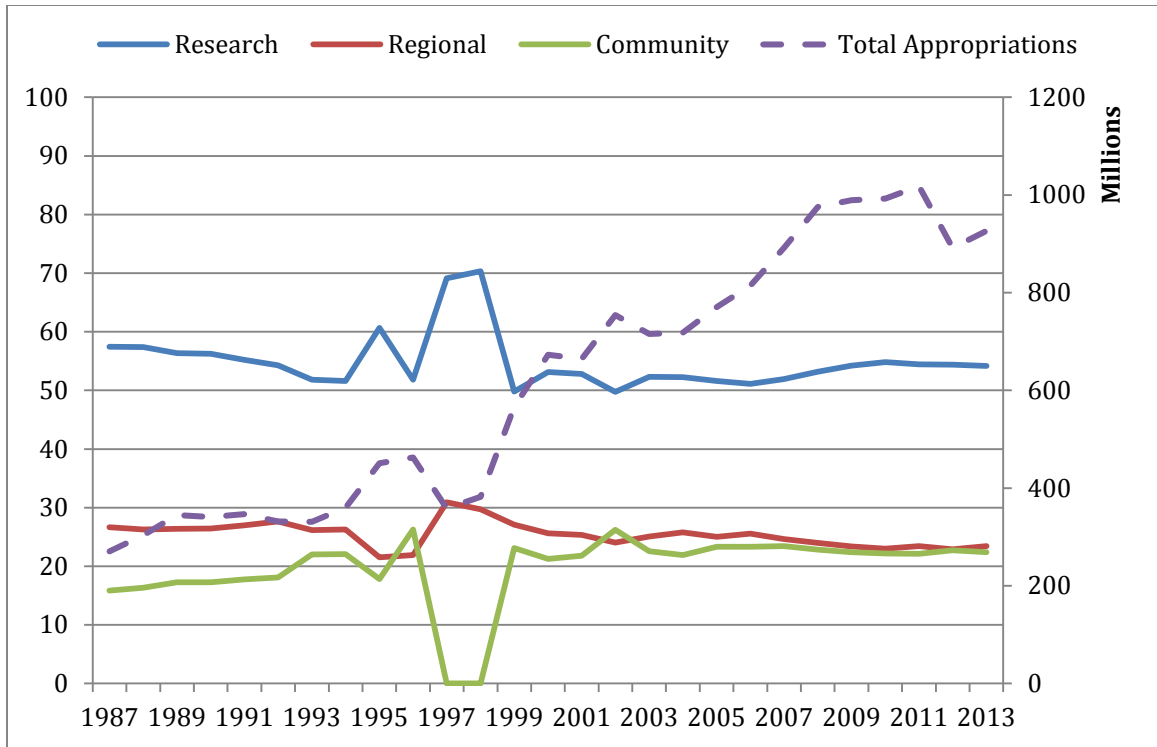
Figure A7. Relative appropriations (left axis) by type and total appropriations (right axis) for Connecticut.
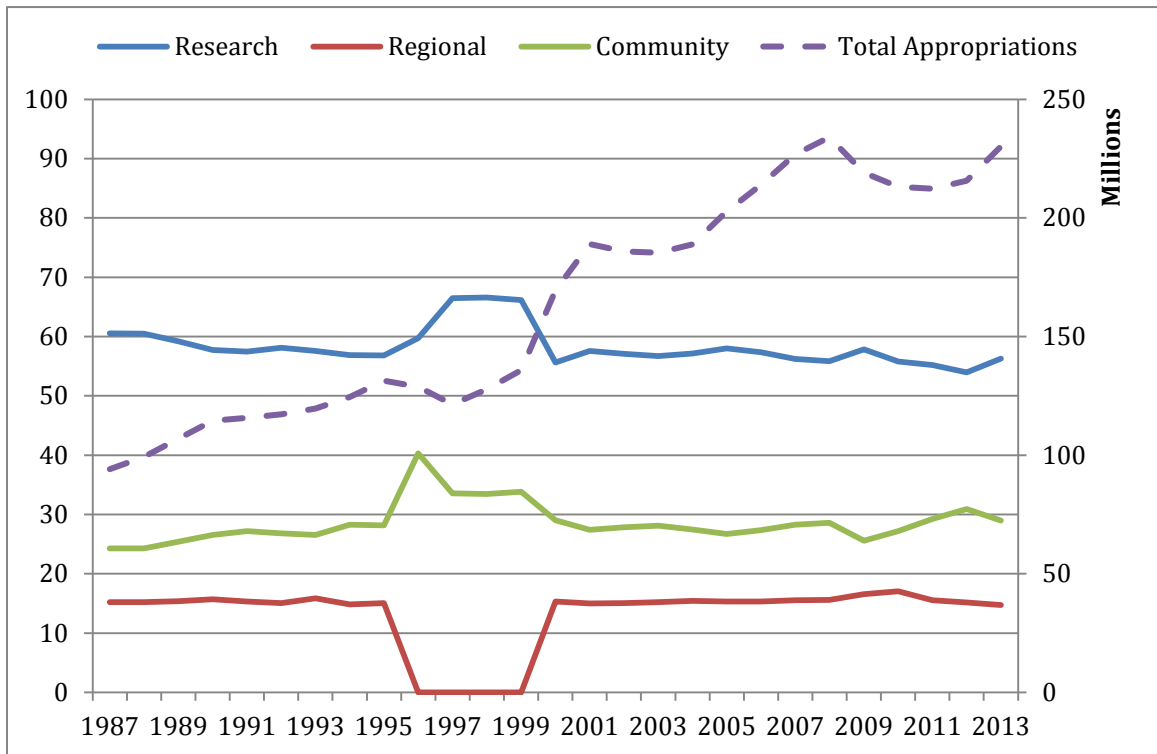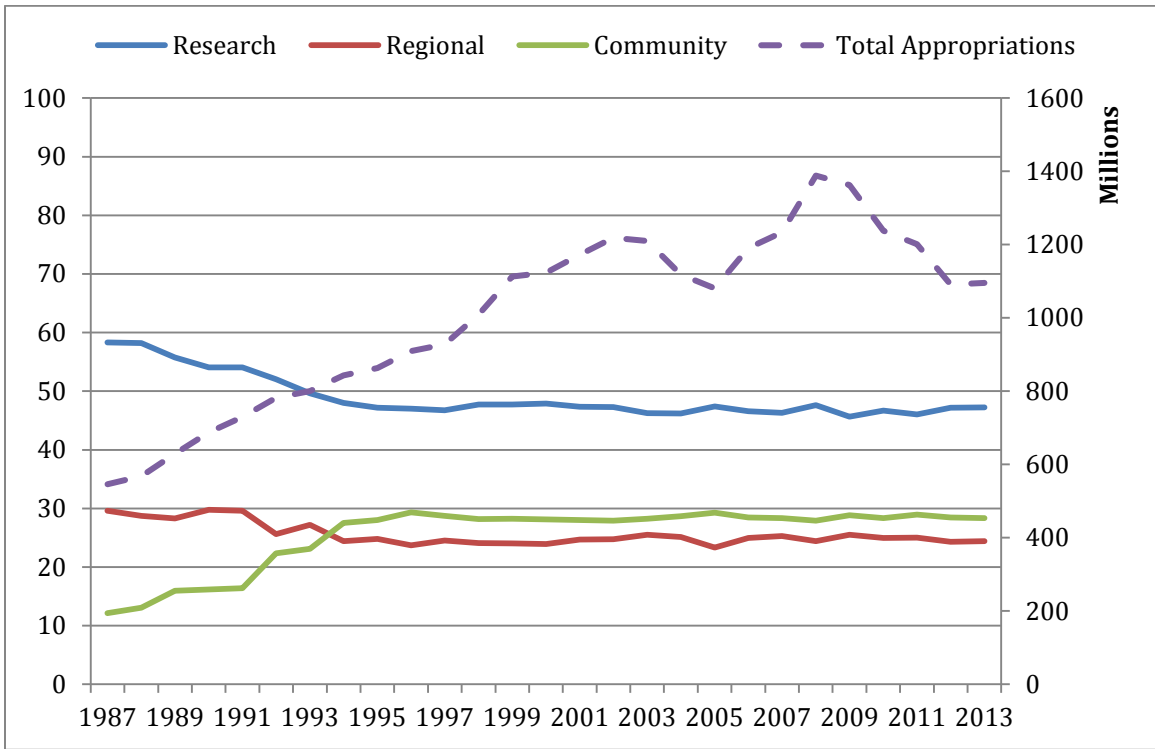

Figure A8. Relative appropriations (left axis) by type and total appropriations (right axis) for Delaware.
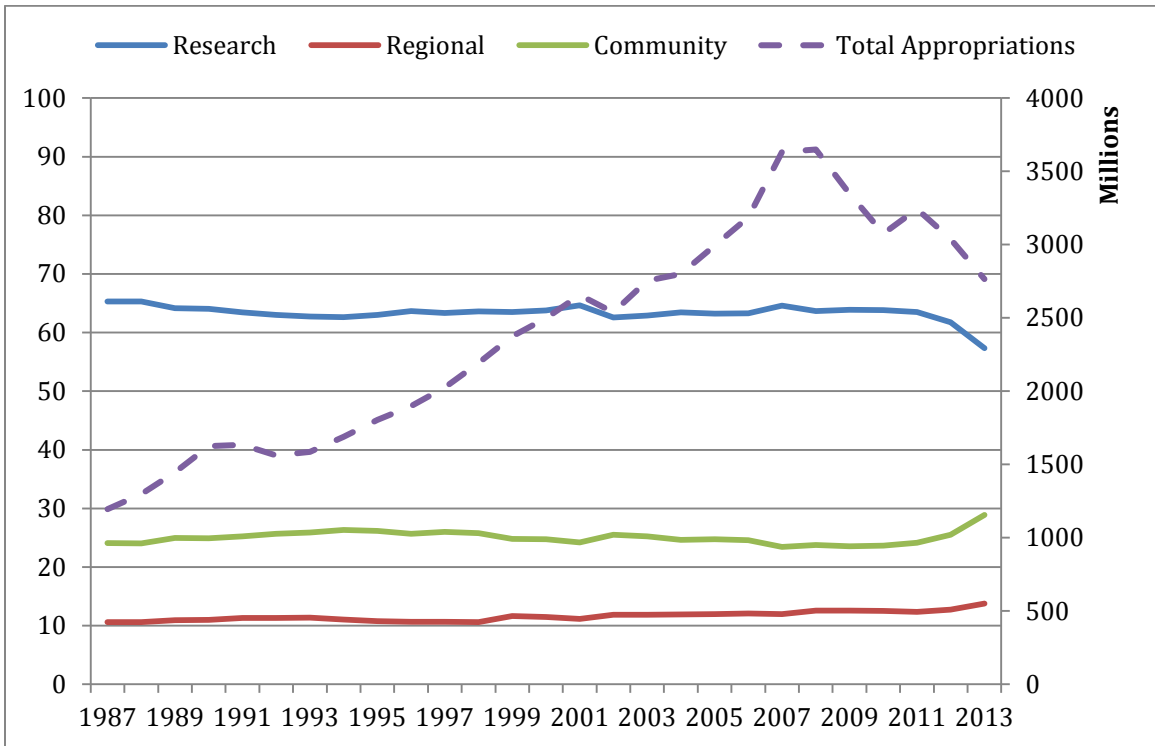
Figure A9. Relative appropriations (left axis) by type and total appropriations (right axis) for Florida.
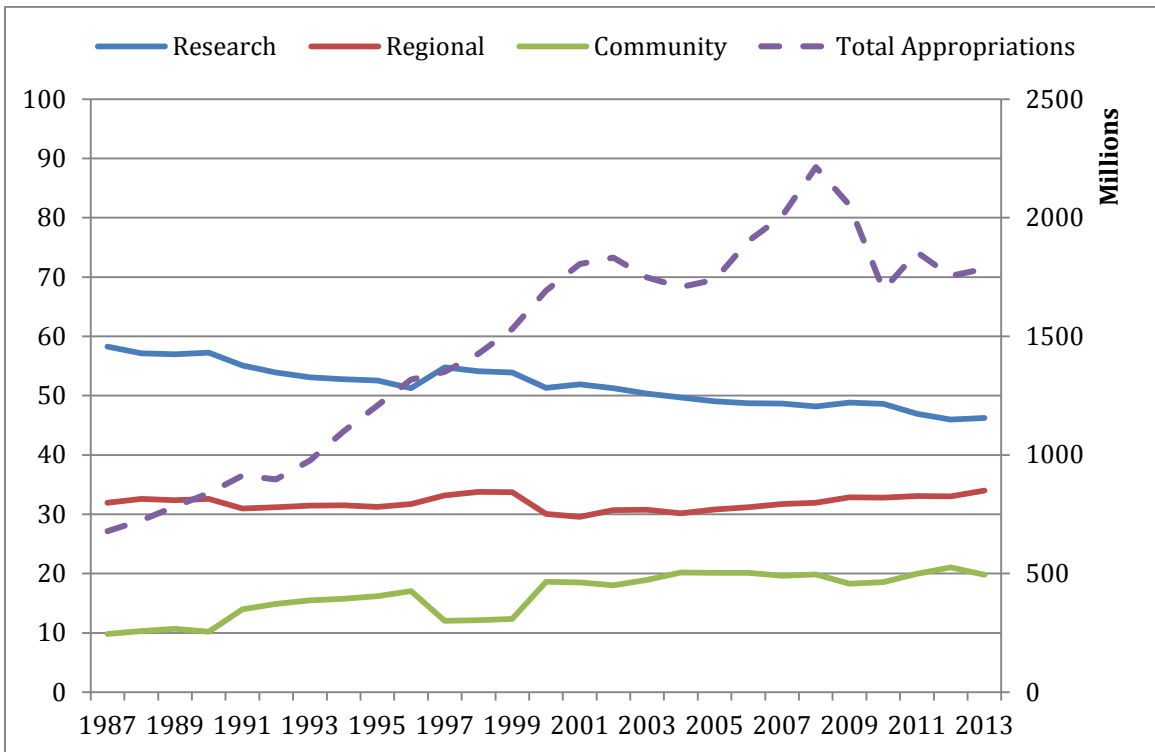
Figure A10. Relative appropriations (left axis) by type and total appropriations (right axis) for Georgia.
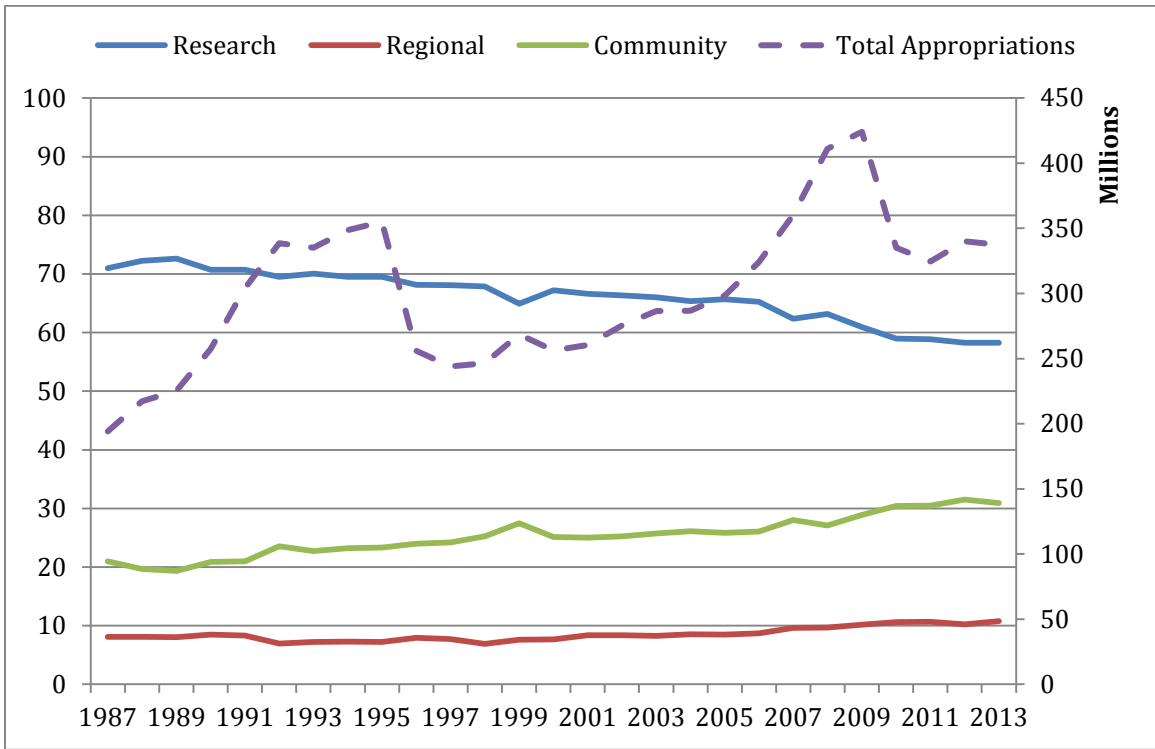
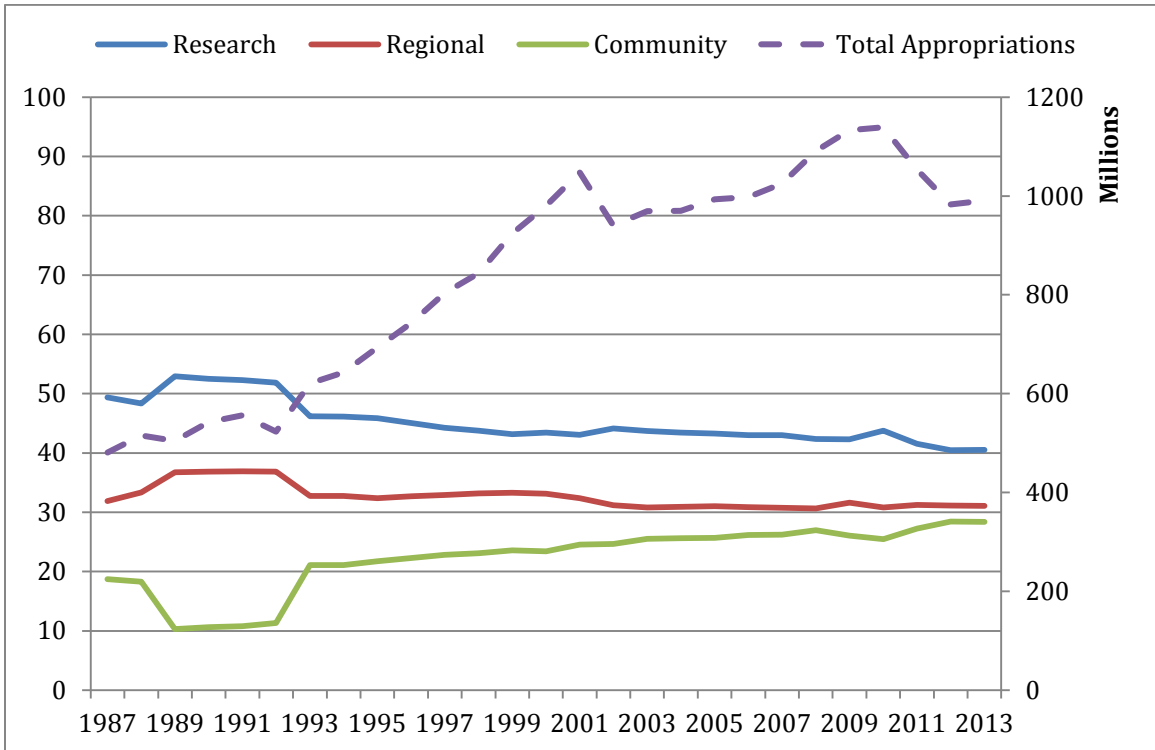*Figure A11*. Relative appropriations (left axis) by type and total appropriations (right axis) for Hawaii.
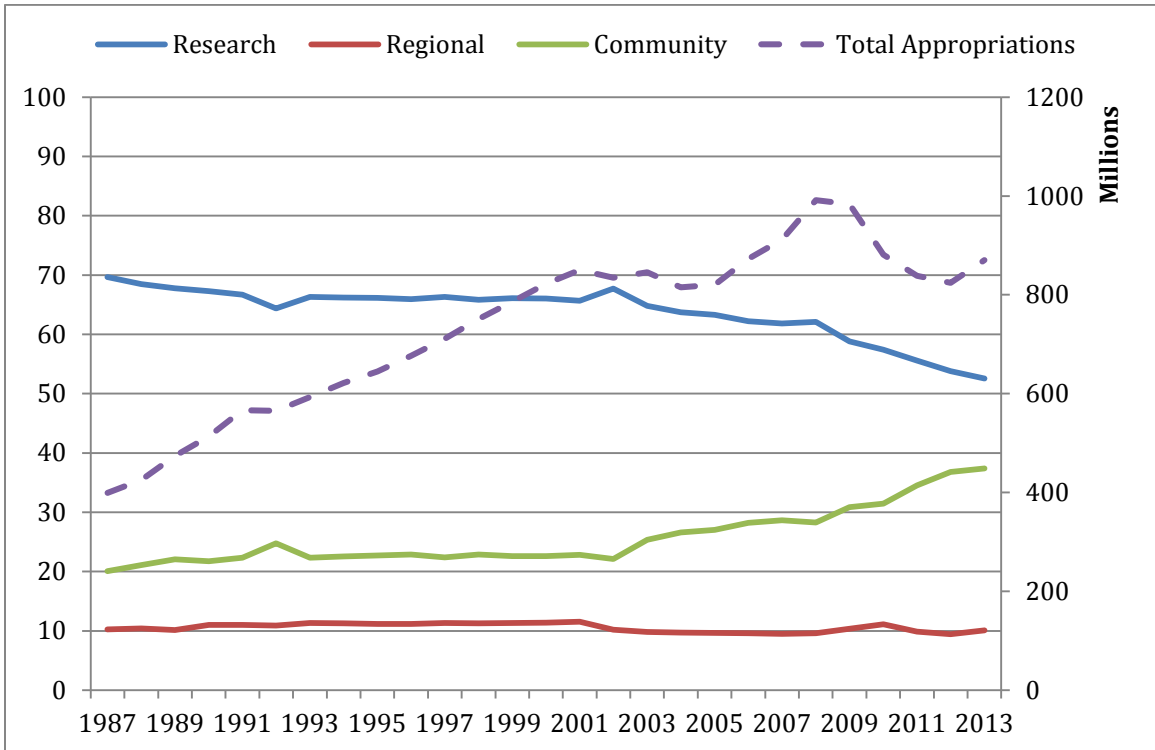
Figure A12. Relative appropriations (left axis) by type and total appropriations (right axis) for Iowa.
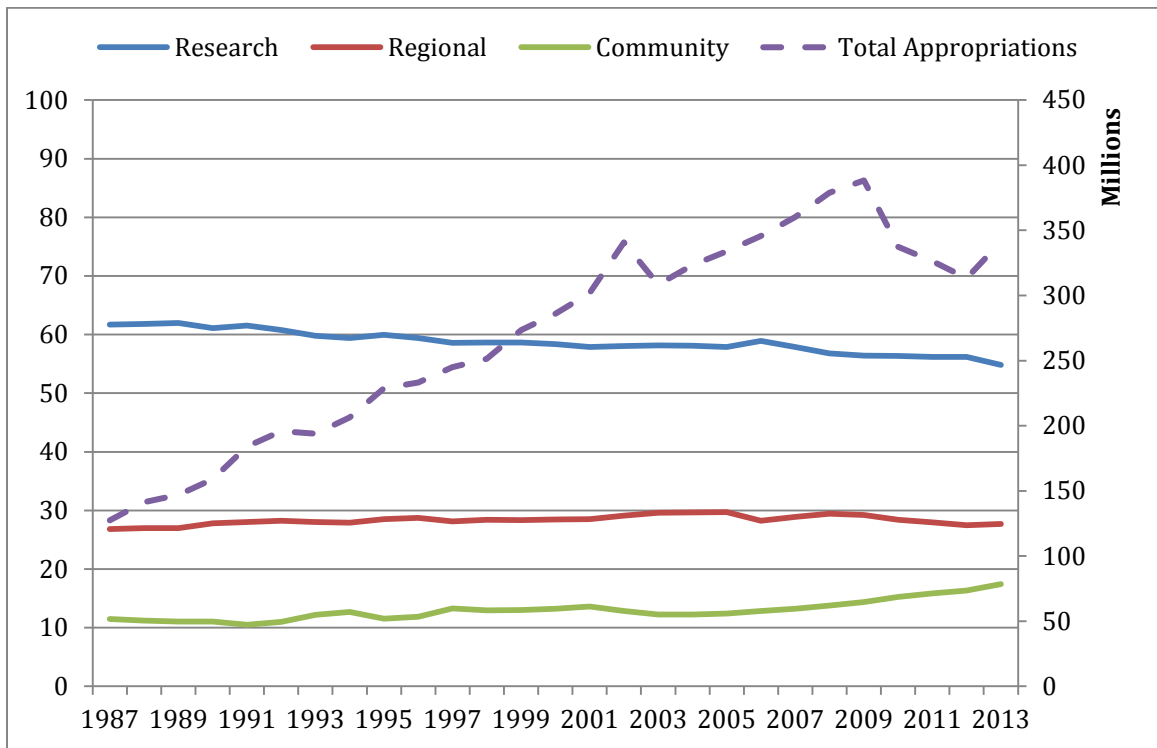
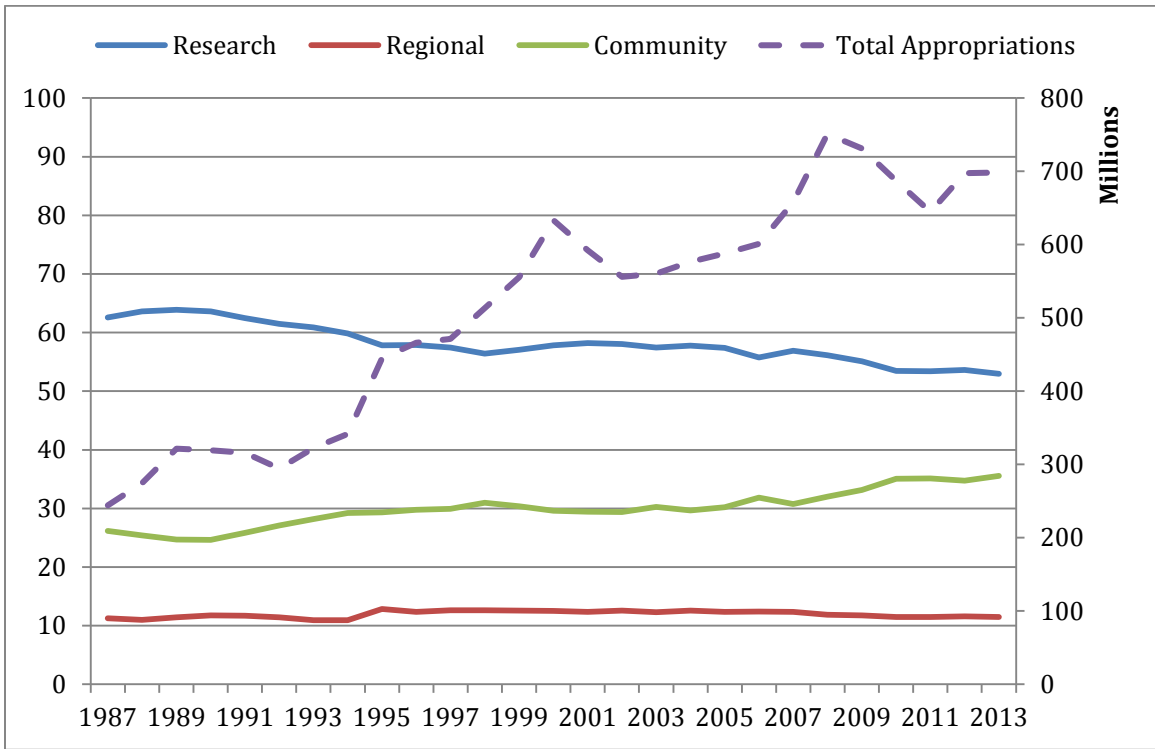*Figure A13.* Relative appropriations (left axis) by type and total appropriations (right axis) for Idaho.

