A (LESS THAN) ZERO SUM GAME? STATE FUNDING FOR PUBLIC EDUCATION: HOW PUBLIC HIGHER EDUCATION INSTITUTIONS HAVE LOST

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Michael John Rizzo

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A (LESS THAN) ZERO SUM GAME? STATE FUNDING FOR PUBLIC EDUCATION: HOW PUBLIC HIGHER EDUCATION INSTITUTIONS HAVE LOST

Michael John Rizzo, Ph. D.

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This dissertation studies the long-term decline in state preferences for education spending in the United States. It constructs an expansive state-level panel data set spanning the fiscal years 1976-77 through 2000-2001 to examine how three budget share measures have changed within states over time and across states at a point in time. The share of state discretionary expenditures allocated to public education has fallen by four percentage points since 1977, while the share of public education expenditures allocated to public higher education has fallen by six points. In addition, the share of public higher education dollars appropriated to institutions (as opposed to directly to students) has fallen by four percentage points. Together the declines translate into real institutional appropriation losses of $2,800 per student in an "average" state – significantly more than the $1,700 increase in real average public four-year instate tuition rates since 1977.

Among the main findings are that competing budget items do not appear to "crowd out" education's budget share. Court mandated K12 funding equalization has resulted in substantial increases in education spending within states, with over a quarter of the increase coming at the expense of public higher education. Attempts by public institutions to increase tuition or raise private funds are seen to trigger a cycle of future budget share cuts, calling into question what institutions can do as they

rapidly spiral toward the private "high tuition" equilibrium. The sensitivity of higher education budget shares to observable state factors has increased over time and dynamic panel estimates indicate that states exercise more discretion over the determination of the higher education – K12 split than over other budgetary decisions.

Three additional findings are noteworthy. First, cross-cohort ethnic heterogeneity increases have led to funding shifts away from higher education. Second, the surging popularity of targeted, merit student-aid programs appears to have been in an effort to redistribute income to economically well-off families. Third, as more households in a state become eligible to receive federal Pell grants, states move aid away from institutions and toward students – sanctioning tuition increases to potentially capture increased student eligibility for federal grant aid.

BIOGRAPHICAL SKETCH

On August 12, 1974, New Yorkers had much to celebrate. A former wild Mets reliever struck out 19 batters in a 4-2 victory over the Red Sox. Mickey Mantle and Whitey Ford became the first teammates to be inducted into Cooperstown on the same day. The Amazin's handed Andy Messersmith and the Dodgers a 3-1 loss to vault themselves to a mere 14 games under .500. And, just a few short steps from Shea Stadium, Michael John Rizzo was born to two wonderful parents. He was born in a time and place where getting a Ph.D. was as realistic as the Rangers winning the Stanley Cup. While baseball, hockey and his five siblings sustained him for his first 17 years in Queens, it was football that punched his ticket to a BA in Economics from Amherst College in May of 1996. His love of the dismal science was spawned from the wasteland of theoretical quantum physics (he just couldn't hack it) and reared in the concrete jungle of investment banking in New York City. Lured by the siren call of having a Ph.D. stamp legitimize his lofty ambitions, his sojourn to Ithaca left him with several indelible impressions including:

1. Don't bet your bottom dollar that the sun will come out tomorrow.

2. An inability to walk into any situation without the incessant nagging of needing to understand exactly what economic cost-benefit decision led to its outcome.

3. If he knew ex-ante how cool it would feel to wear the funny hat and flowing robes at graduation, he would have applied to Cornell three years earlier.

4. He should have been trained to work with one arm tied behind his back – economists are incapable of completing a sentence without adding, “on the other hand.”

5. While he will always be a Lord Jeff, Cornell will remain dear to his heart - for its bounty bestowed upon him his wonderful wife, his incredible mentor, and of course, Lynah Rink.

Upon receiving his Ph.D. in August, 2004, he and his wife settled in the Commonwealth of Kentucky, where like Abe and Mary before them, they begin their improbable (and some say ludicrous) journey toward restoring America to a place resembling that which our grandparents and forefathers fought so hard to create and defend.

To the incredible woman

who always has,

and always will

make my blood boil

and

In loving memory of

Julianna Rose Rizzo

ACKNOWLEDGMENTS

Though he is likely unaware of this fact, the one person responsible for sparking my interest in Economics is Ralph Beals, with whom I had the pleasure of taking my introductory course from at Amherst College in the spring of 1993. An even more unsuspecting spark came from fellow Amherst alum Joseph Stiglitz – it was in his introductory textbook that he mentioned in a footnote to a story that the economic theory being discussed does not take into account, "the feelings of the cows." I simply had to learn more.

It turns out that without the help of both Steve Rivkin and Frank Westhoff at Amherst, not only would I not have been recommended to my thesis advisor (who skillfully tricked me into believing that I found him by my merit alone), but I probably would not have been accepted at Cornell either. For their support, and for being an undergraduate at a college that truly valued undergraduate teaching and overall personal development, I am extremely grateful.

To all of those who preceded me both corporally and in spirit in 258 Ives – Kerwin Charles, Dan Goldhaber, Dominic Brewer, Dan Rees, John Cheslock, Dan Hosken, and to those that are still there, it was a great comfort to know that we all went through similar ups and downs during graduate school.

The staff in Ives Hall made it an absolute joy to come to work every day and heartbreaking to leave after graduating. I particularly want to thank Darrie O'Connell (great to know another Italian!), Alexa, Claire, Carol, Rhonda, Mike, Alan, and the folks in OSS. Great people.