Figure A14. Relative appropriations (left axis) by type and total appropriations (right axis) for Illinois.

Figure A15. Relative appropriations (left axis) by type and total appropriations (right axis) for Indiana.
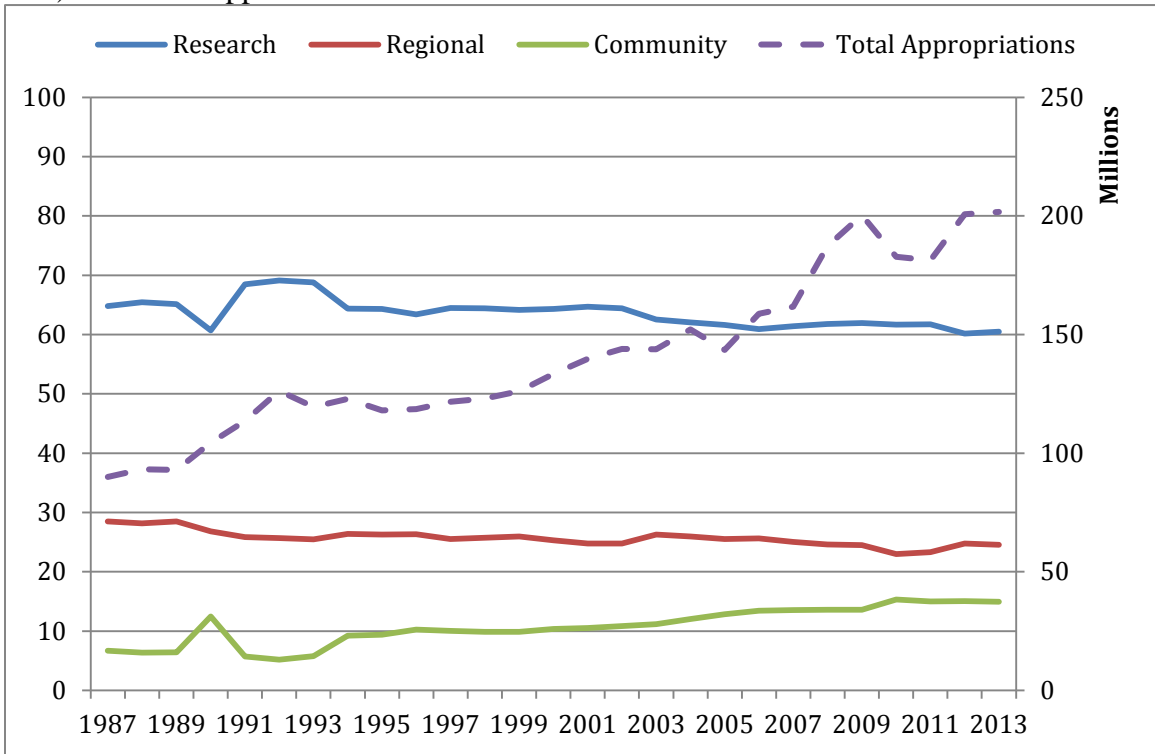

Figure A16. Relative appropriations (left axis) by type and total appropriations (right axis) for Kansas.

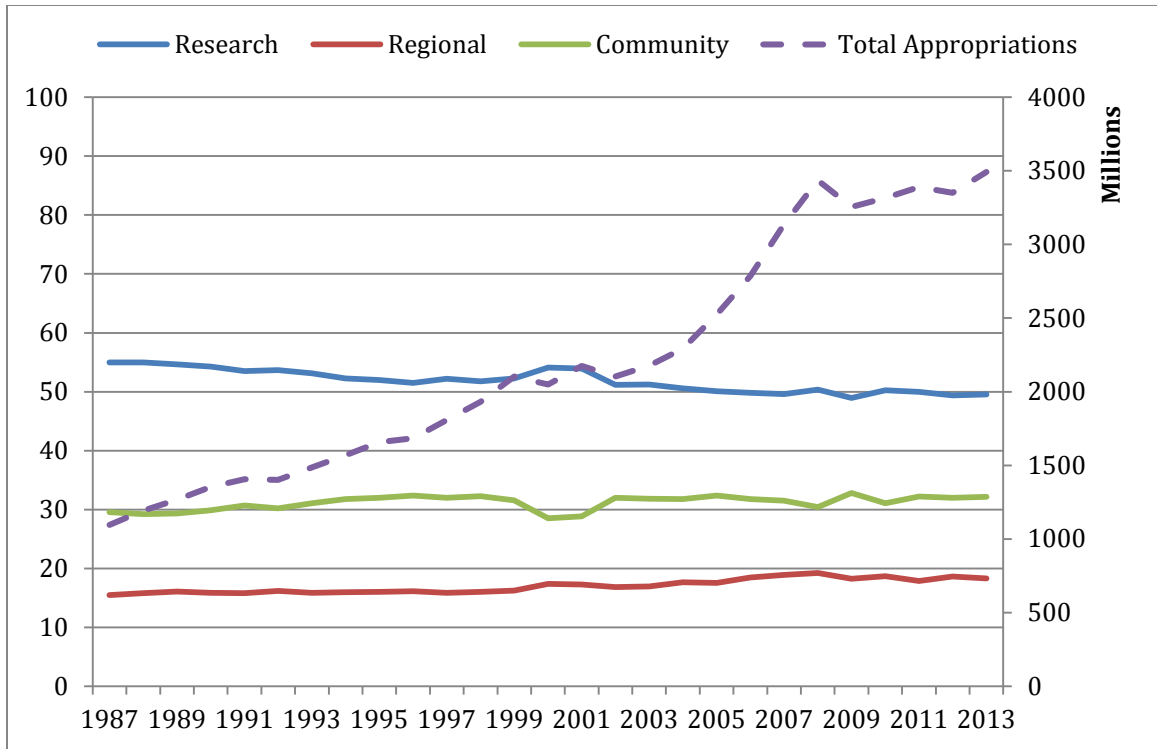*Figure A17*. Relative appropriations (left axis) by type and total appropriations (right axis) for Kentucky.
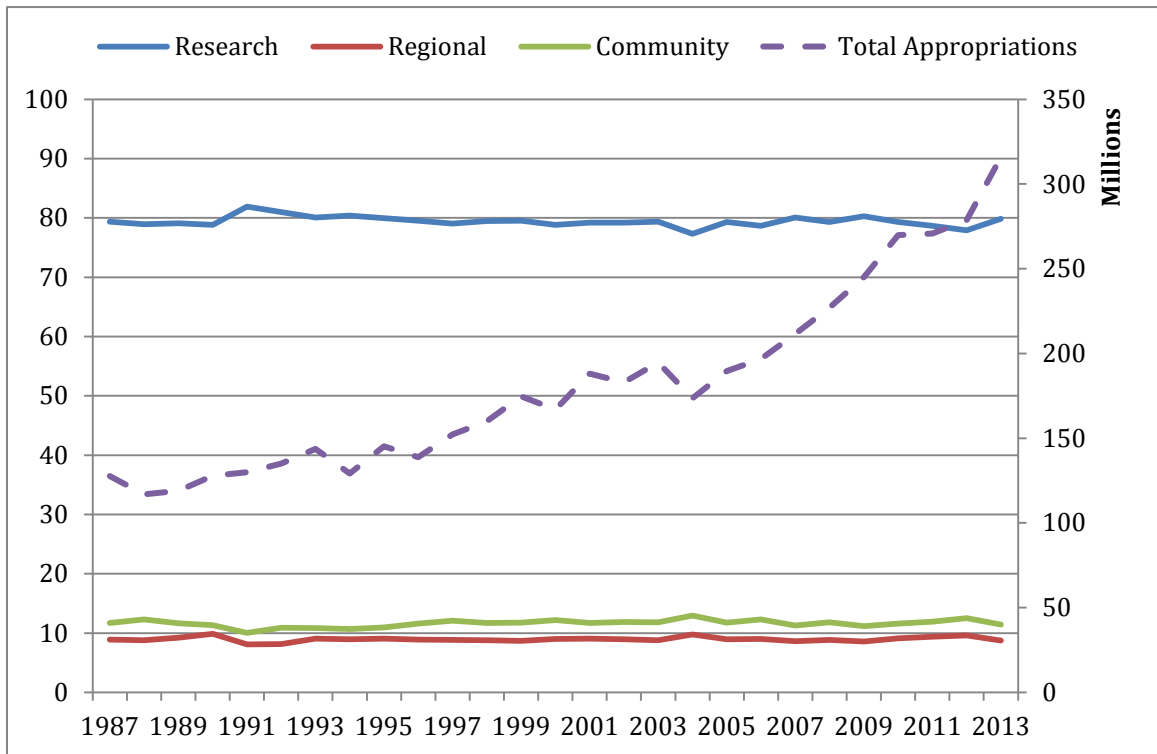

Figure A18. Relative appropriations (left axis) by type and total appropriations (right axis) for Louisiana.

Figure A19. Relative appropriations (left axis) by type and total appropriations (right axis) for Massachusetts.

Figure A20. Relative appropriations (left axis) by type and total appropriations (right axis) for Maryland.

Figure A21. Relative appropriations (left axis) by type and total appropriations (right axis) for Maine.

Figure A22. Relative appropriations (left axis) by type and total appropriations (right axis) for Michigan.
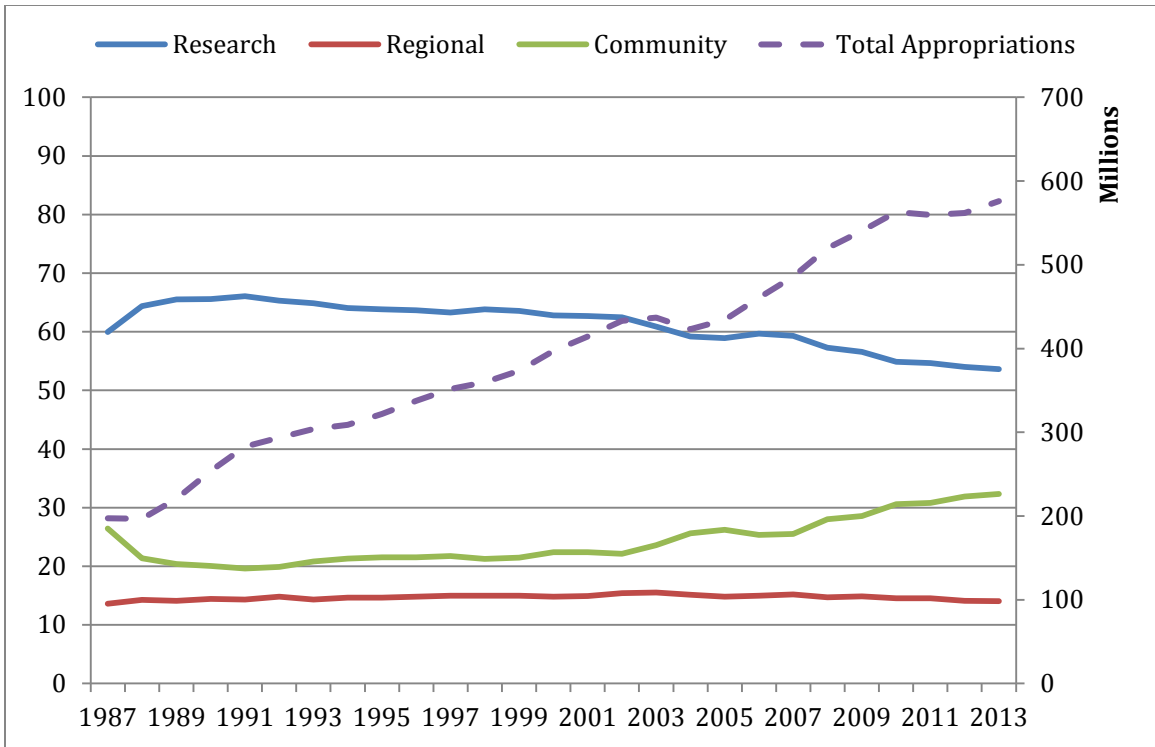
96

Figure A23. Relative appropriations (left axis) by type and total appropriations (right axis) for Minnesota.

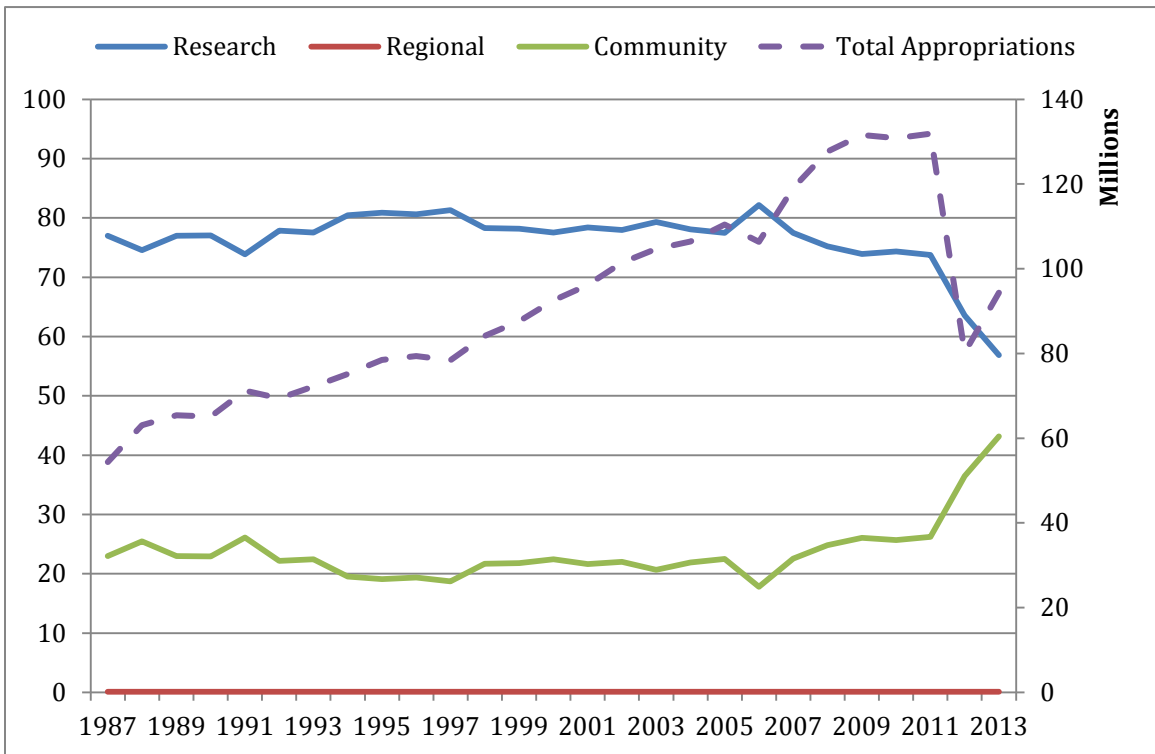*Figure A24.* Relative appropriations (left axis) by type and total appropriations (right axis) for Missouri.

Figure A25. Relative appropriations (left axis) by type and total appropriations (right axis) for Mississippi.

Figure A26. Relative appropriations (left axis) by type and total appropriations (right axis) for Montana.

Figure A27. Relative appropriations (left axis) by type and total appropriations (right axis) for North Carolina.

Figure A28. Relative appropriations (left axis) by type and total appropriations (right axis) for North Dakota.

Figure A29. Relative appropriations (left axis) by type and total appropriations (right axis) for Nebraska.

Figure A30. Relative appropriations (left axis) by type and total appropriations (right axis) for New Hampshire.
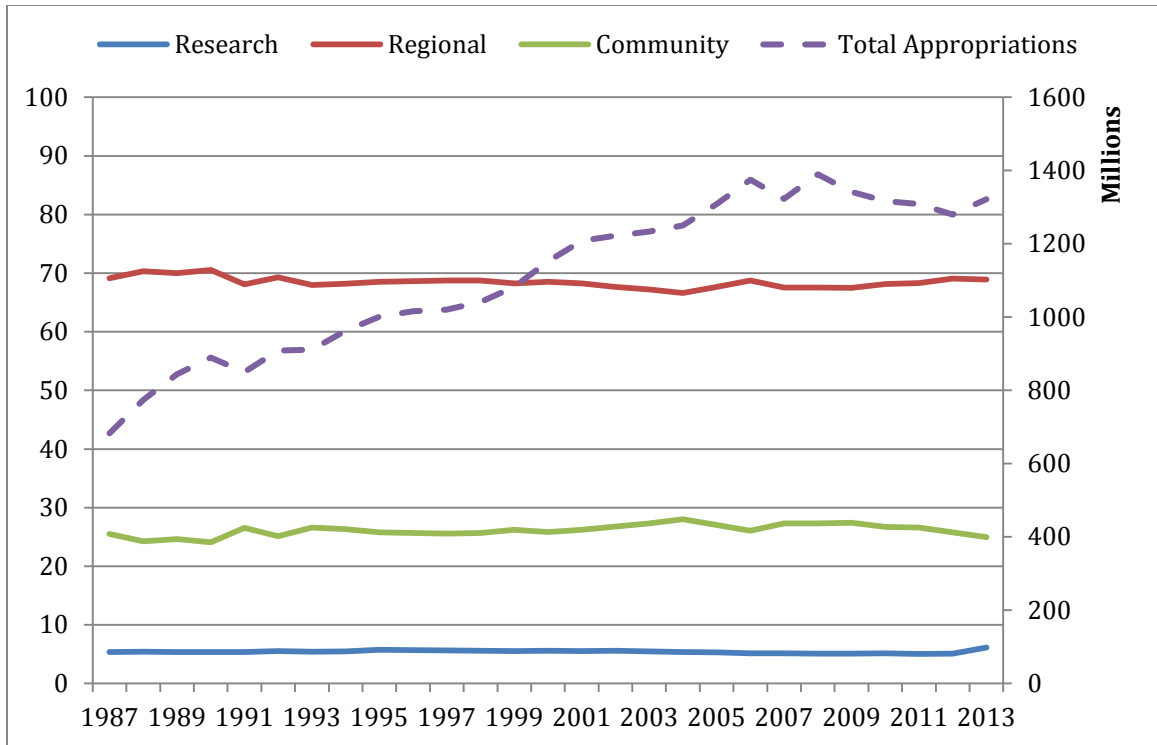
Figure A31. Relative appropriations (left axis) by type and total appropriations (right axis) for New Jersey.
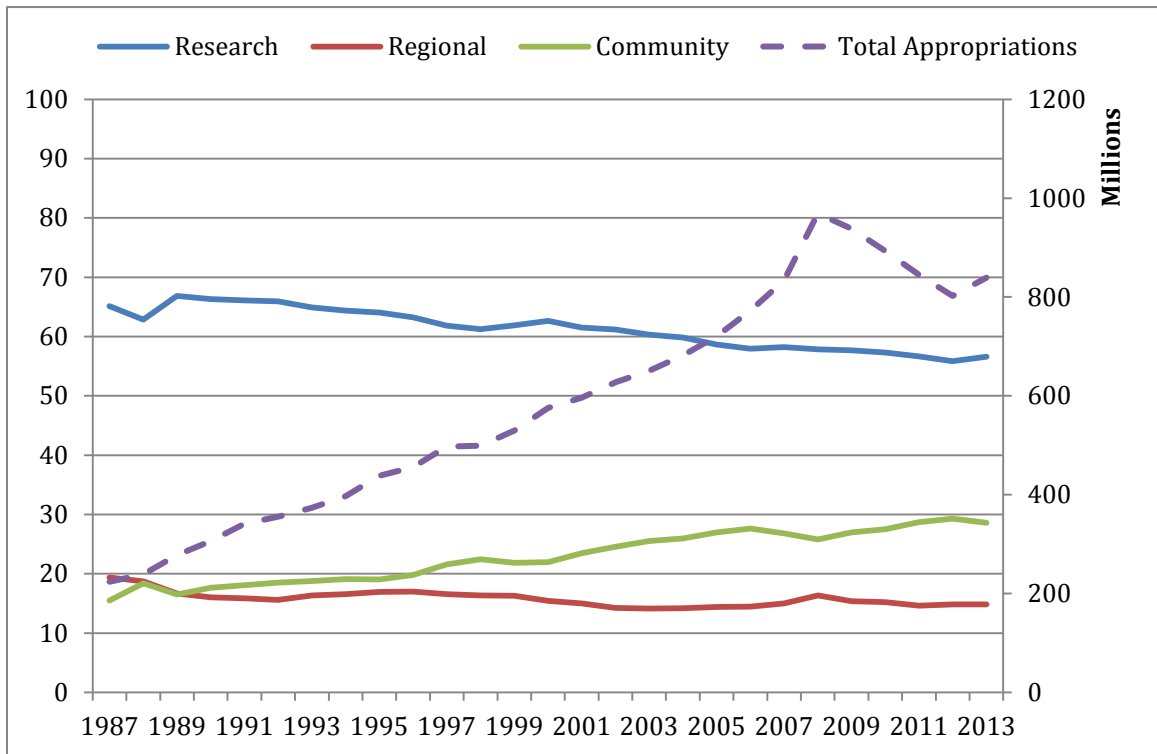

Figure A32. Relative appropriations (left axis) by type and total appropriations (right axis) for New Mexico.
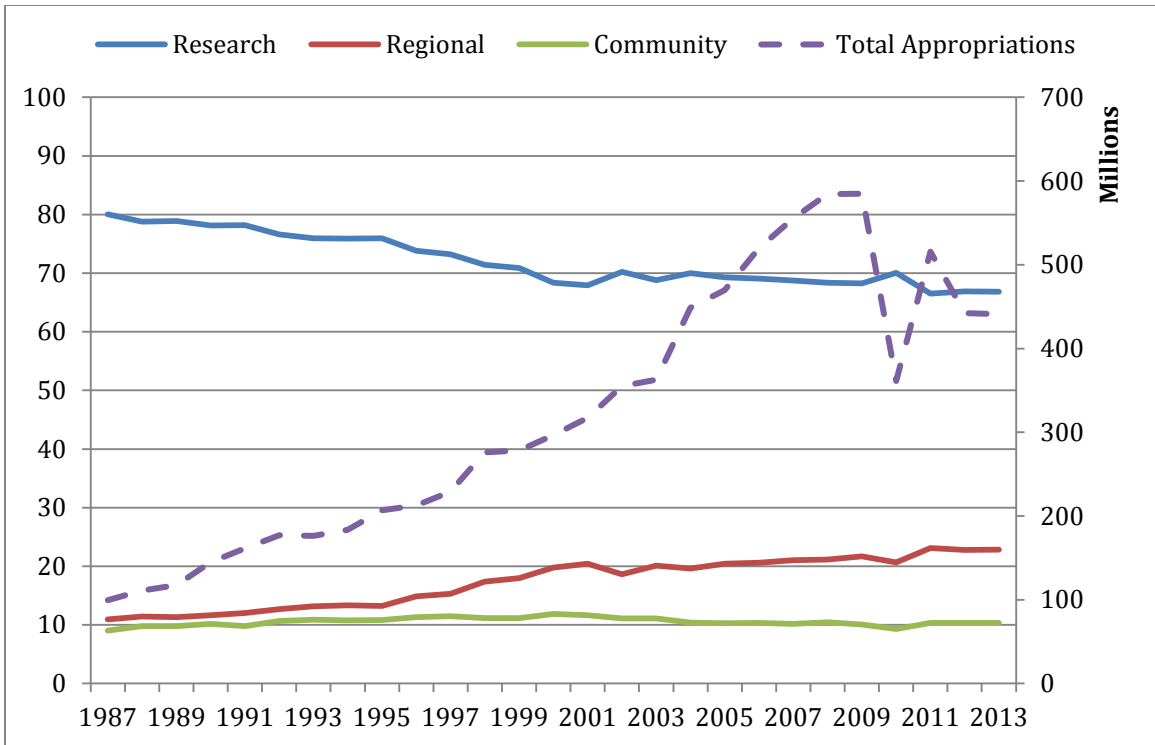
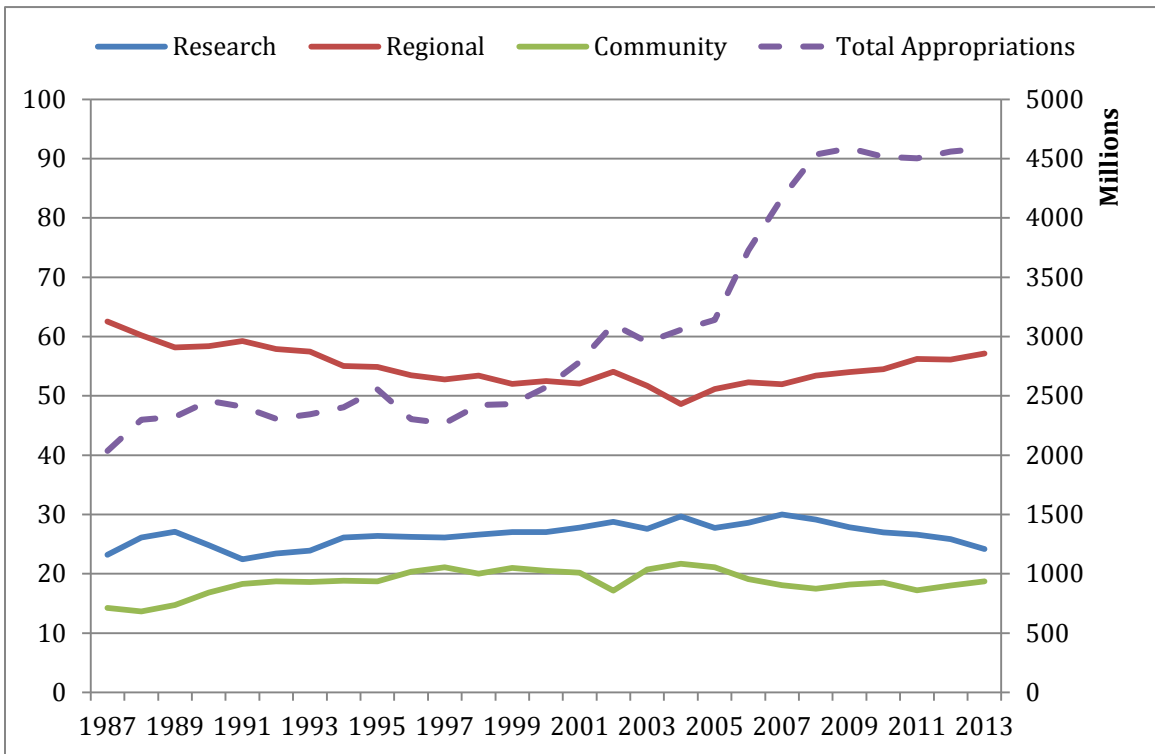*Figure A33.* Relative appropriations (left axis) by type and total appropriations (right axis) for Nevada.

Figure A34. Relative appropriations (left axis) by type and total appropriations (right axis) for New York.
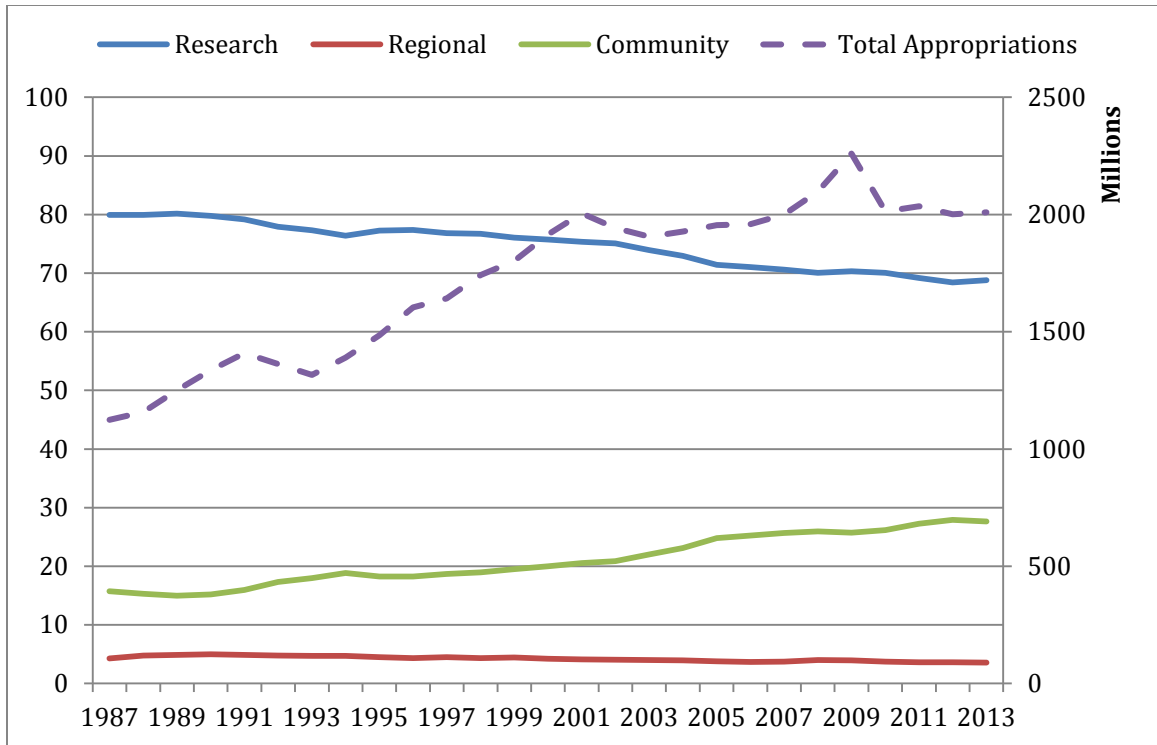
Figure A35. Relative appropriations (left axis) by type and total appropriations (right axis) for Ohio.
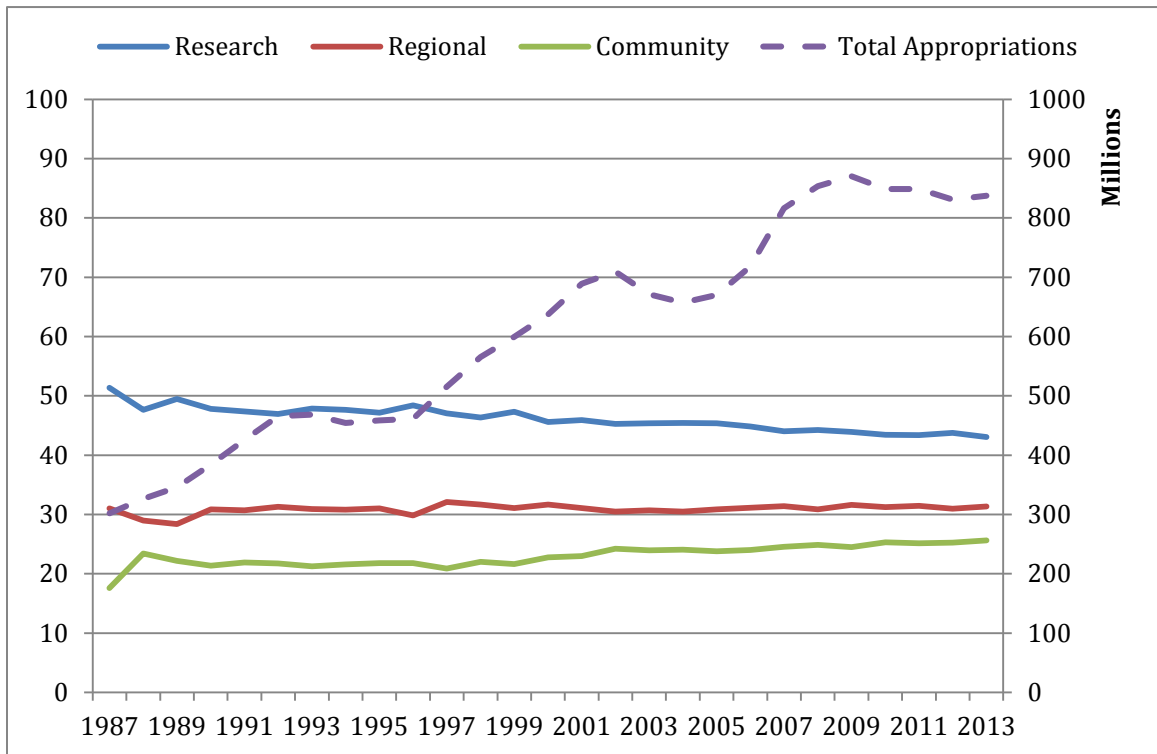

Figure A36. Relative appropriations (left axis) by type and total appropriations (right axis) for Oklahoma.

Figure A37. Relative appropriations (left axis) by type and total appropriations (right axis) for Oregon.

Figure A38. Relative appropriations (left axis) by type and total appropriations (right axis) for Pennsylvania.

Figure A39. Relative appropriations (left axis) by type and total appropriations (right axis) for Rhode Island.

Figure A40. Relative appropriations (left axis) by type and total appropriations (right axis) for South Carolina.

Figure A41. Relative appropriations (left axis) by type and total appropriations (right axis) for South Dakota.

Figure A42. Relative appropriations (left axis) by type and total appropriations (right axis) for Tennessee.
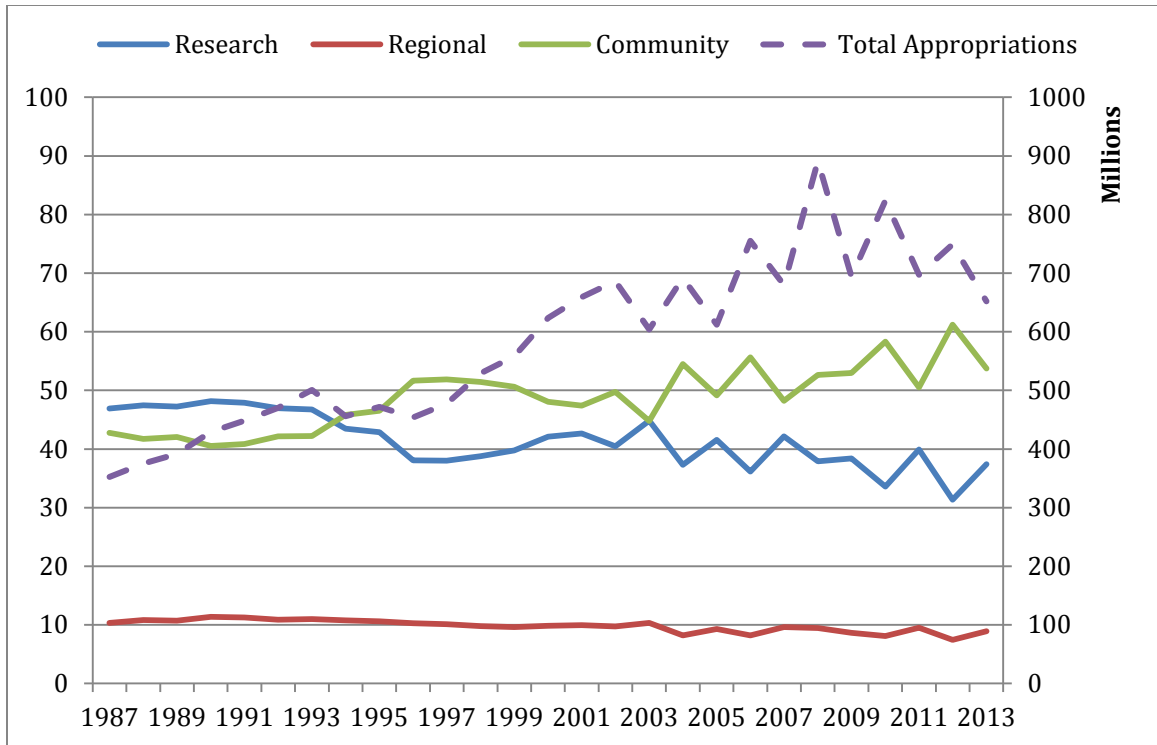
Figure A43. Relative appropriations (left axis) by type and total appropriations (right axis) for Texas.

Figure A44. Relative appropriations (left axis) by type and total appropriations (right axis) for Utah.

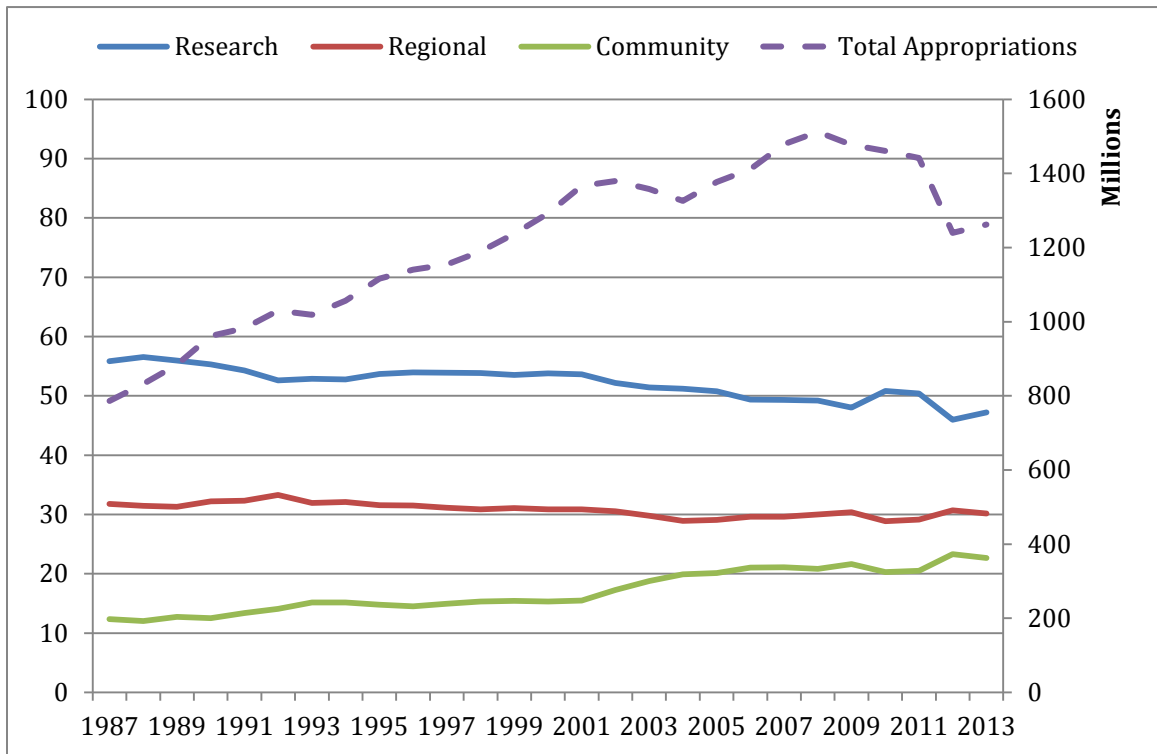Figure A.45 Relative appropriations (left axis) by type and total appropriations (right axis) for Virginia.

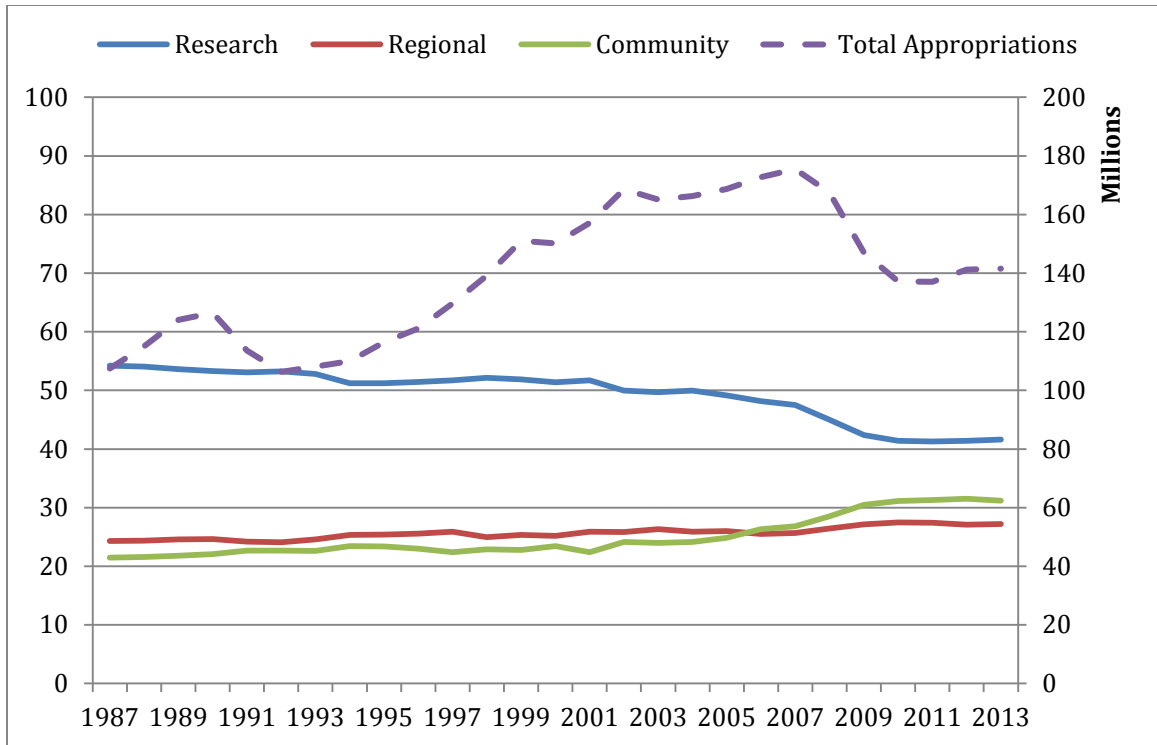*Figure A46.* Relative appropriations (left axis) by type and total appropriations (right axis) for Vermont.

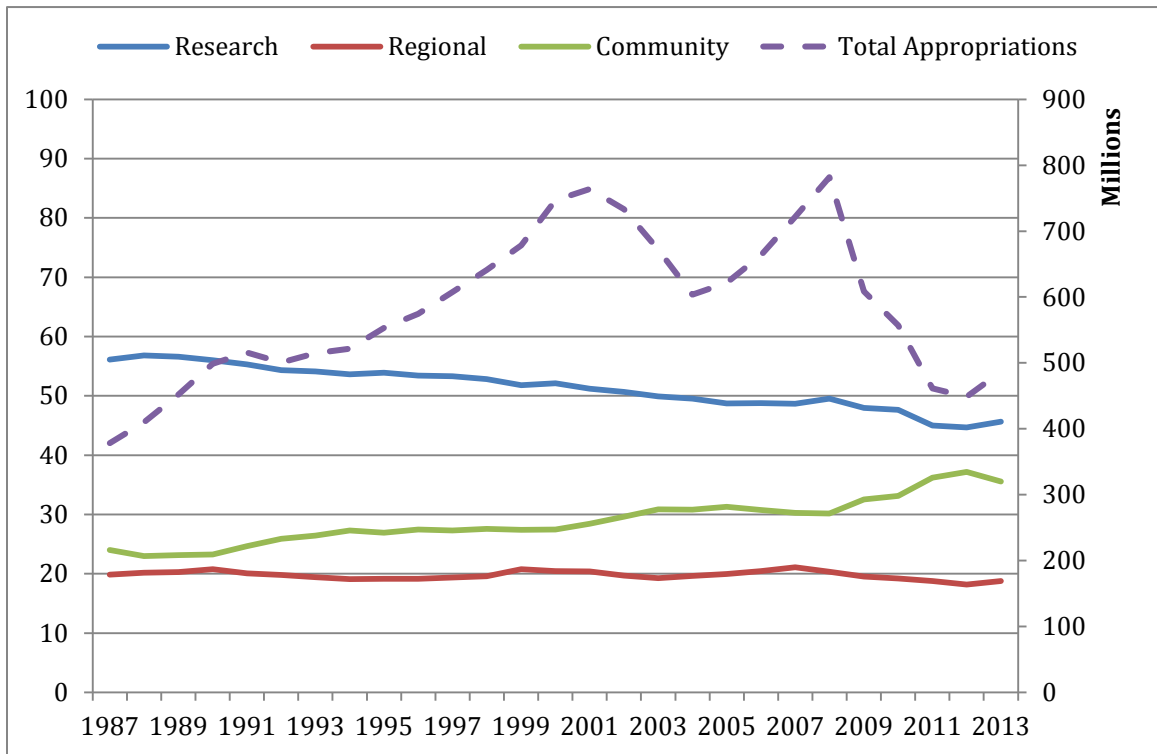*Figure A47*. Relative appropriations (left axis) by type and total appropriations (right axis) for Washington.
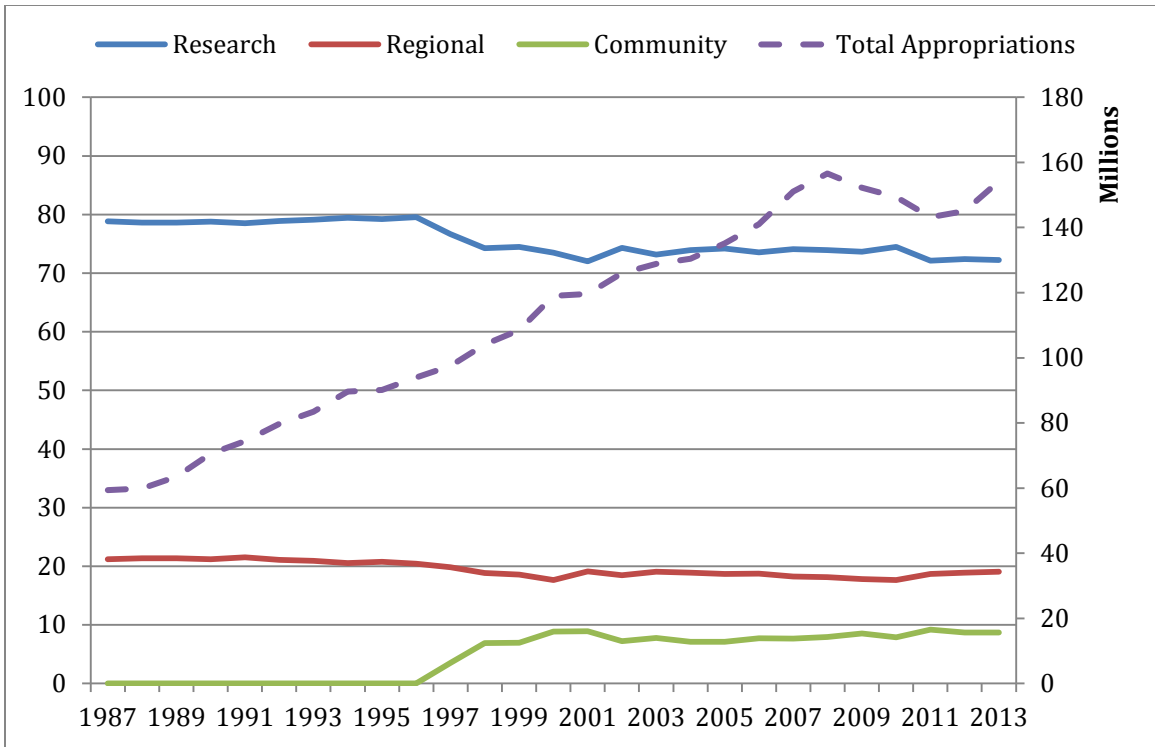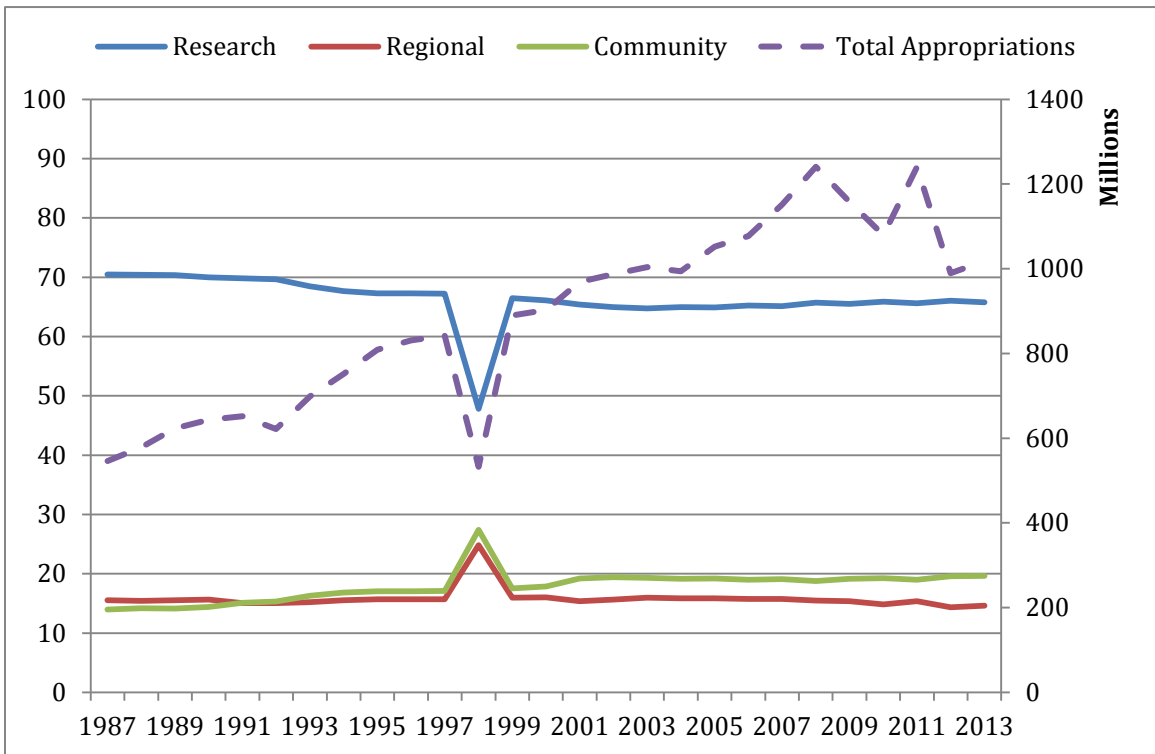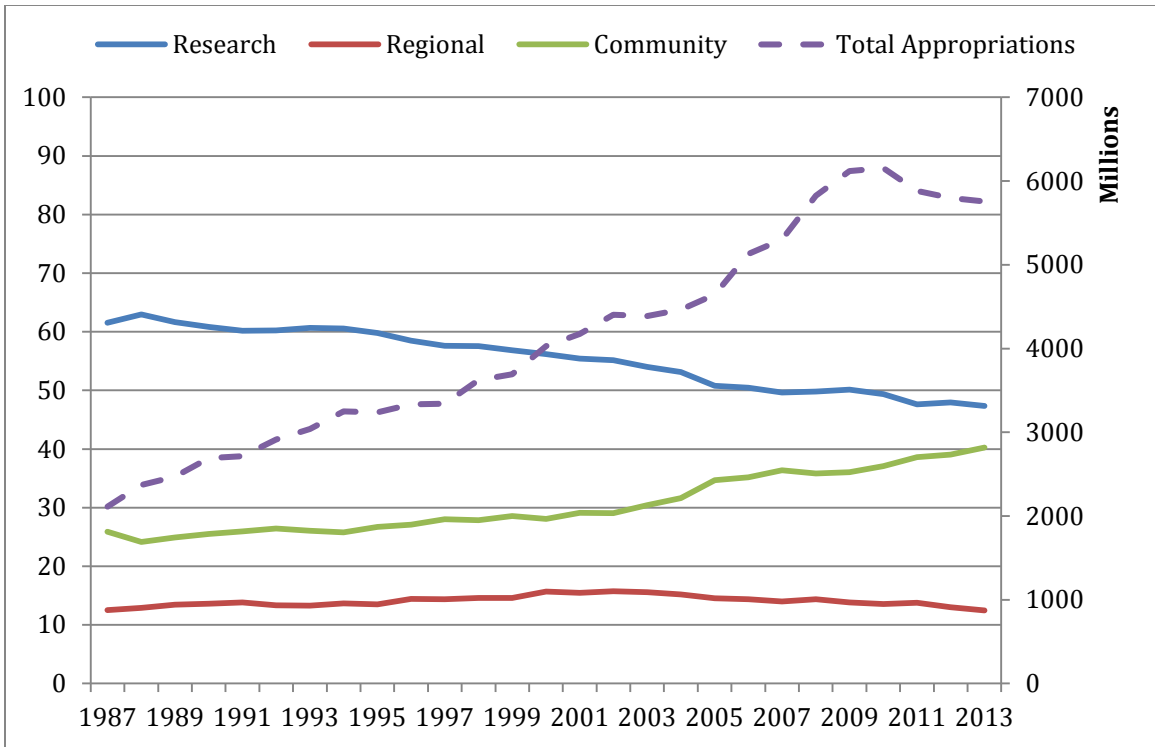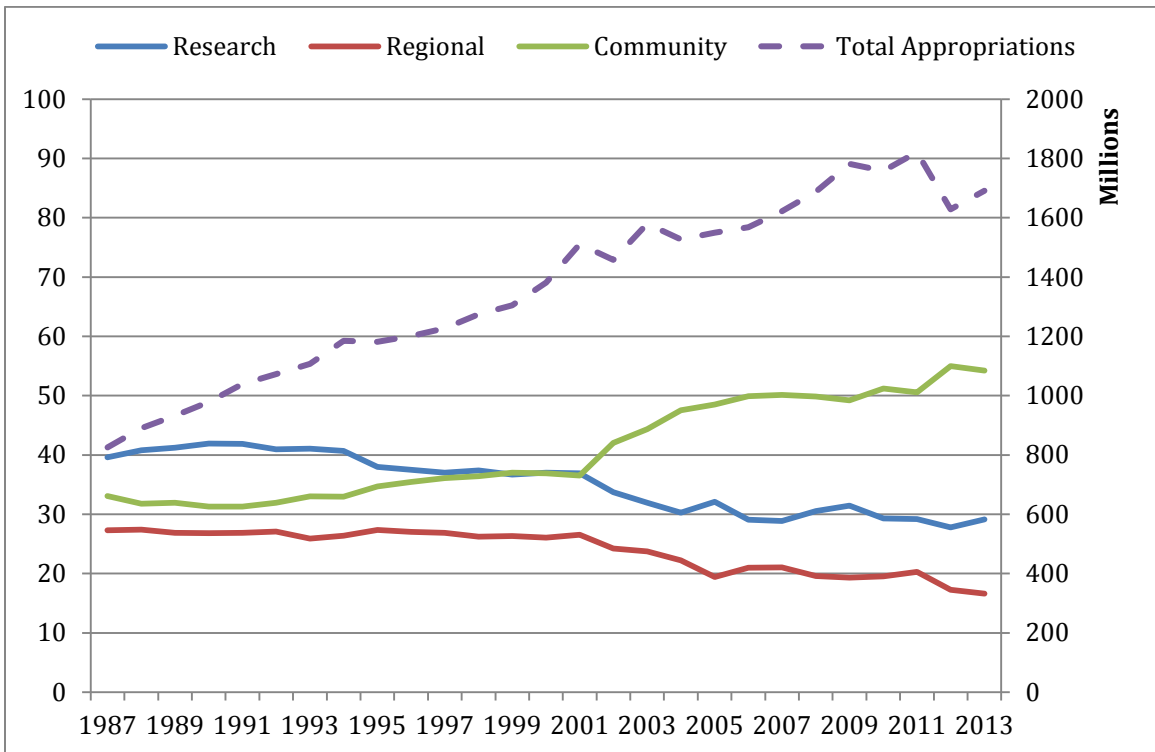

Figure A48. Relative appropriations (left axis) by type and total appropriations (right axis) for Wisconsin.

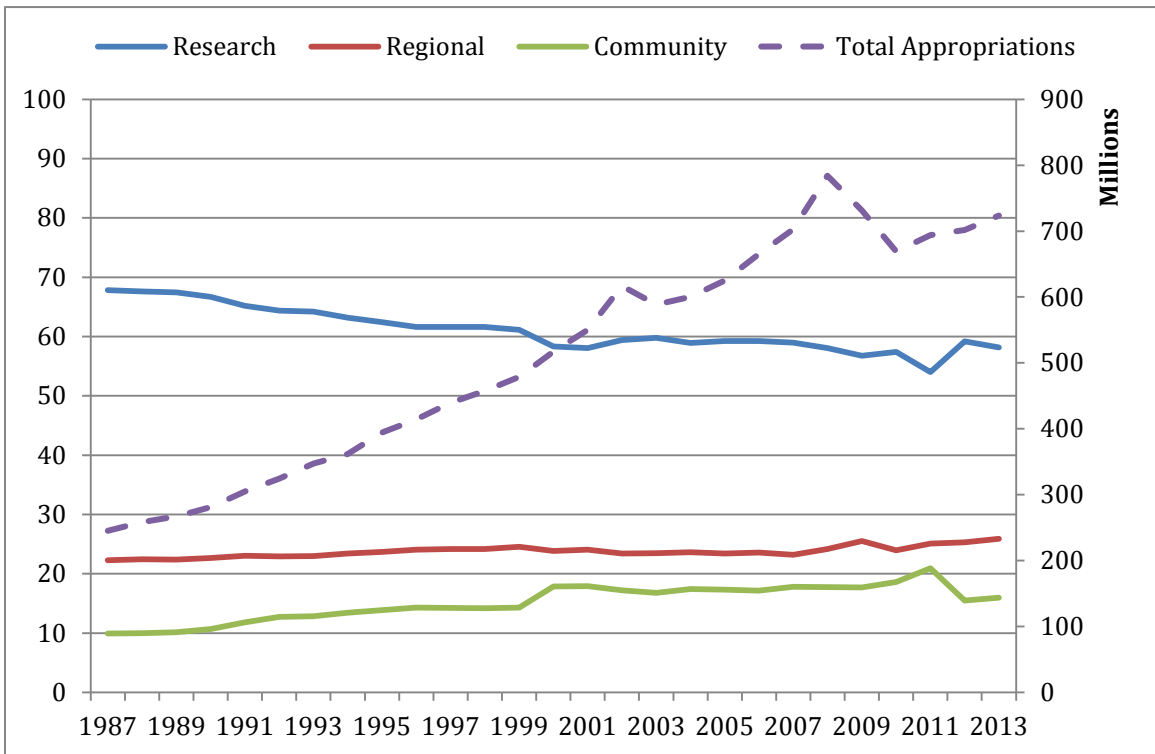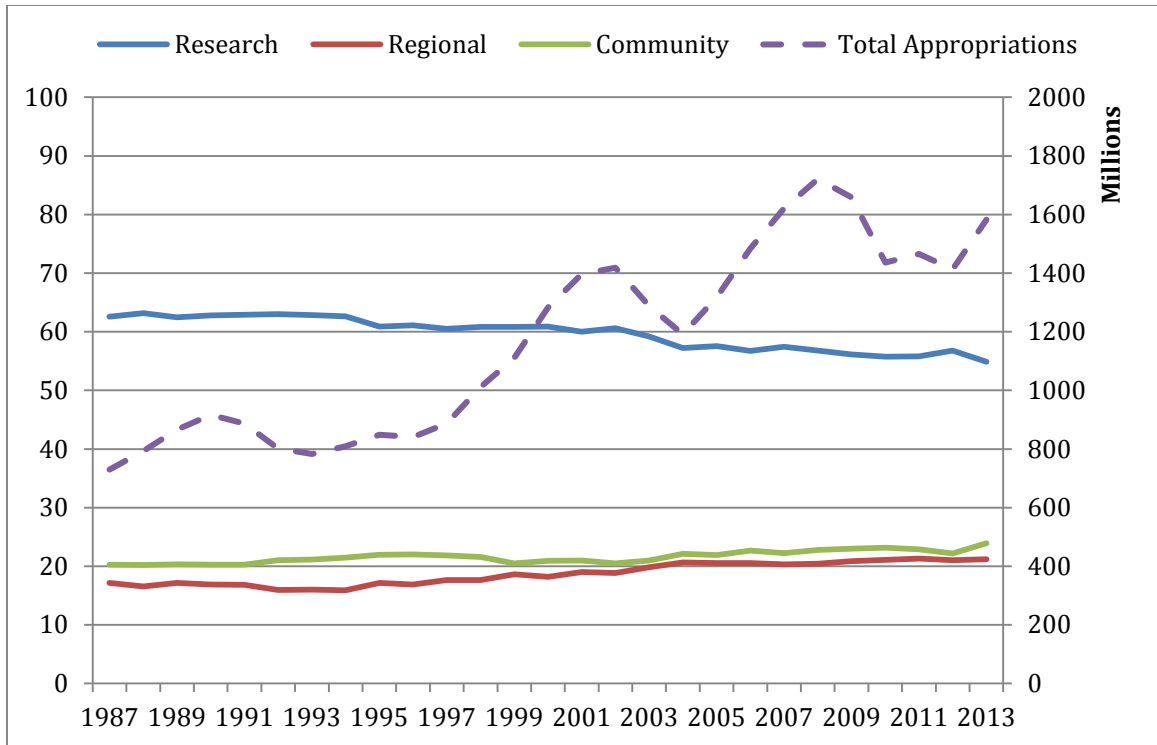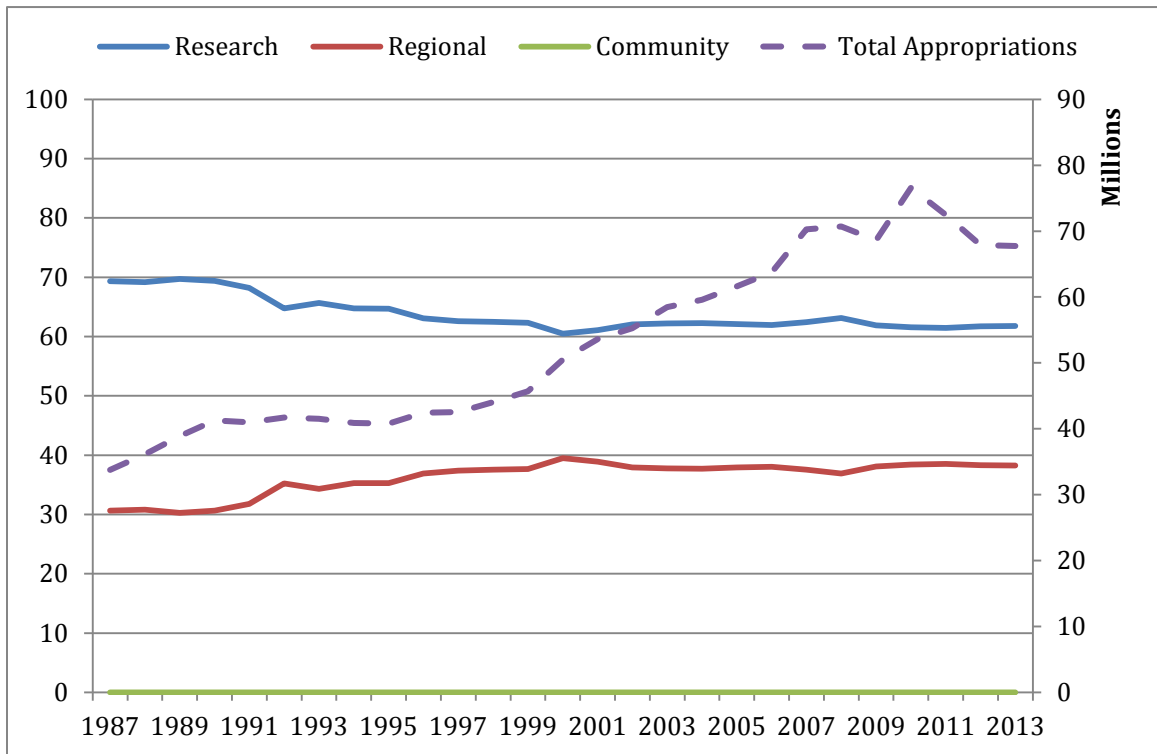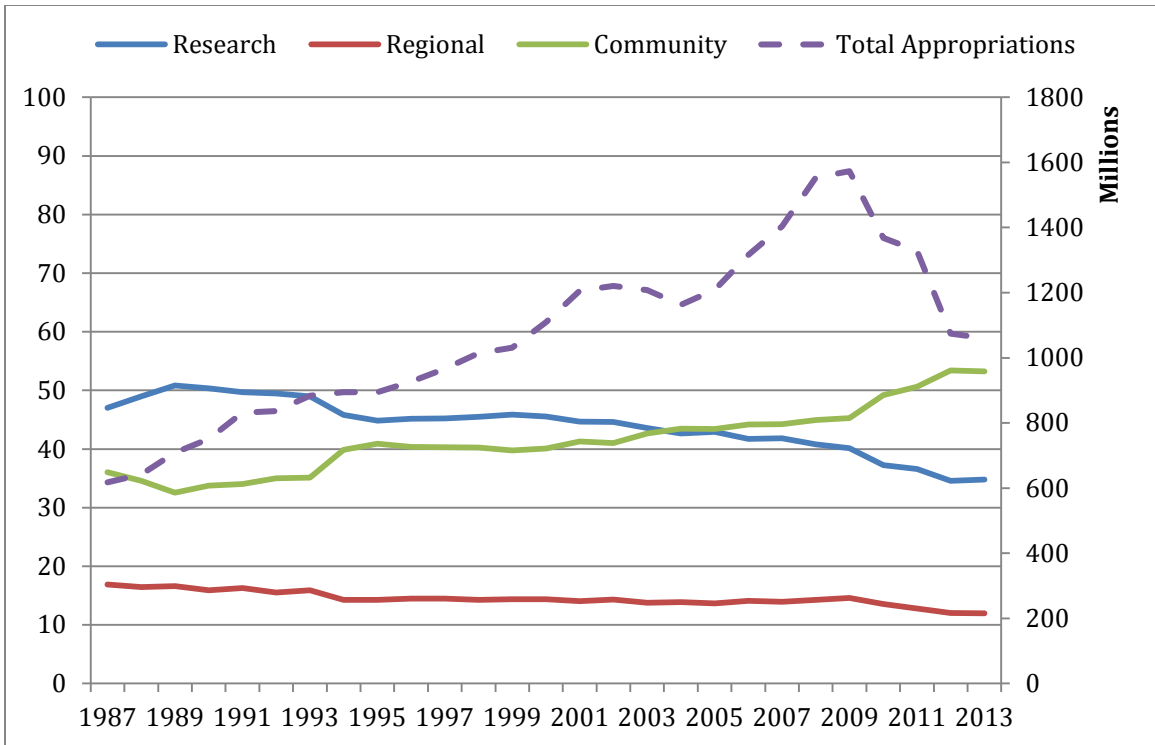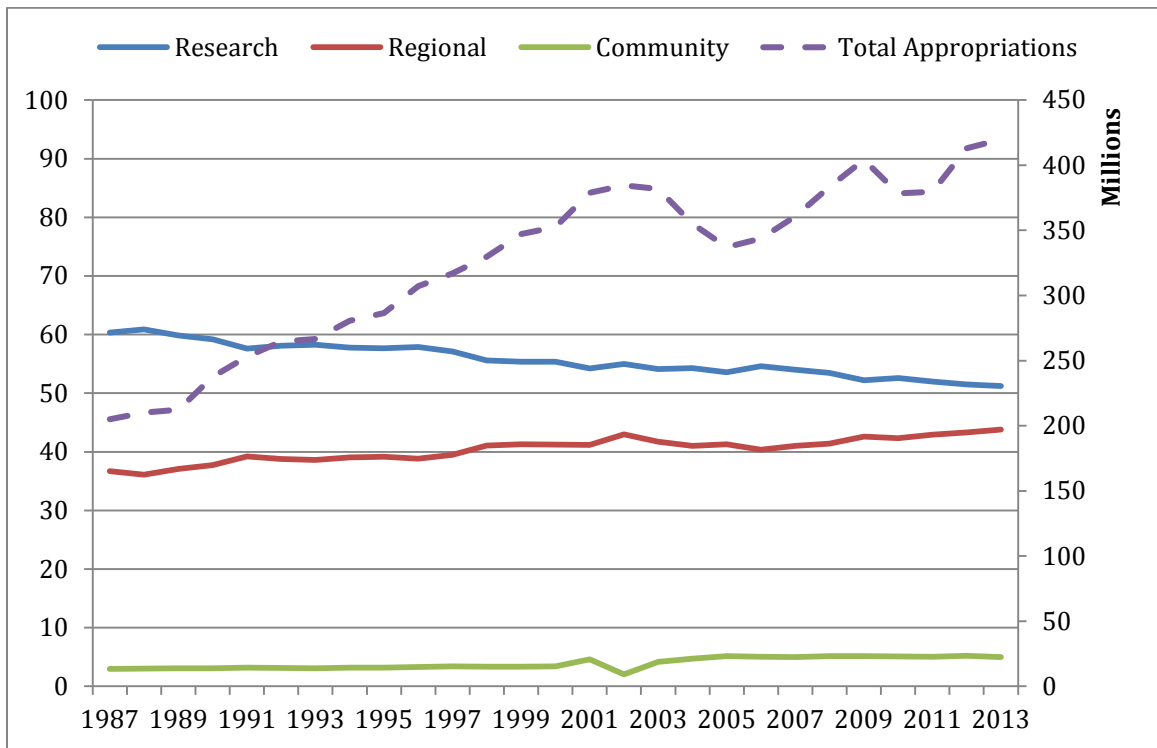*Figure A49*. Relative appropriations (left axis) by type and total appropriations (right axis) for West Virginia.
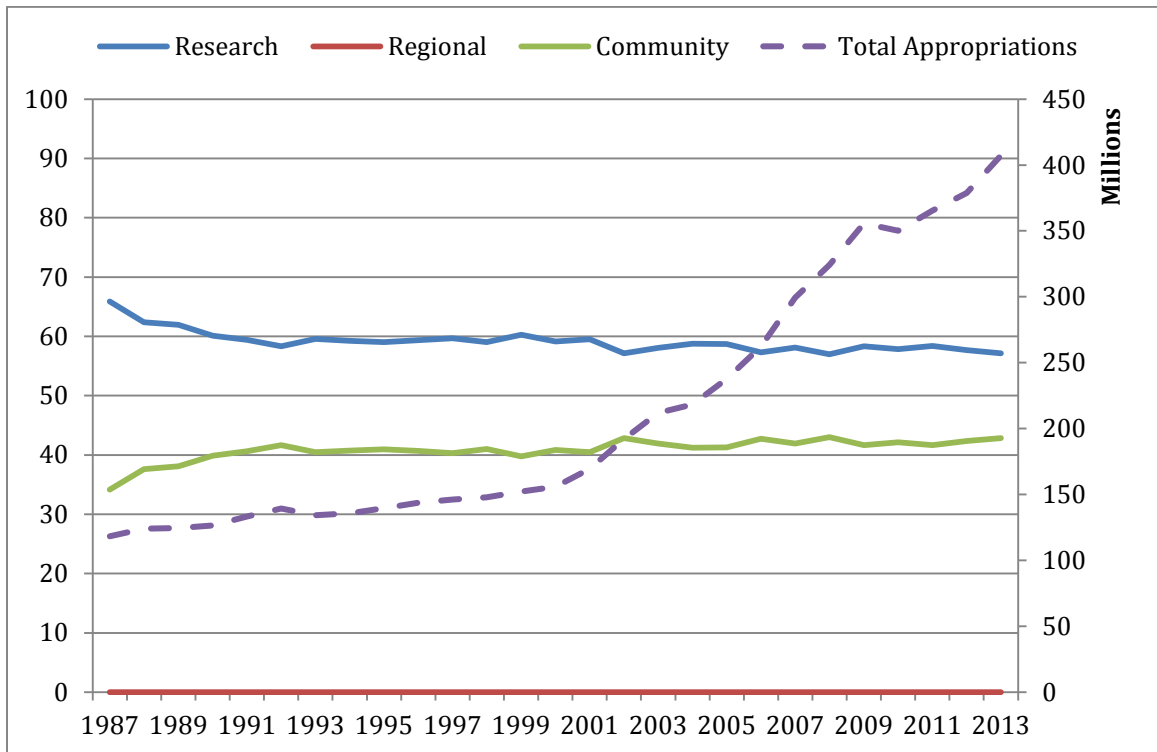
Figure A50. Relative appropriations (left axis) by type and total appropriations (right axis) for Wyoming.

Appendix B

Introduction

While compositional data analysis is best suited to this type of time series data, there is also value in cross-sectional analysis. By considering only one year of data it is possible to estimate the impact of variables that are different across states but do not vary within states over time, governance structure for example. This appendix utilizes a cross-sectional analysis to investigate those variables.

Methods

A number of the variables identified in the higher education appropriations literature have been included in this study to determine the impact on the relative support for institutional types. The primary outcome of interest is the proportion of appropriations allotted to community, regional, and research institutions. As described in earlier chapters, this proportion was obtained by totaling the appropriations reported by each institutional type and dividing these sums by the total for research, regional, and community colleges. For academic year 2007, the total appropriations provided to institutions are summed by state, $A_s(2007) = \sum_i \sum_{j=1}^{J} a(2007)_{ij}$, where i represents the type of institution (1= research, 2= regional, and 3=community) and j represents the specific institution in a particular state s. The proportion for each type is calculated by dividing the appropriation total for a particular institutional type (i) by the total annual appropriations for the state, $P_{si}(2007) = \frac{\sum_{j=1}^{J} a(2007)_{ij}}{A_s(2007)}$. Only appropriations for the specified institutional types are considered so that the sum of the proportions within any state equals one, $P_{s1}(2007) + P_{s2}(2007) + P_{s3}(2007) = 1$.

Political variables. The influence of a political party within a given state has been shown to have an impact on the appropriations policy both at the legislative and gubernatorial levels. Previous studies have linked Democratic control of the legislature and the governor's office to increased overall appropriations levels (Archibald & Feldman, 2006; Knott & Payne, 2004; Nicholson-Crotty & Meier, 2003) and noted that Democrats are generally in favor of increased governmental spending (McLendon, Hearn, et al., 2009; Nicholson-Crotty & Meier, 2003). Each party holds a different view on the size and scope of government activities with Democrats generally preferring greater levels of spending on social programs, including higher education, than Republicans (Archibald & Feldman, 2006; Okunade, 2004). Democrat control of legislatures has also been linked to increased support for less research intensive institutions favoring access over higher levels of education (McLendon, Mokher, et al., 2009).

Public higher education variables. Just as each state has the opportunity to develop the public higher education system, it also must determine how to oversee the institutions. Governance has been shown to affect a number of policies related to higher education (Hearn, Griswold, & Marine, 1996; McLendon, Mokher, et al., 2009). There exists a wide range of power and responsibility delegated to the various governance entities, and it is the centralization of power that is used to classify the states into groups (Mcguinness, 2003). States where the governance board has significant program and budgetary power are called consolidated, while those boards with a lesser role are coordinating boards; and two states employ planning boards, which are merely advisory. It is unclear which type of institution may be favored by a given governance structure.

Another tool available to state policymakers to control the distribution of appropriations are funding formulas put in place for precisely that purpose. In academic year 2007, 27 states employed funding formulas for some portion of appropriations (America, 2006). Many states that employ formulas use enrollment or other measures to determine funding; however, recently a number of states have or plan to integrate performance measures such as graduation rates into the formula. While these formulas should determine the precise distribution of resources, they are subject to frequent change or removal. The complexity of these formulas also makes it difficult to categorize the states in any meaningful way beyond the fact that a formula is in place.

The final system variable considered is the prevalence of private higher education options within the state. During the drastic increase in participation in higher education following WWII, public institutions were founded and expanded at a rapid rate to meet the demand (Thelin, 2004). In 2009, public institutions enrolled approximately 75% of all undergraduate students (Desrochers & Wellman, 2011). The distribution of private institutions is largely concentrated in the Northeast and Midwest states and provides an alternative to the public institutions.

Economic and demographic variables. Economic and demographic characteristics of states help to determine the resources available to support as well as the need for public higher education. Previous studies have shown a relationship between state resources, measured as GDP and income, and larger expenditures on higher education and other public programs (Lowry, 2001). Increases in the unemployment rate have been linked to decreased appropriations (Kane et al., 2005; Toutkoushian & Hollis, 1998). Increased unemployment may also indicate the need for job training of the type

most often associated with community colleges. Likewise, prior studies have found a positive relationship between the number of potential students, population or some subset of population, and appropriations (Toutkoushian & Hollis, 1998). The distribution of appropriations is also likely to change based on the number of potential students; states needing to serve more students are likely to turn towards lower-cost alternatives.

Data source. Data from the Delta Cost Project was used for this analysis. The Delta Cost Project includes data at the institution-level obtained from IPEDS (Integrated Post-Secondary Education System, "the primary source for data on colleges, universities, and technical and vocational post-secondary institutions in the United States"). Only public institutions (identified as research, regional, or community) were selected for analyses. Data at the institutional-level were averaged to create state-level aggregated data for each variable. The Delta Cost Project data were augmented by the dataset maintained by Dr. Edward Jennings that contains population, economic, and political variables by state. The most recent year of data for the Delta Cost Project that could be linked to the Jennings data repository was used. Therefore, the data for this analysis includes 2007 state-aggregated data from the Delta Cost Project and the Jennings dataset.

Statistical Analysis

Data were described with summary statistics (mean, SD) for continuous variables and with frequencies and percentages for categorical variables by institutional type Compositional data analysis was incorporated through transformed outcomes used in linear regressions. Compositional data analysis investigates the relative frequency with which the different types of institutions were allocated appropriations. Using the log-ratio transformation suggested by Fry et al. (2000) and Aitchison (1986), new dependent

variables were obtained by dividing the proportion of appropriations for regional

institutions and community colleges by the proportion of appropriations for research

institutions within a state for a given academic year; the ratios were then log-transformed,

$r_2(2007) = ln\left(\frac{P_{s2}(2007)}{P_{s1}(2007)}\right)$ and $r_3(2007) = ln\left(\frac{P_{s3}(2007)}{P_{s1}(2007)}\right)$, where $P_{si}(2007)$ represents

the proportion of appropriations for research (1) and regional (2) institutions and

community colleges (3), respectively. For states with a proportion of zero for any

particular year and institutional type, the zero was replaced by 0.01 (Fry et al., 2000).

These new variables now appropriately account for the relative relationship of funding

decisions, but no longer represent a set of constrained outcomes. Of particular interest

was the variable created from the community college and research proportions, $r_3(2007)$,

as this variable provides a measure of how appropriations are allocated to community

colleges relative to the funding decisions for research institutions.

　　To better understand the relationship of the compositional variables with each

other, scatterplots were created. Scatterplots and bivariate correlations were also used to

describe relationships of appropriation proportions by type and the transformed relative

ratios with continuous variables measuring population, economic, and political

characteristics of the states.

　　Variables were included in a linear regression model to examine potential

associations with the relative funding allocations; separate models were used for the

outcomes r_2 and r_3. Variables were divided into political (Democratic control of the

Upper and Lower House, Citizen Ideology, Government Ideology, governance type,

Governor's institutional powers, and whether a formula was used in the determination of

appropriations), economic (GDP, percent unemployed, median income, and the

percentage of jobs in a union), and population size. Variables for the final models were selected based on graphical and numerical summaries, bivariate associations, lack of colinearity, and previous literature. As this is somewhat exploratory, variables were not omitted from the models based on statistical significance. Because there were two resulting independent variables (r_2 and r_3), results were provided for each (community vs. research and regional vs. research). Because of the Aitchison transformation, the relationship between regional and community is also possible through simple subtraction and are also provided. Given the potential for colinearity among regressors, variance inflation factors (VIF) were examined again; variables with large VIFs were removed (political: governor's ideology and governor's party, population size); the final model resulted in VIFs less than 3.0. Parameter estimates from final models are presented with standard errors and *p*-values. These regression models were conducted including all states, excluding CO as the system of appropriation allocation changed, additionally excluding VT due to its large value on citizen ideology, and excluding any state missing one of the three types (no regional institutions or community colleges; AK, CO, NH, WY, VT).

As an additional analysis, linear regression models were also used to examine these variables using the appropriation percentages for each type (community, research, and regional). However, while these regression models result in intercept estimates that sum to 100% and slope estimates that sum to 0 due to the constraint of unit sum, they do not readily inform the association of variables (political, economic, and population) to the relative allocation of appropriations without considering the three models as a whole.

These models are provided as a supplementary analysis to contrast the benefit of compositional data analysis.

Results

The total appropriations reported in 2007 for each of the states varied from $70,243,536 (VT) to $10,976,132,899 (CA); appropriations per FTE ranged from $460 (CO) to $15,303 (AK). In addition to amounts of appropriations allotted to each state, states varied with how these appropriations were distributed between the three types of institutions: research, community colleges, and regional (Figures 1 and 2).

Likewise, the states varied in their contribution to community colleges relative to research institutions (Figure 3) and to regional relative to research institutions (Figure 4). The relative contribution to community colleges versus research institutions also varied across the states ranging from -8.7 (Vermont) and-4.6 (Alaska), which favors funding to research institutions over community colleges to 3.1 (favoring community colleges, Colorado). However, AK, VT, and CO may be considered outliers as AK has no regional institutions, VT has no community colleges, and CO recently reduced the appropriations provided to institutions and increased those provided to the individual student via a voucher system. Excluding these three states, the range in relative contribution was -2.3 (favoring funding to research institutions over community colleges) to 1.7 (favoring community college funding relative to research). The range of relative contributions to regional versus research institutions is from -9.2, -9.0, -8.7, -6.0 (AK, NH, WY, CO, respectively) to 2.6 (NJ). However, as all four of the states with the greatest funding of research to regionals do not actually have regional institutions, the more accurate range of the relative funding of regional versus research would be from -3.2 (favoring funding to

117

research relative to regional) to 2.6 (New Jersey, favoring funding to regional relative to research).

To aid in examining differences that exists between states, states were grouped according to the relative contribution of community colleges versus research institutions (the transformed variable, r_3). This grouping was not done for the regional versus research as four states would be removed and a natural clustering of the remaining states did not emerge. The groups included those which funded community colleges at the highest relative rates, those that funded at similar rates, and those that funded research institutions at the highest relative rates (Table 1). Characteristics (demographic, economic, and political) of the states were summarized by these groups (Table 2). Given that some of the groups have small numbers, statistical tests were not used for comparison. However, population density was observed to be smallest in states with the lowest proportion of appropriations going to community colleges relative to research institutions. Additionally, a decrease in the average GDP was observed as funding moved from community colleges to research institutions. Although there are only six states with proportions of funding highest for community colleges relative to research institutions, all six states had Democratic control of the Upper House and only one did not also have Democratic control of the Lower House; a decrease in the proportion of states with Democratic Governors was also observed as funding moved from community colleges to research institutions.

The relationship of political variables and GDP (Figures 5a, b, c and 6a,b,c) to the relative contribution to community colleges and regional institutions help identify potential outliers and bivariate trends. Estimates of these relationships, including all

states, with the transformed variables (contributions relative to research appropriations for community colleges and regional institutions) as well with the individual appropriations of each type are provided with Pearson correlation coefficients (Table 3). An overall positive relationship was observed for Governor's power, GDP, and population size with the relative contribution to community colleges versus research institutions; weaker associations were observed with citizen ideology (negative) and median income (positive). For regional funding relative to research, citizen ideology, GDP, and population size were positively correlated while income was negatively correlated. Correlation estimates with the political, economic, and population size variables were also calculated for the appropriation proportions for the specific types (research, regional, and community). It is interesting to observe how the positive and negative correlation estimates contrast for community colleges and research and regional institutions. The transformed, compositional variables agree with the individual proportions, provided the individual proportions are taken as a whole. For example, GDP is positively correlated with the relative rate of appropriations for community versus research ($r = 0.30$); as GDP increases the appropriations shift towards community colleges relative to research institutions. Similarly, GDP is negatively correlated with proportion of appropriations for research institutions ($r = -0.39$) but is positively correlated with the proportion given to community colleges ($r = 0.30$); as GDP increases, the proportion to research decreases while the proportion to community colleges increases.

Finally, the scatterplot of the two outcomes representing the relative contribution of community versus research (r_3) and regional versus research (r_2) provide a description

119

of the overall funding picture (Figure 7). Excluding states that do not have all three types of institutions, a positive relationships exists between the relative contribution to community and regional versus research. This suggests that when states favor funding community colleges over research, they also favor funding regional over research institutions.

Based on bivariate results, a multi-variable regression model was used to investigate the relationship between political, economic, and population variables and the funding contributions to community colleges (r_3) and regional institutions (r_2) relative to research institutions. These regressions were performed for different subsets of states: all states (Table 4a), excluding CO (Table 4b), excluding CO and VT (Table 4c), and excluding states without all three types of institutions (Table 4d).

All states. (Table 4a) Resulting estimates that are positive suggest that an increase in the variable moves appropriations towards community or regional relative research institutions. In contrast, estimates that are negative indicate inverse relationships with the relative funding, where increases in the variable suggest appropriation rates that favor research and not community colleges or regional institutions.

Of the political variables, Democratic control of the upper legislative house, citizen ideology, and the institutional powers of the governor were the only political variables that resulted in estimates that were statistically different from 0. Democratic control of the upper legislative house and higher levels of citizen liberalism less support for community colleges relative to research institutions. In contrast, stronger institutional powers for the office of the governor indicate an increase in funding rates for community colleges relative to research institutions. Economic and demographic variables did not

have a significant impact on r_3 aside from population density ($p = 0.06$) with higher

densities associated with increased funding for community colleges relative to research

institutions.

Citizen ideology and population density were also related to the funding for

regional relative research institutions. Specifically, as states increased the levels of citizen

liberalism, regional funding increased relative to research institutions. Higher levels of

population density were also associated with more funding for regional universities

relative to research institutions. The use of funding formulas also had a statistically

significant impact on relative appropriations. States where a funding formula was in place

had lower levels of funding for regional institutions relative to research. Additionally,

there was also a positive association for median income and the relative proportion of

appropriations going to research universities.

All states excluding Colorado. (Table 4b) The voucher system implemented in

Colorado, which reduced direct appropriations from the state to individual institutions,

set that state apart in terms of funding public higher education. The same multiple

variable linear regression model was run, excluding Colorado from the data. While the

same variables remained significant without Colorado, the previous finding that having a

funding formula in place resulted in more funding for research institutions relative to

regional institutions is reversed favoring regional. It should be noted that in the results

including all states, Colorado did not employ a funding formula in 2007.

All States Excluding Colorado and Vermont. (Table 4c*).* Vermont is also

unique among the states in that the level of citizen ideology is the highest of all the states.

Moreover, as it does not employ any community colleges in the public higher education

system, appropriations are split between regional and research institutions alone. Therefore, a third multiple variable linear regression model, excluding both Colorado and Vermont, was performed. In this model, the significance and relationships to the relative contribution of appropriations changed for variables of interest. Positive relationships with the appropriations for community colleges relative to research institutions were observed for the governance body, population density, and GDP. As the governance body becomes less centralized (not statistically significant when CO and VT were included), population density increases, and state GDP increases, the appropriations increase to community colleges versus research institutions. Research funding remained positively associated with Democratic control of the upper legislative house. Relative funding for regional and research institutions, in this model, is impacted by the use of a funding formula and median income which favor research institutions while increases in population density which favor funding for regional relative to research institutions.

Excluding those without all three types. (Table 4d) Given that compositional data analysis has the goal of explaining variability if appropriations distributed among three types of institutions, a final multiple variable linear regression model was conducted excluding any state that did not have all three types of institutions (community colleges, regional, and research institutions). A total of five states were excluded from this model because they were missing one of the three types. In addition to the previous exclusion of CO and VT, this exclusion added Alaska, New Hampshire, and Wyoming, all of which provided no support for regional institutions in 2007. For this model, relative appropriations for community colleges versus research institutions decreased when democrats control the upper legislative house and with increasing citizen liberalism.

Relative support for community colleges increased, however, with population density, state GDP, and the percentage of unemployed. As the citizenry became more liberal, funding to regional relative to research also decreased, and increasing population density favored funding to regionals relative to research institutions.

Conclusions

The results of this analysis suggest that there are state characteristics that impact the allocation of appropriations among the different types of public institutions. The initial model includes all states and finds that Democratic control of the upper house of the legislature, citizen ideology, the Governor's institutional powers, use of a funding formula, and population density are all related to the relative funding of institutions. To test the robustness of the model several iterations were implemented dropping states that do not use standard appropriations funding or support only two types of institutions.

In the restricted model Democratic control of the upper house of the legislature continued to show a significant association with the relative appropriations allocated to community colleges and research universities. States with Democratic control tend to favor research spending over community colleges. This finding is counter to the a priori hypothesis that Democrats would favor the lower cost options for post-secondary education in an effort to expand access. Increased liberalism among the citizenry is also associated with increased relative funding for research universities at the expense of both community and regional institutions. In previous literature, Democrats in both the legislature and the Governor's office as well as a liberal citizenry have been linked to increased appropriations (Archibald & Feldman, 2006; Nicholson-Crotty & Meier, 2003).

It may be the case that when appropriations are high more support can be allocated to the highest levels of post-secondary education while maintaining access.

Population density also impacts the relative support provided to public institutions. As density increases states increase the relative appropriations to both community colleges and regional institutions. This finding is consistent through each iteration of the model and suggests that states build and fund the public higher education system to meet student demand efficiently. In states where density is low, efficiency is achieved by bringing students to a single or limited number of institutions. As density increases states increase the number of local institutions to increase access.

These findings show that states choose the institutional mix and funding strategy for the overall system based on both existing demographic conditions and political preferences. While political preferences are subject to change, or sudden shifts in the case of control over a legislative body, choosing an allocation based on population characteristics may indicate the existence of an overarching framework guiding choices and unaffected by politics. If there is a framework in place it should be reflected in trend of appropriations over time, which is the question undertaken in the earlier chapters.

Table B1. Grouping of states by the relative contribution to community colleges versus research institutions.

Favoring Community Colleges (A)	Approximately Equal (B)	Favoring Research (C)	Strongly Favoring Research (D)
Washington	Missouri	Ohio	Vermont[1]
Oregon	Minnesota	Virginia	Alaska[2]
Wisconsin	South Carolina	Alabama	South Dakota
California	North Carolina	Pennsylvania	West Virginia
New Jersey	Kansas	Kentucky	North Dakota
Colorado[2,3]	Arkansas	Nebraska	Nevada
	Connecticut	Georgia	Maine
	Wyoming[2]	Hawaii	Indiana
	Texas	New Mexico	Montana
	Michigan	Iowa	Idaho
	Arizona	Delaware	New Hampshire[2]
	Illinois	Massachusetts	Tennessee
	Maryland	Mississippi	Utah
		Oklahoma	Louisiana
		Rhode Island	Florida
		New York	

[1] Vermont does not have any community colleges.

[2] Wyoming does not have any regional institutions.

[3] Colorado no longer provides substantial appropriations to institutions and instead uses a voucher system that is given to individual students.

Table B2. State characteristics grouped on relative funding to community versus research

	Group A[1] (N = 6)	Group B[1] (N = 13)	Group C[1] (N = 16)	Group D[1] (N = 15)
Demographic Variables				
Population Density	280.9 (439.4)	186.6 (216.8)	262.8 (288.0)	79.8 (91.6)
High School Degree[2]	87.1 (3.5)	85.7 (3.8)	85.0 (3.6)	86.9 (3.8)
Bachelor's Degree[2]	30.4 (3.6)	27.0 (4.6)	26.6 (5.0)	25.3 (4.3)
Economic Variables				
GDP ($100,000)	55.3 (65.58)	32.4 (29,10)	26.5 (27.22)	14.0 (18.92)
2007 Median Income	59,058.4 (4,853.6)	52,961.4 (8,131.6)	51,931.5 (7,701.6)	51,719.1 (7,994.5)
Unemployment[2]	4.65 (0.60)	4.67 (1.05)	4.22 (1.06)	3.95 (0.93)
Union[2]	15.6 (4.2)	10.03 (5.3)	11.5 (6.1)	10.0 (5.2)
Poverty[2]	10.9 (1.6)	12.1 (2.6)	12.3 (3.7)	11.0 (2.8)
Political Variables				
Citizen Ideology	64.4 (9.3)	54.4 (16.7)	61.1 (18.3)	56.6 (14.3)
Government Ideology	59.4 (11.1)	50.7 (14.7)	52.8 (13.1)	48.0 (15.3)
Democrat Control Upper House				
No	0 (0.0%)	7 (53.8%)	8 (53.3%)	9 (60.0%)
Yes	6 (100.0%)	6 (46.2%)	7 (46.7%)	6 (40.0%)
Democrat Control Lower House				
No	1 (16.7%)	6 (46.2%)	6 (40.0%)	7 (46.7%)
Yes	5 (83.3%)	7 (53.8%)	9 (60.0%)	8 (53.3%)
Democratic Governor				
No	2 (33.3%)	5 (38.5%)	7 (43.8%)	9 (60.0%)
Yes	4 (66.7%)	8 (61.5%)	9 (56.3%)	6 (40.0%)
Governor's Institutional Powers	3.6 (0.32)	3.4 (1.2)	3.4 (0.50)	3.5 (0.48)
Unified Government				
No	3 (50.0%)	6 (46.2%)	12 (75.0%)	5 (33.3%)
Yes	3 (50.0%)	7 (53.8%)	4 (25.0%)	10 (66.7%)

Table B2. Continued

System Variables				
Percentage of Students in Public Institutions	80.7 (4.4)	76.3 (13.6)	72.5 (15.2)	77.2 (10.8)
Governance Type				
Consolidated (Single)	0 (0.0%)	1 (7.7%)	2 (12.5%)	6 (40.0%)
Consolidated (Two)	2 (33.3%)	4 (30.8%)	3 (18.8%)	5 (33.3%)
Coordinating Board	4 (66.7%)	7 (53.8%)	10 (62.5%)	4 (26.7%)
Planning Board	0 (0.0%)	1 (7.7%)	1 (6.3%)	0 (0.0%)

Note: Continuous variables are described as mean (SD) and categorical variables are described with counts and percentages.

[1]Defined by the log ratio of community college and research institution appropriation proportions as described in Table 1.

[2]Data are rates reported.

Table B3. Correlation Estimates

	Appropriations Relative to Research		Rate of Appropriations for		
	Community	Regional	Research	Regional	Community
Citizen Ideology	-0.12	0.33	-0.14	0.28	-0.08
Governor's Power	0.26	-0.01	-0.14	0.07	0.10
Government Ideology	0.04	0.09	-0.20	0.14	0.10
GDP	0.30	0.24	-0.39	0.15	0.30
Unemployment %	0.07	0.08	-0.12	0.03	0.11
Union %	0.01	-0.01	-0.13	0.14	0.03
Median Income	0.16	-0.30	-0.11	-0.16	0.25
Population Size	0.30	0.25	-0.37	0.12	0.30
Population Density	0.26	0.33	-0.39	0.43	0.05

Table B4a. Multiple variable relationships with relative funding ratio (All States)

	Community (r3)		Regional (r2)	
	Estimate (SE)	p-value	Estimate (SE)	p-value
Intercept	-2.63 (2.76)	0.3469	5.46 (3.56)	0.1337
Governance Type				
4	1.6 (1.17)	0.1806	0.63 (1.51)	0.6764
3	0.52 (0.66)	0.4396	0.33 (0.85)	0.7014
2	0.12 (0.67)	0.8608	-0.32 (0.87)	0.7173
1	Reference		Reference	
Democratic Control of Upper House				
Yes	-1.09 (0.5)	0.0384	-0.18 (0.65)	0.7783
No	Reference		Reference	
Citizen Ideology	-0.06 (0.02)	0.0021	0.05 (0.02)	0.0578
Governor's Powers	1.17 (0.53)	0.0353	-0.22 (0.69)	0.7541
Formula Used				
Yes	-0.43 (0.46)	0.3513	-1.15 (0.59)	0.0595
No	Reference		Reference	
Population Density (by 10)	0.02 (0.01)	0.068	0.03 (0.01)	0.0399
GDP (by 100,000)	0.09 (0.07)	0.2314	0.06 (0.09)	0.4941
Unemployment %	0.11 (0.25)	0.6504	-0.27 (0.32)	0.4002
Union %	-0.01 (0.06)	0.8366	0 (0.07)	0.9612
Median Income (by 10,000)	0.15 (0.35)	0.6666	-1.54 (0.45)	0.0015

Table B4b. Multiple variable relationships with relative funding ratio (CO Removed)

		Community (r_3)		Regional (r_2)	
		Estimate (SE)	p-value	Estimate (SE)	p-value
Intercept		-1.43 (2.63)	0.5906	4.76 (3.62)	0.1966
Governance Type					
	4	1.63 (1.1)	0.1459	0.61 (1.51)	0.6858
	3	0.41 (0.62)	0.5152	0.39 (0.86)	0.6488
	2	0.3 (0.63)	0.6373	-0.42 (0.87)	0.6311
	1	Reference		Reference	
Democratic Control of Upper House					
Yes		-0.85 (0.48)	0.0882	0.32 (0.66)	0.6302
No		Reference		Reference	
Citizen Ideology		-0.06 (0.02)	0.0031	0.05 (0.02)	0.0789
Governor's Powers		1.01 (0.5)	0.0525	0.13 (0.69)	0.8553
Formula Used					
Yes		-0.64 (0.44)	0.1556	1.04 (0.6)	0.0948
No		Reference		Reference	
Population Density (by 10)		0.02 (0.01)	0.0205	0.03 (0.01)	0.0652
GDP (by 100,000)		0.08 (0.07)	0.2544	0.07 (0.09)	0.4592
Unemployment %		0.07 (0.23)	0.7623	0.24 (0.32)	0.4446
Union %		0.01 (0.05)	0.7864	0.02 (0.07)	0.8003
Median Income (by 10,000)		-0.09 (0.34)	0.793	1.4 (0.47)	0.0052

Table B4c. Multiple variable relationships with relative funding ratio (CO,VT Removed)

		Community (r_3)		Regional (r_2)	
		Estimate (SE)	p-value	Estimate (SE)	p-value
Intercept		1.06 (1.54)	0.4973	4.44 (3.73)	0.2418
Governance Type					
	4	1.3 (0.63)	0.0467	0.66 (1.53)	0.6698
	3	0.8 (0.36)	0.0336	0.34 (0.87)	0.6971
	2	1.03 (0.37)	0.0098	-0.52 (0.91)	0.5726
	1	Reference		Reference	
Democratic Control of Upper House					
Yes		-0.49 (0.28)	0.0914	-0.37 (0.68)	0.5907
No		Reference		Reference	
Citizen Ideology		-0.01 (0.01)	0.3367	0.04 (0.03)	0.1779
Governor's Powers		-0.33 (0.33)	0.3271	0.05 (0.8)	0.9544
Formula Used					
Yes		-0.24 (0.26)	0.3642	-1.09 (0.62)	0.0888
No		Reference		Reference	
Population Density (by 10)		0.02 (0.01)	0.0109	0.03 (0.01)	0.0617
GDP (by 100,000)		0.07 (0.04)	0.1023	0.07 (0.09)	0.4542
Unemployment %		-0.09 (0.13)	0.5096	-0.22 (0.32)	0.493
Union %		0.02 (0.03)	0.5562	-0.02 (0.07)	0.7977
Median Income (by 10,000)		-0.14 (0.2)	0.4752	-1.39 (0.47)	0.006

Table B4d. Multiple Variable Relationships with Relative Funding Ratio

		Community (r_3)		Regional (r_2)	
		Estimate (SE)	p-value	Estimate (SE)	p-value
Intercept		-2.83 (1.26)	0.0318	0.58 (2.06)	0.7808
Governance Type					
	4	0.53 (0.46)	0.2615	-0.07 (0.75)	0.9308
	3	0.33 (0.27)	0.2346	0.37 (0.44)	0.4113
	2	0.44 (0.29)	0.1431	-0.2 (0.48)	0.6821
	1	Reference		Reference	
Democratic Control of Upper House					
Yes		-0.59 (0.2)	0.0056	-0.44 (0.32)	0.1874
No		Reference		Reference	
Citizen Ideology		-0.03 (0.01)	0.0021	-0.03 (0.01)	0.0512
Governor's Powers		0.2 (0.25)	0.445	0.29 (0.41)	0.4949
Formula Used					
Yes		-0.07 (0.19)	0.7232	0 (0.31)	0.9951
No		Reference		Reference	
Population Density (by 10)		0.01 (0)	0.0244	0.02 (0.01)	0.0046
GDP (by 100,000)		0.05 (0.03)	0.0808	0.02 (0.05)	0.655
Unemployment %		0.24 (0.11)	0.0365	-0.07 (0.18)	0.6853
Union %		0.02 (0.02)	0.2959	0.05 (0.04)	0.1928
Median Income (by 10,000)		0.31 (0.16)	0.0692	-0.26 (0.27)	0.3365
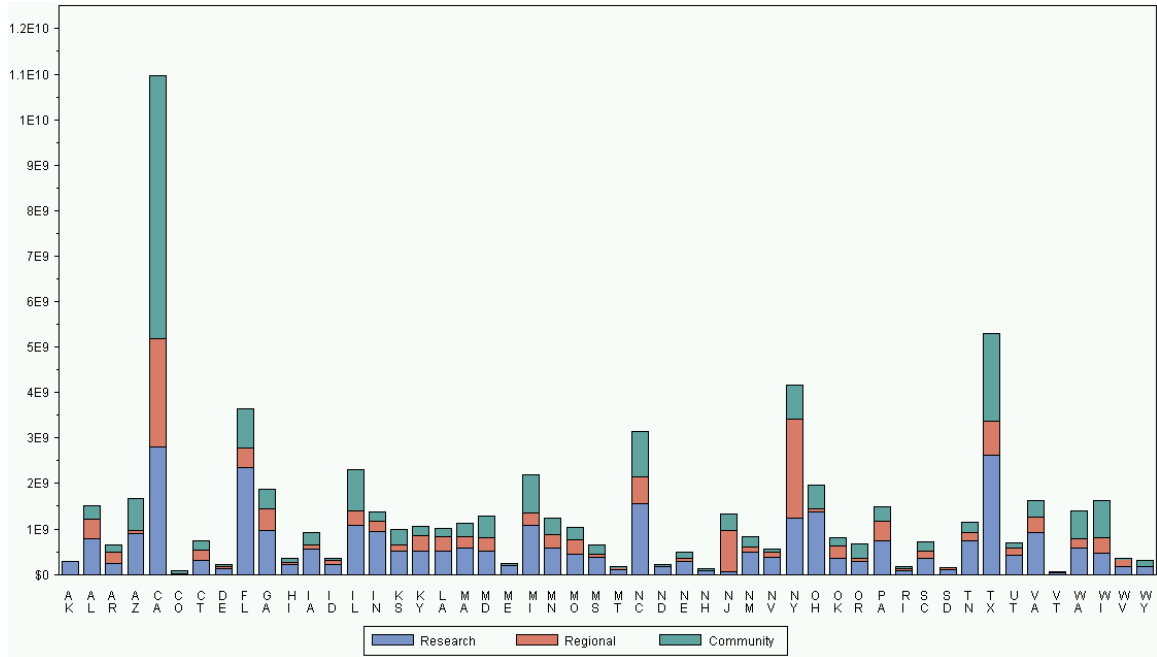
Figure B1. Total appropriations by institutional type, 2007.
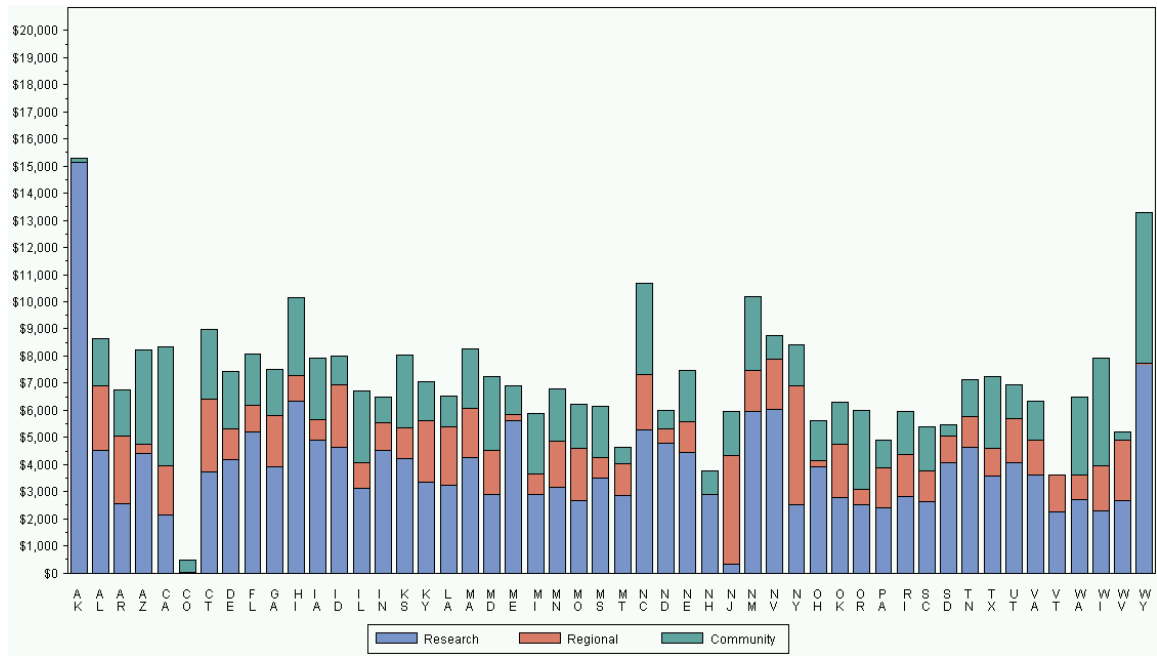
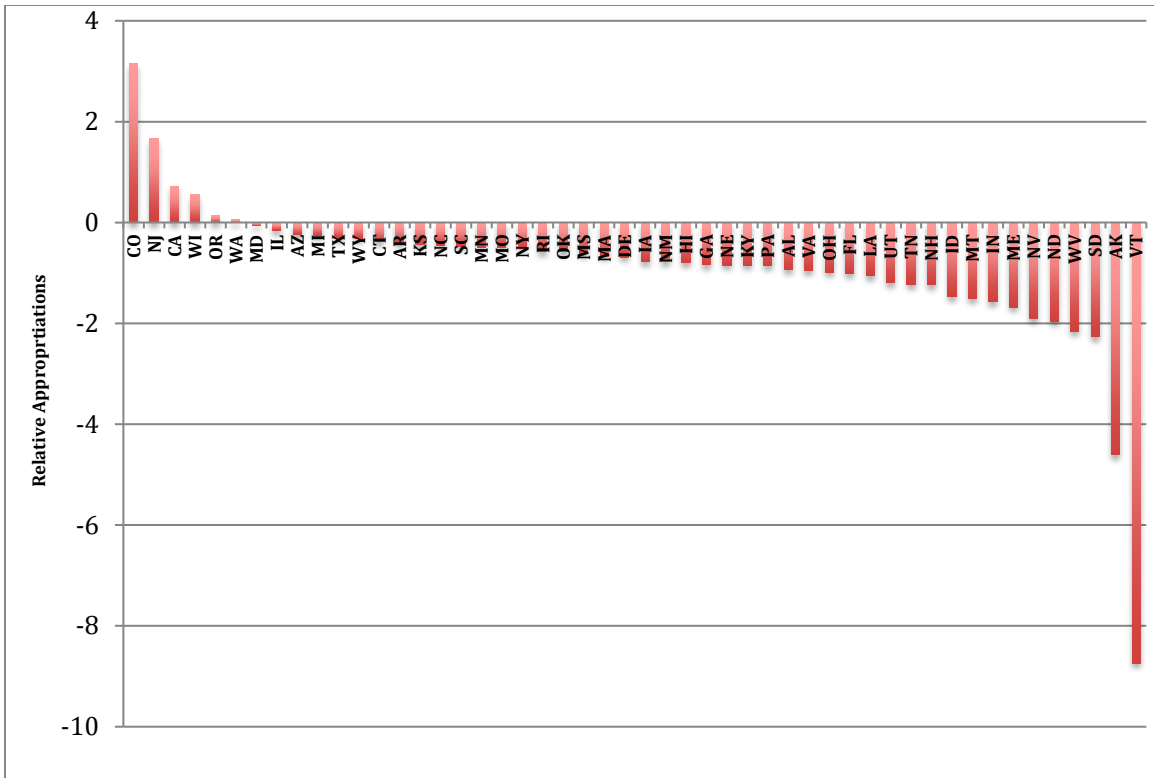Figure B2. Appropriations per FTE student by institutional type, 2007.

Figure B3. State variation in appropriations to community relative to research institutions.
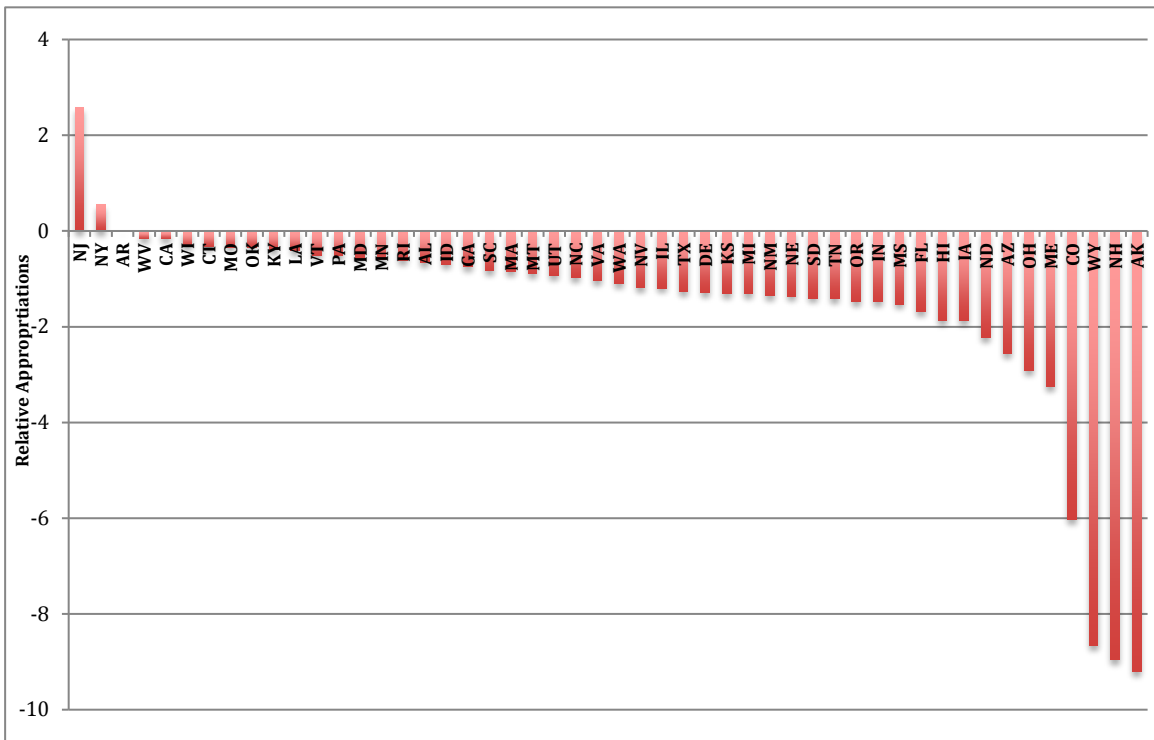

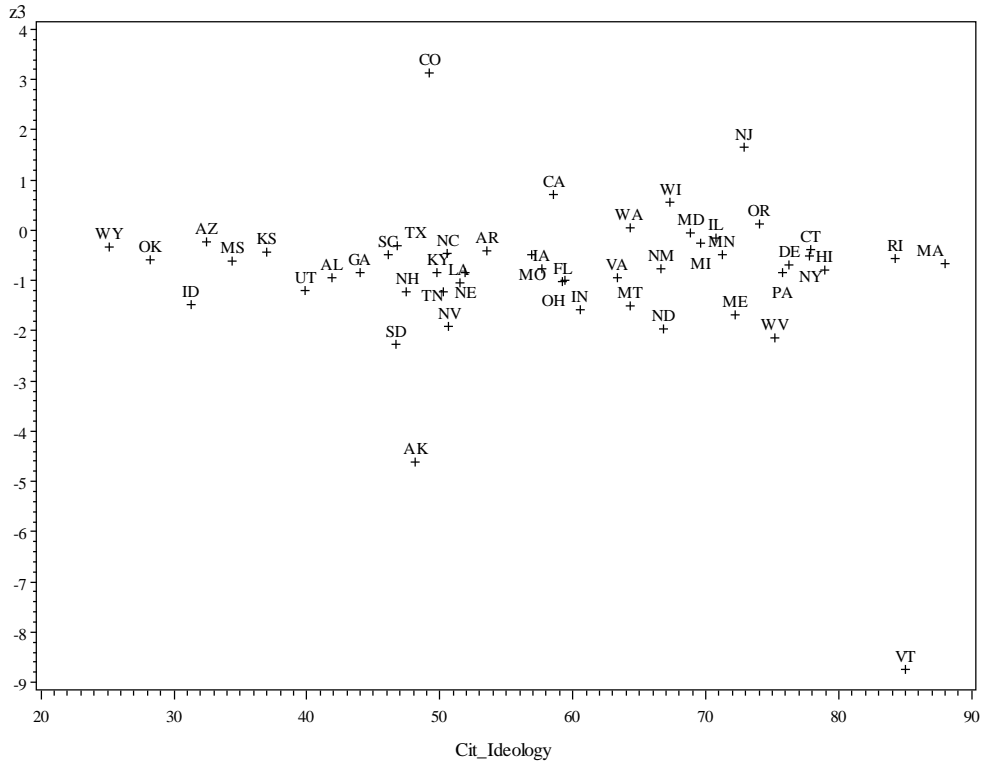Figure B4. State variation in appropriations to regional relative to research institutions.

Figure B5a. Scatterplot of community college funding relative to research. Political: Citizen Ideology.
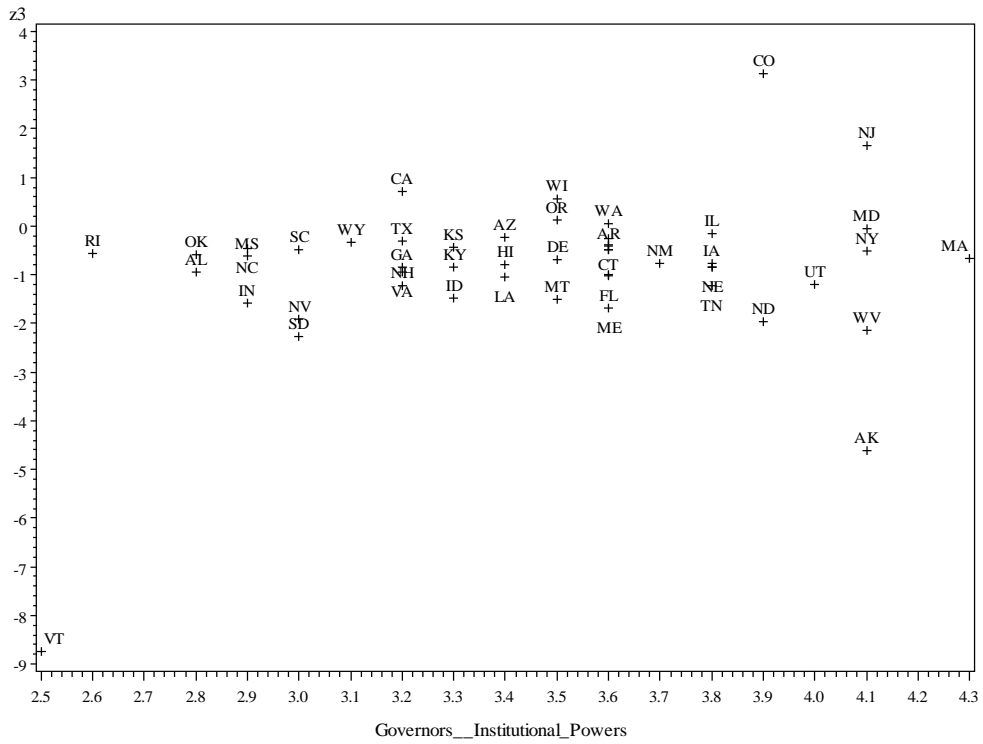

Figure B5b. Scatterplot of community college funding relative to research. Political: Governor's Institutional Powers.

135
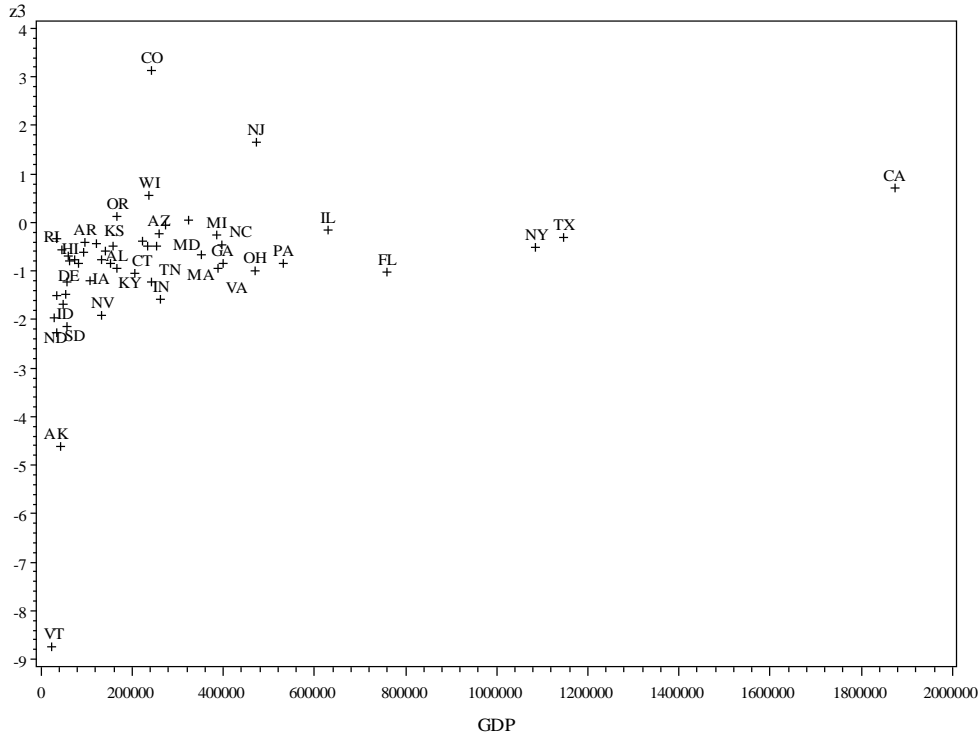
Figure B5c. Scatterplot of community college funding relative to research. Economic: GDP.
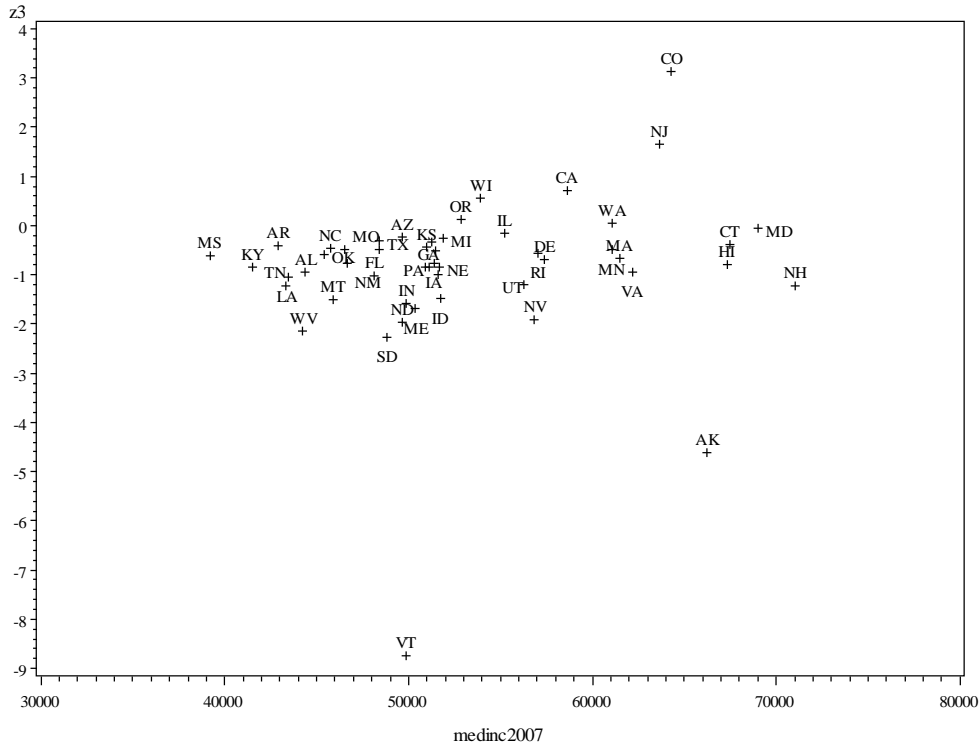

Figure B5d. Scatterplot of community college funding relative to research. Economic: 2007 Median Income.
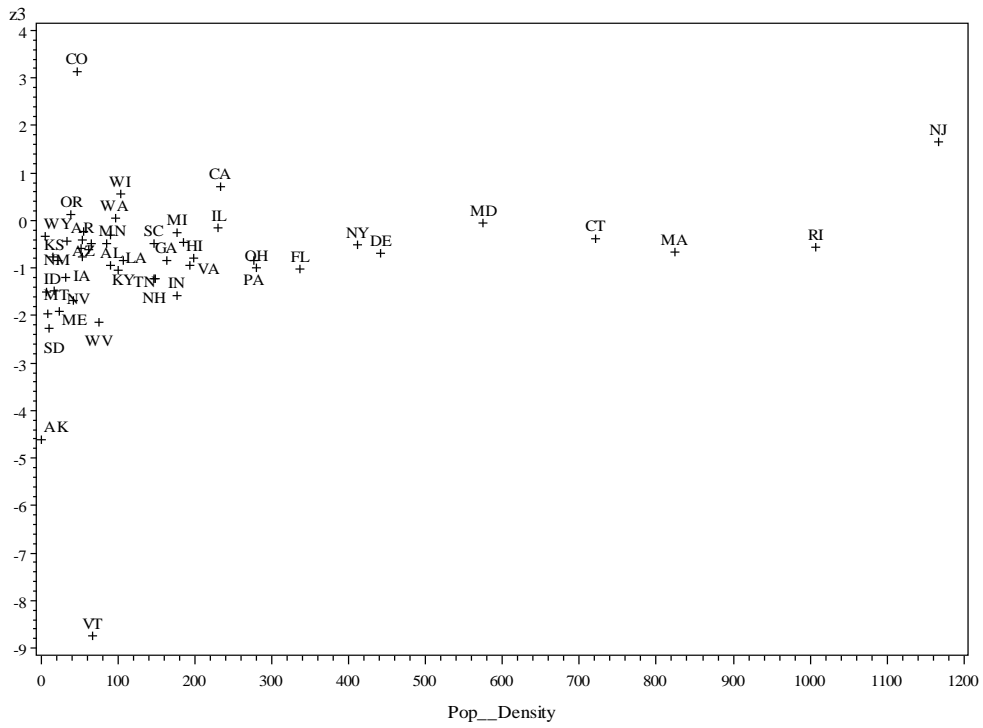
136

Figure B5e. Scatterplot of community college funding relative to research. Demographic: Population Density.
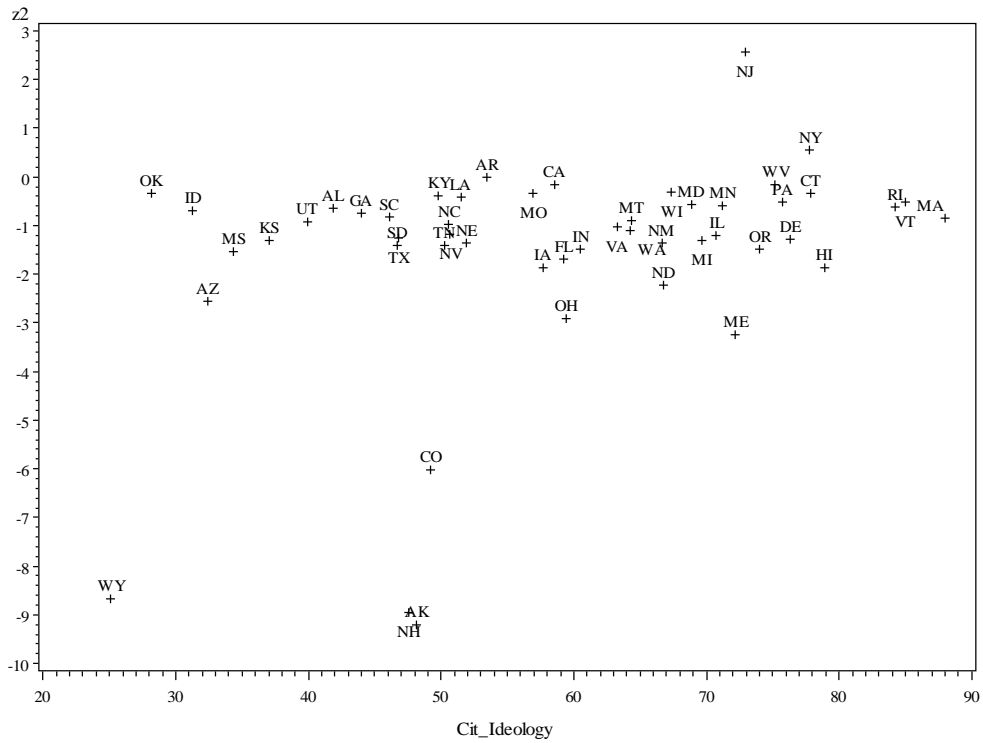

Figure B6a. Scatterplot of regional funding relative to research. Political: Citizen Ideology.
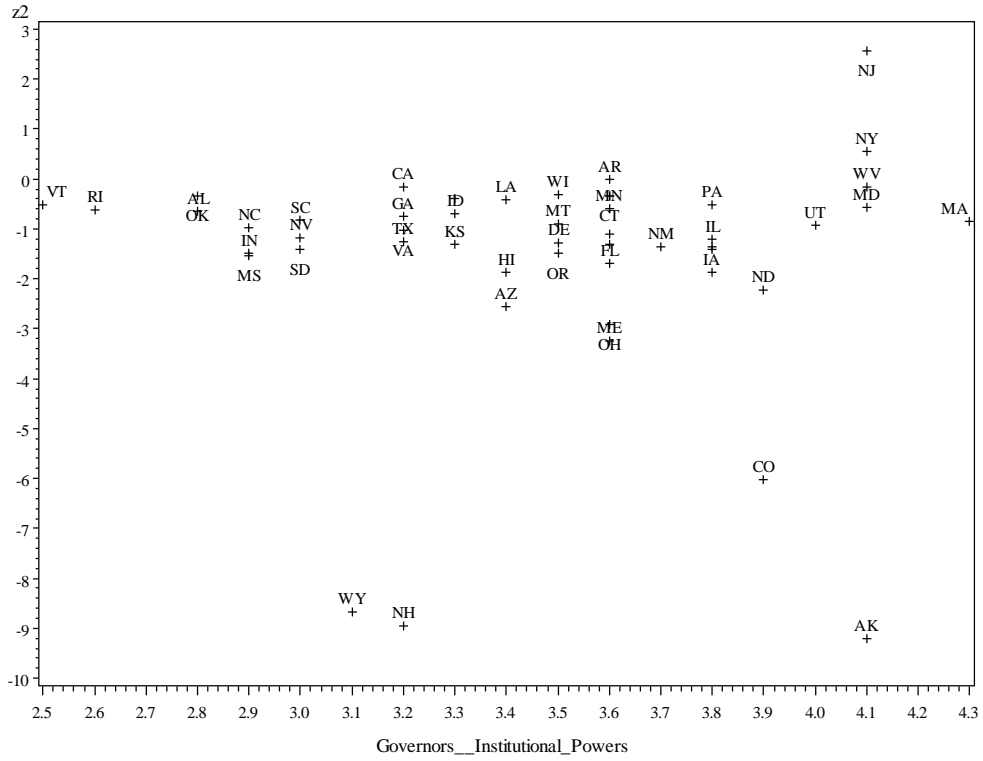
137

Figure B6b. Scatterplot of regional funding relative to research. Political: Governor's Institutional Powers.
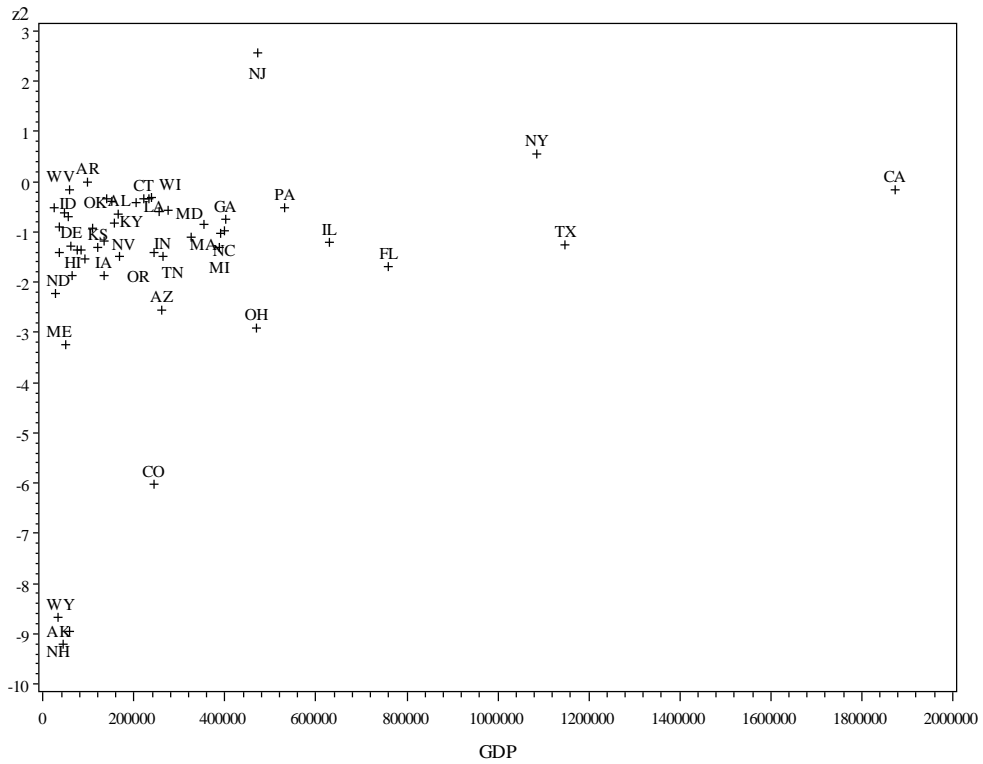

Figure B6c. Scatterplot of regional funding relative to research. Economic: GDP.
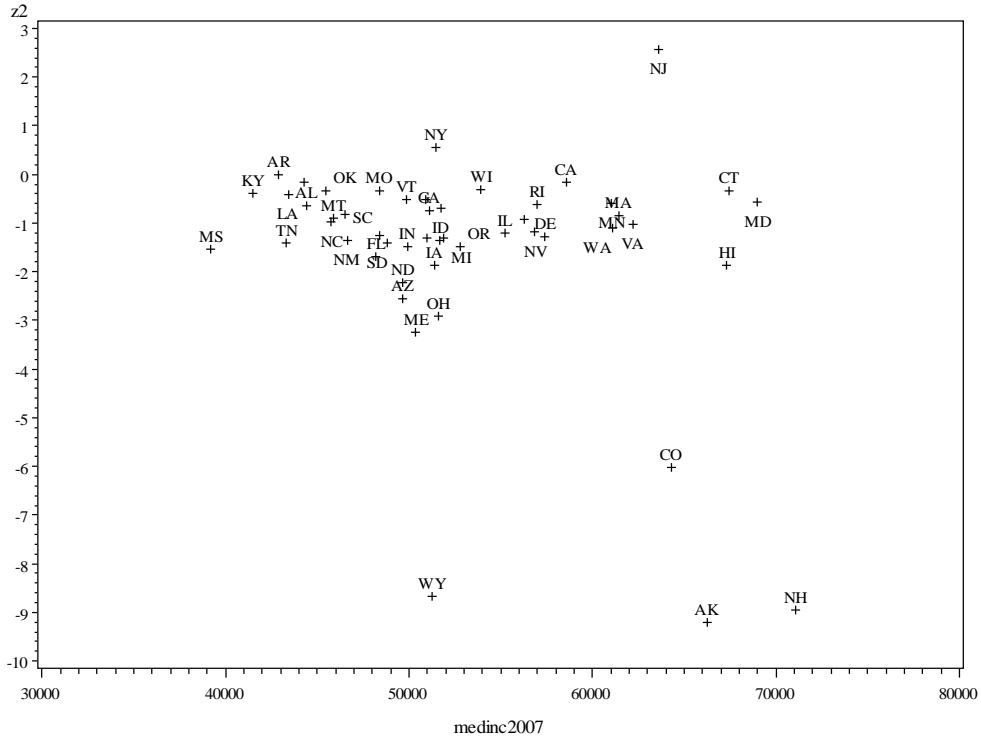
138

Figure B6d. Scatterplot of regional funding relative to research. Economic: 2007 Median Income.
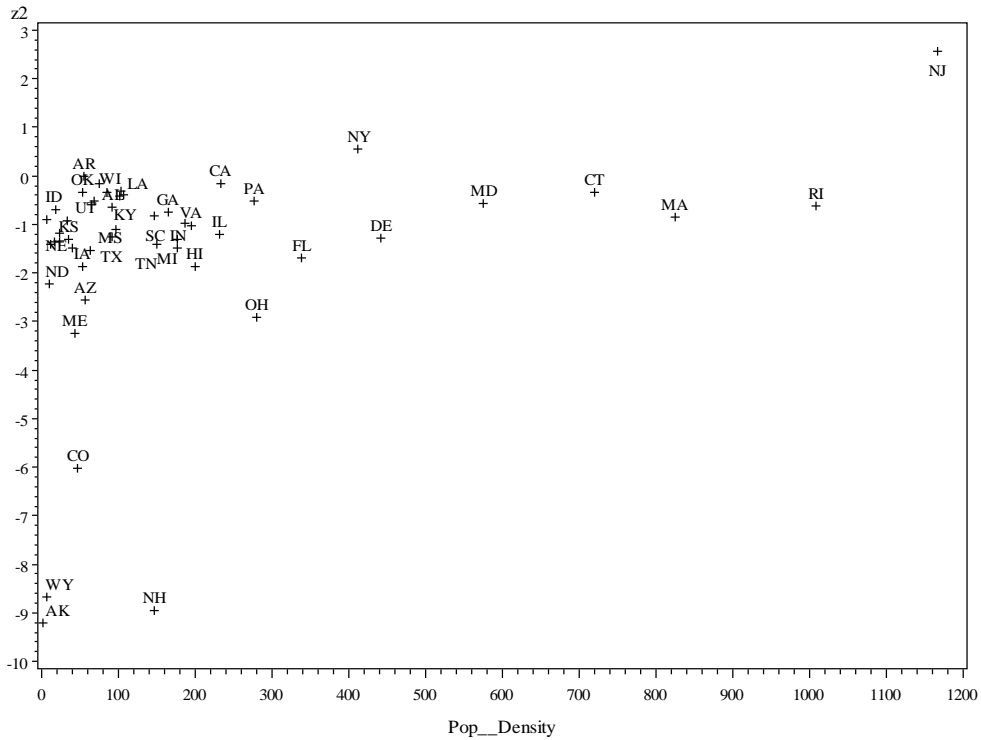

Figure B6e. Scatterplot of regional funding relative to research. Demographic: Population Density.
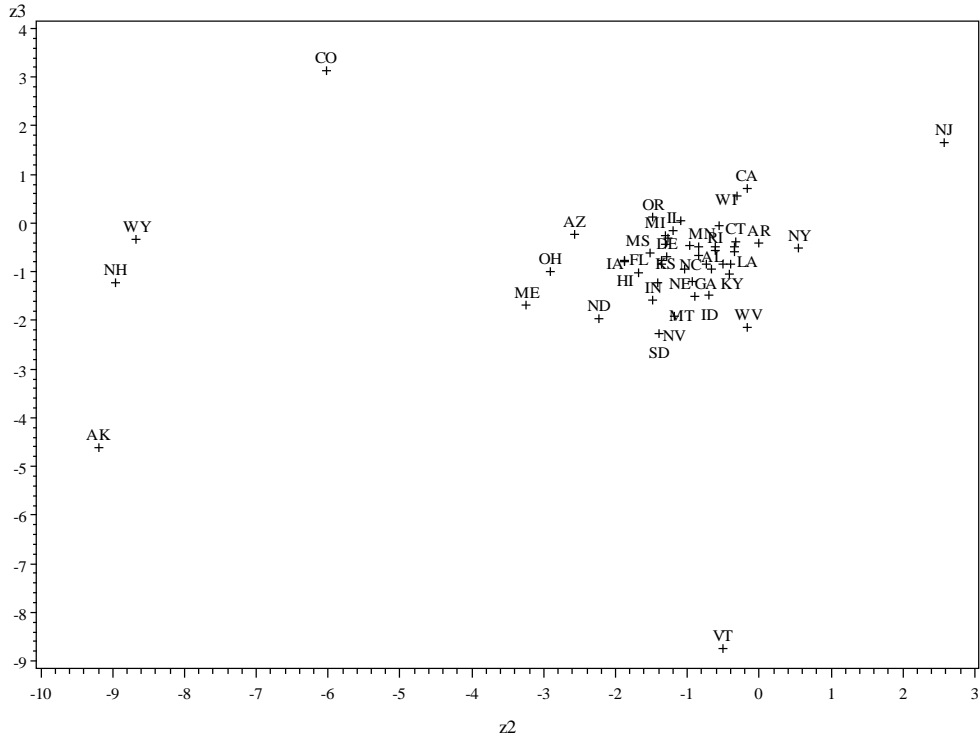
139

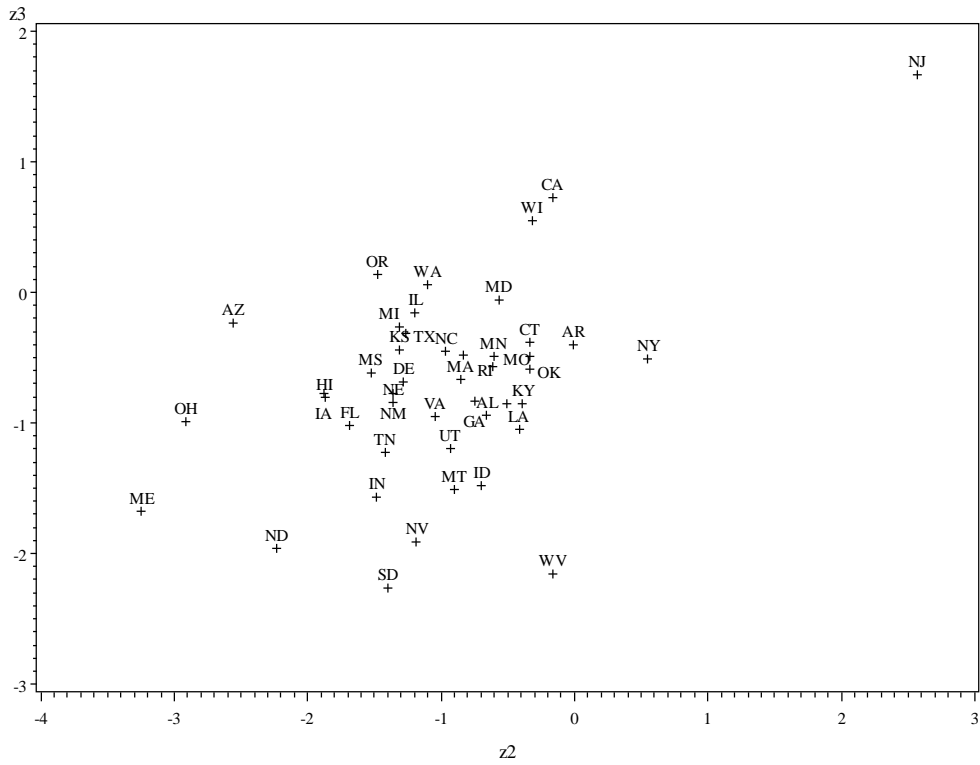Figure 7a. Scatterplot of the relative ratio outcomes (r_2 and r_3).

Figure 7b. Scatterplot of the relative ratio outcomes (r_2 and r_3), excluding states without all three types.

140

References

Adams, W. (1977). Financing Public Higher Education. *The American Economic Review*, *67*(1), 86–89.

Aebischer, N. J., Robertson, P. A., & Kenward, R. E. (1993). Compositional Analysis of Habitat Use From Animal Radio-Tracking Data. *Ecology*, *74*(5), 1313–1325.

Aitchison, J. (1982). The Statistical Analysis of Compositional Data. *Journal of the Royal Statistical Society*, *44*(2), 139–177.

Archibald, R. B., & Feldman, D. H. (2006). State Higher Education Spending and the Tax Revolt. *Higher Education*, *77*(4), 618–644.

Bailey, T. R., & Averianova, I. E. (1998). *Multiple Missions of Community Colleges: Conflicting or Complementary?* New York, NY.

Bails, D., & Tieslau, M. A. (2000). THE IMPACT OF FISCAL CONSTITUTIONS ON STATE AND LOCAL EXPENDITURES. *Cato Journal*, *20*(2), 255–277.

Betts, J. R., & Mcfarland, L. L. (1995). Safe Port in a Storm : The Impact of Labor Market Conditions on Community College Enrollments. *The Journal of Human Resources*, *30*(4), 741–765.

Beyle, T. (2003). The Governors. In V. Gray & R. R. Hanson (Eds.), *Politics in the American States: A Comparative Analysis* (8th ed., pp. 194–231). Washington D.C.: CQ Press.

Beyle, T. (2012). Data , and Lessons Of Footnotes , Missing for The Gubernatorial 50-StateData Collection : Finance Data Project , at Albany , at Chapel of North. *Policy*, *3*(2), 203–214.

Birnbaum, R. (1983). *Maintaining Diversity in Higher Education*. San Francisco, CA: Jossey-Bass.

Boylan, R. T. (2010). States' responses to fiscal droughts and riches. Retrieved from http://ssrn.com/abstract=1641360

Carnegie Commission on Higher Education. (1973). *A Classification of Institutions of Higher Education*. Berkeley: Carnegie Commission on Higher Education.

Clotfelter, C. T. (1976). Public Spending for Higher Education: An Empirical Test of Two Hypotheses. *Public Finance*, *31*, 177 – 195.

Cohen, A., & Brawer, F. (1996). *The American Community College*. San Francisco: Jossey-Bass.

Conner, T. W., & Rabovsky, T. M. (2011a). Accountability , Affordability , Access: A Review of the Recent Trends in Higher Education Policy Research. *Policy Studies Journal*, *39*, 93–112.

Conner, T. W., & Rabovsky, T. M. (2011b). Accountability, Affordability, Access: A Review of the Recent Trends in Higher Education Policy Research. *Policy Studies Journal*, *39*(S1), 93–112. http://doi.org/10.1111/j.1541-0072.2010.00389_7.x

Cox, N. J. (2004). Speaking Stata : Graphing categorical and compositional data. *The Stata Journal*, *4*(2), 190–215.

Dar, L. (2010). Politics, Inequality and State Priorities for Higher Education. *SSRN Electronic Journal*. http://doi.org/10.2139/ssrn.1641486

Delaney, J. A., & Doyle, W. R. (2007). The Role of Higher Education in State Budgets. In K. M. Shaw & D. E. Heller (Eds.), *State Postsecondary Education Research: New Methods to Inform Policy and Practice* (p. 55–). Sterling, VA: Stylus Publishing, LLC.

Delaney, J. A., & Doyle, W. R. (2011). State Spending on Higher Education: Testing the Balance Wheel over Time. *Journal of Education Finance*, *36*(4), 343–368.

Desrochers, D. M., & Wellman, J. V. (2011). *Trends in College Spending*.

Doyle, W. R. (2007). The Politics of Public College Tuition and State Financial Aid, *034*, 1–27.

Doyle, W. R., & Delaney, J. A. (2009). State Spending On Higher Education: Testing the Balance Wheel Over Time. San Diego, CA: American Educational Research Association.

Eaton, J. S. (1994). *Strengthening Collegiate Education in Community Colleges*. San Francisco, CA: Jossey-Bass. Retrieved from http://eric.ed.gov/?id=ED367409

Faes, C., Molenberghs, G., Hens, N., Muller, A., Goossens, H., & Coenen, S. (2011). Analysing the composition of outpatient antibiotic use: A tutorial on compositional data analysis. *Journal of Antimicrobial Chemotherapy*, *66*(SUPPL. 6). http://doi.org/10.1093/jac/dkr461

Fast Facts. (2017). Washington D.C. Retrieved from https://nces.ed.gov/fastfacts/

Fowles, J. (2010). *Funding and focus : Resource dependence in public higher education*.

Fry, J. M., Fry, T. R., & McLaren, K. R. (2000). Compositional Data Analysis and Zeros in Micro Data. *Applied Economics*, *32*, 953–959.

FUNDING FORMULA USE IN HIGHER EDUCATION. (2006). Tallahasse, Fl.

Granger, C. W. J. (1969). Investigating Causual Relations by Econometric Models and Cross-spectral Methods. *Econometrica*, *37*(3), 424–438. Retrieved from http://www.jstor.org/stable/1912791

Hearn, J. C., Griswold, C. P., & Marine, G. M. (1996). Region, resources, and reason: A contextual analysis of state tuition and student aid policies. *Research in Higher Education*, *37*(3), 141–178. http://doi.org/10.1007/BF01730117

Hearn, J., & Holdsworth, J. (2002). Influences of State-Level Policies and Practices on College Students' Learning. *Peabody Journal of Education*, *77*(3), 6–39. http://doi.org/10.1207/S15327930PJE7703_2

Heller, D. E. (2001). *The States and Public Higher Education Policy: Affordability, Access, and Accountability*. JHU Press.

Hovey, H. A. (1999). *State Spending for Higher Education in the Next Decade: The Battle to Sustain Current Support*. Washington D.C.

Humphreys, B. R. (2000). Do Business Cycles Affect State Appropriations to Higher Education? *Southern Economic Journal*. http://doi.org/10.2307/1061477

Hurlburt, S., & Kirshstein, R. J. (2012). *Spending: Where Does the Money Go?* Washington D.C

Johnstone, D. (2004). The economics and politics of cost sharing in higher education: comparative perspectives*1. *Economics of Education Review*, *23*(4), 403–410. http://doi.org/10.1016/j.econedurev.2003.09.004

Kane, T. J. (1994). College Entry by Blacks since 1970: The Role of College Costs, Family Background, and the Returns to Education. *Journal of Political Economy*, *102*(5), 878. http://doi.org/10.1086/261958

Kane, T. J. (2006). Public Intervention in Post-Secondary Education. In E. A. Hanushek & F. Welch (Eds.), *Handbook of the Economics of Education* (pp. 1369–1401). Amsterdam: Elsevier.

Kane, T. J., & Orszag, P. R. (2003). *Funding Restrictions at Public Universities : Effects and Policy Implications*. *Policy*.

Kane, T. J., Orszag, P. R., Apostolov, E., Inman, R. P., & Reschovsky, A. (2005). Higher Education Appropriations and Public Universities: Role of Medicaid and the Business Cycle. *Brookings-Wharton Papers on Urban Affairs*, (1), 99–145. http://doi.org/10.1353/urb.2006.0008

Kane, T. J., Orszag, P. R., & Gunter, D. L. (2003). *State Fiscal Constraints and Higher Education Spending: The Role of Medicaid and the Business Cycle* (No. 11). *Education*. Washington D.C.

Knott, J. H., & Payne, A. A. (2004). The Impact of State Governance Structures on Management and Performance of Public Organizations: A Study of Higher Education Institutions. *Journal of Policy Analysis and Management*, *23*(1), 13–30.

Koshal, R. K., & Koshal, M. (2000). State Appropriation and Higher Education Tuition: What is the Relationship? *Education Economics*, *8*(1), 81–89.

Leslie, L. L., & Brinkman, P. T. (1987). Student Price Response in Higher Education: The Student Demand Studies. *Journal of Higher Education*, *58*(2), 181–204.

Leslie, L. L., & Ramey, G. (1986). State Appropriations and Enrollments Does Enrollment Growth Still Pay ? *The Journal of Higher Education*, *57*(1), 1–19.

Liefner, I. (2003). Funding, Resource Allocation, and Performance in Higher Education Systems. *Higher Education*, *46*(4), 469–489.

Lowry, R. C. (2001a). Governmental Structure, Trustee Selection, and Public University Prices and Spending: Multiple Means to Similar Ends. *American Journal of Political Science*, *45*(4), 845–861. Retrieved from http://www.jstor.org/stable/2669328

Lowry, R. C. (2001b). The effects of state political interests and campus outputs on public university revenues. *Economics of Education Review*, *20*, 105–119.

McGuiness, A. (1997). *State Postsecondary Education Structures Sourcebook : 1997*. Denver, CO.

Mcguinness, A. C. (2003). *Models of Postsecondary Education Coordination and Governance in the States*. *Education*. Denver, CO. Retrieved from http://www.ecs.org/html/Document.asp?chouseid=3423

McLendon, M. K., Hearn, J. C., & Mokher, C. G. (2009). Partisans , Professionals , and Power : The Role of Political Factors in State Higher Education Funding. *The Journal of Higher Education*, *80*(6), 686–713.

McLendon, M. K., Mokher, C. G., & Doyle, W. (2009). "Privileging" Public Research Universities: An Empirical Analysis of the Distribution of State Appropriations Across Research and Non-Research Universities. *Journal of Education Finance*, *34*(4), 372–401.

Morphew, C. C. (2009). Conceptualizing Change in the Institutional Diversity of U . S . Colleges and Universities. *The Journal of Higher Education*, *80*(3), 243–269.

Morphew, C. C., & Hartley, M. (2006). Mission Statements : A Thematic Analysis of Rhetoric Across Institutional Type. *The Journal of Higher Education*, *77*(3), 456–471.

Nicholson-Crotty, J., & Meier, K. J. (2003). Politics, Structure, and Public Policy: The Case of Higher Education. *Educational Policy*, *17*(1), 80–97.

Okunade, A. (2004). What Factors Influence State Appropriations in the United Education for Public Higher States ? *Journal of Education Finance*, *30*(2), 123–138.

Peterson, R. G. (1976). Environmental and Political Determinants of State Higher Education Appropriations Policies. *The Journal of Higher Education*, *47*(5), 523–542.

Rayens, W. S., & Srinivasan, C. (1991). Box-Cox Transformations in the Analysis of Compositonal Data. *Journal of Chemometrics*, *5*, 227–239.

Rizzo, M. J. (2004). *State Preferences for Higher Education Spending: A Panel Data Analysis, 1977-2001* (Vol. 2004).

Ryan, J. F. (2004). The Relationship Between Institutional Expenditures and Degree Attainment at Baccalaureate Colleges. *Research in Higher Education*, *45*(2), 97–114. http://doi.org/10.1023/B:RIHE.0000015691.02545.61

Slaughter, S., & Leslie, L. L. (1997). *Academic Capitalism: Politics, Policies and the Entrepreneurial University*. Baltimore, MD: The Johns Hopkins University Press.

Slaughter, S., & Rhoades, G. (2004). *Academic Capitalism and the New Economy: Markets, State, and Higher Education*. Baltimore, MD: JHU Press.

Stadtman, V. A. (1980). *Academic Adaptations. Higher Education Prepares for the 1980s and 1990s.* San Francisco, CA: Jossey-Bass.

STATE EXPENDITURE REPORT. (2016). Washington D.C. Retrieved from https://higherlogicdownload.s3.amazonaws.com/NASBO/9d2d2db1-c943-4f1b-b750-0fca152d64c2/UploadedImages/SER Archive/State Expenditure Report (Fiscal 2014-2016) - S.pdf

State Higher Education Finance FY 2011. (2012). Boulder, Colorado.

Tandberg, D. (n.d.). *A Comparison of Measures of State Higher Education Funding*.

Tandberg, D. A. (2008). The Politics of State Higher Education Funding. *Higer Education in Review*, *5*, 1–36.

Tandberg, D. a. (2010). Politics, Interest Groups and State Funding of Public Higher Education. *Research in Higher Education*, *51*(5), 416–450. http://doi.org/10.1007/s11162-010-9164-5

Thelin, J. R. (2004). Higher Education and the Public Trough. In E. P. St. John & M. D. Parsons (Eds.), *Public Funding of Higher Education: Changing Contexts and New Rationales* (pp. 21–39). Baltimore: The Johns Hopkins University Press.

Thelin, J. R. (2011). *A History of American Higher Education* (Second). Baltimore, MD: The Johns Hopkins University Press.

Thelin, J. R., Edwards, J. R., Moyen, E., Berger, J. B., & Calkins, M. V. (2009). *Higher Education in the United States - Historical Development, System. Education Encyclopedia*. StateUniversity.com. Retrieved from http://education.stateuniversity.com/pages/2044/Higher-Education-in-United-States.html

Thomas, C. S., & Hrebenar, R. J. (2004). Interest groups in the states. In V. Gray, R. L. Hanson, & T. Kousser (Eds.), *Politics in the American States: A Comparative Analysis* (8th ed., pp. 100–128). Washington D.C.: CQ Press.

Titus, M. A. (2006). Understanding the influence of the financial context of institutions on student persistence at four-year colleges and universities. *The Journal of Higher Education*, *77*(2), 353–375.

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, and Practice* (p. 28). Agathon Press.

Toutkoushian, R. K., & Hollis, P. (1998). Using Panel Data to Examine Legislative Demand for Higher Education. *Education Economics*, *6*(2), 141–157. Retrieved from http://profile.educ.indiana.edu/Portals/131/Toutkoushian Hollis EE 1998.pdf

Trostel, P. A., & Ronca, J. M. (2009). A Simple Unifying Measure of State Support for Postsecondary Education. *Research in Higher Education*, *50*(3), 215–247.

Weerts, D. J., & Ronca, J. M. (2013). Examining Differences in State Support for Higher Education : A Comparative for Study of State Appropriations Research I Universities. *The Journal of Higher Education*, *77*(6), 935–967.

Zhang, L. (2008). Does State Funding Affect Graduation Rates at Public Four-Year Colleges and Universities? *Educational Policy*, *23*(5), 714–731. http://doi.org/10.1177/0895904808321270

JOSHUA L. BUSH, CPA

EDUCATION

2003   M.S. in Accounting
University of Kentucky

1999   B.A. in Accounting
Mount Vernon Nazarene University

PROFESSIONAL EXPERIENCE

2014-Present   Visiting Professor
Department of Accounting, Finance and Information Systems
Eastern Kentucky University

2013-2014   Research Internship for Information and Research Group
Kentucky Council on Postsecondary Education
Budget, Planning, and Policy

2008-2013   Research Assistant
Martin School of Public Policy and Administration
University of Kentucky

Instructor (Spring 2011)
University of Kentucky
Gatton College of Business and Economics
Department of Economics

2006-2008   Accountant Principal
Office of the Treasurer
Sponsored Projects Accounting
University of Kentucky

2003-2006   Staff Accountant
Crowe Chizek and Company LLC
Lexington, Kentucky

CERTIFICATIONS

Certified Public Accountant, License number: 9922

FUNDING (ACTIVE)

R01CE002690 (Bush & Coker)   9/01/15 – 8/31/18
CDC
Randomized Trial Integrating Substance Abuse With Bystander-Based Violence Prevention
This randomized intervention trial will determine which bystander-based programmatic elements are most efficacious in changing risk behaviors which may lead to violence and/or alcohol abuse. This aim will determine the cost and relative cost effectiveness of implementing bystander training by approach. The ultimate goal of this trial is to provide strategic information needed by public colleges to effectively meet the mandate to implement effective bystander interventions.
Role: Consultant

U01CE002668 (Coker & Bush)   9/30/15 – 9/29/19
CDC
Bystander Program Adoption & Efficacy to Reduce SV-IPV in College Community
Because the 2013 Campus Sexual Violence Elimination Act1 (SaVE) now requires bystander training for all publicly funded colleges and universities (hereafter colleges), a "natural experiment" presents itself as the opportunity to determine relative bystander training efficacy across multiple colleges. This quasi-experimental design study will provide evidence needed by colleges to select and implement bystander interventions that 1) are more feasible for large colleges, 2) have the greater impact on reducing interpersonal violence and 3) have the greater cost effectiveness based on intervention-associated changes in students' violence acceptance and violent incidents. This research seeks to determine the promise of bystander interventions for college communities as mandated by SaVE and provide capacity to grow and support VAW researchers into the future.
Role: Consultant

PAPERS

Bush, J. L., Bush, H. M., Coker, A. L., Brancato, C. J., Clear, E. R., & Recktenwald, E. A. (2018). Total and Marginal Cost Analysis for a High School Based Bystander Intervention.*Journal of School Violence*, *17*(2), 152-163.

Davidson, J. C., & **Bush, J. L.** (2016). Community college student degree completion using classification and regression tree analysis. *Journal of Applied Research in the Community College*, *23*(1), 57-69.

RESEARCH PROJECTS & PRESENTATIONS

Vanderpool, R. C., Swanberg, J. E., Bush, H. M., & **Bush, J. L.** (2014, October). Personal, Financial, and Employment Burdens of Low-Wage-Earning Cancer Survivors. In*JOURNAL OF WOMENS HEALTH* (Vol. 23, No. 10, pp. 871-871).

140 HUGUENOT STREET, 3RD FL, NEW ROCHELLE, NY 10801 USA: MARY ANN LIEBERT, INC.

"Exploring Retention in Higher Education Using Tree-Based Models." The Association for Institutional Research Annual Meeting. Orlando, FL. May 2014

"CART Analysis of the 2005 Class at Kentucky Public Institutions." Kentucky Council of Postsecondary Education. Frankfort, KY. March 2014.

"Trends in the Allocation of Appropriations to Higher Education by Institutional Type." The Association for Education Finance and Policy Annual Meeting. New Orleans, LA. March 2013.

"Public Higher Education: Distribution of State Appropriations Across Institutional Types." The Association for Education Finance and Policy Annual Meeting. Boston, MA. March 2012.

Bush J.L. & Toma E.F. (2011). "Alternative Models of State Financing of Higher Education: A Glimpse at the Future" Prepared for the Kentucky Council of Postsecondary Education.

Bush, JL & Toma, E.F. (2009). "The Fiscal Impact of High School Dropouts in Greater Owensboro" Prepared for The Citizens Committee on Education.

"The Fiscal Impact of High School Dropouts in Greater Owensboro." Dropout Prevention Summit. Bowling Green KY. November 2009. Bush presenting.