My three committee members, Ron Ehrenberg, George Jakubson and Bill Schulze, in addition to a close friend, Professor George Boyer are all inspiring and unique in their commitments to both research and teaching. While they are each at the

absolute top of their respective fields, their accessibility and friendships demonstrate a "down-to-earth" and impeccable character that I have found both reassuring and motivational. I have thoroughly enjoyed my conversations with Bill on kayaking and his early academic life; with Jakubson about his kids, Maine and his work with the Boy Scouts; and with Boyer about almost everything – hellfire I say!

Were I to be put in the awkward position of including only one name in this acknowledgement section, it would have to be that of my advisor, mentor and friend - Ron Ehrenberg. Ron took a chance on a less intelligent, but hard working kid that almost nobody else in his position would have done. From the second I met him I felt a close connection and I still am not sure whether it was because of our similar New York City upbringings, our mutual belief in the power and promise of higher education, our mutual passion for working with undergraduates or because both he and my wife share the same alma mater (Harpur College / Binghamton University). Ron has always treated me as he would his own son. He has shared his feelings with me; has shared stories about his own personal life; he has displayed undeterred confidence in my abilities; and he has simply been a great friend when I have needed someone to share my excitements and disappointments with. My appreciation for his financial generosity (through the Cornell Higher Education Research Institute – which is funded by the Mellon Foundation and the Atlantic Philanthropies, Inc.) cannot be overstated nor can my appreciation for his professional generosity. He has allowed me to publish with him for nearly four years now and he has introduced me to many wonderful people in the economics of, and many other areas of, higher education. Finally, while I still do not believe that Ron suffers from the "imposter syndrome," I appreciate his patience in dealing with me in trying to keep my spirits high when things seemed gloomiest. For all of these things, and for countless others that my sieve-like brain is likely forgetting at this time, I am forever in debt to him. I will honor our relationship

by pouring my heart and soul into helping all of the undergraduates that will cross my path in the future and to teach each and every one of my classes with the same passion that I have today.

Several other folks helped keep my fires burning for the long five years in Ithaca. Reg and Lois Collins, Mike and Sarah Goettel (and their son to be), Mom and Dad Racibor and of course my wonderful brother Peter – each have exhibited a flattering enthusiasm, interest and excitement about my graduate school progress and career ambitions. Thank you.

It goes without saying that I would never have achieved much of anything in my life without the love and support of my parents, Frank and Angelina Rizzo. Thank you.

Last, but certainly not least, I seriously doubt that I would have succeeded in this endeavor without the support of my beautiful wife Rachel. She was certainly more excited about our career search and graduation than I was. Her smile and fervor are firmly ensconced in my soul. As I walked out of my office for the final time I found myself welling up – Cornell is the place that brought her into my life – and for all of the complaining I did about her barging into my office a dozen times a day, there's still nothing more enjoyable than coming to work every day with the woman you love at your side. Thank you sweetheart, I love you.

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PREFACE

The state of Oregon cut the budget of the Oregon University System by 9% from 2001-2003 and by 11% in 2004. The System will receive the same amount of state support in the 2005 academic year as it did in the 1991 academic year. The share of state tax dollars going to the university system fell from 12.2 percent to 6.1 percent over this time period. Despite these trends and a substantial run-up in tuition, Oregon taxpayers soundly rejected a personal income tax increase (Measure 30) in a referendum that would have raised $800 million for public education in the state. The University of Oregon System was (and is) forced with an unattractive decision: respond to further budget cuts by reducing support for its undergraduate students, and thereby allow an erosion of its academic quality; or maintain its program quality but limit the number of students enrolled in the system. Oregon chose the former and now enrolls 20,000 more students in 2004 than it did in 1991, with the same absolute level of state support.

The state of California's budget situation has been so desperate that its voters recalled Governor Gray Davis and voted in Arnold Shwarzenegger in November of 2003 on a platform of fiscal reform. Faced with funding cuts as dramatic as the Oregon System, the University System of California was faced with the same unattractive decision as its northern neighbor – but rather than take measures that would reduce program quality, this system that was dedicated to access and built by the visionary Clark Kerr has now begun turning away qualified students from its overcrowded colleges and universities and forcing them into the Community College system, to the private system, out-of-state, or out of the system entirely.

In response to a dramatic cut in state support for higher education in Maryland during the 2003-04 fiscal year, the public colleges and universities in that state raised

tuition rates by an average of 19%. In response, the state legislature is pushing through a measure that would impose caps on tuition increases. Building on Representative Buck McKeon's proposal to cap tuition increases at any college receiving federal funding, Iowa, Indiana, Kentucky, Michigan and several other states are pushing for similar measures in their states.

Budget cuts in Delaware have reduced state support for its colleges and universities from 6 percent of state budgets in 1990 to 4 percent in 2004. Based on cuts in 2003-2004 alone, the University of Delaware was forced to increase tuition by 11 percent. The University's longer term response to budget cuts has been to build an endowment that has now reached a value of $1 billion. In response to the completion of a five-year, $383 million campaign, University of Delaware President David Roselle said, "If we fall flat on our face, we might get more money from the state …, it's the curse of the competent."[1]

The state of Colorado Senate Education Committee voted to send a bill to the Appropriations Committee that would make future Colorado high school graduates eligible for vouchers to attend in-state colleges and universities, prompted by dramatic tuition hikes following years of state budget difficulties. "We are faced with the potential end of public higher education in this state," University of Colorado President Betsy Hoffman told lawmakers in a dramatic plea for support.[2] She continued, "This bill alone will not solve the problem - I understand that perfectly. It is step one. Step two is achieving enterprise status, (which would give universities more budget flexibility and ability to raise tuitions) step three is a ballot initiative to reform TABOR and Amendment 23." TABOR is the Taxpayer's Bill of Rights which limits government revenues and spending. Amendment 23 mandates annual increases

[1] *University Business,* February 26, 2004.

[2] John J. Sanko, *Rocky Mountain News,* March 4, 2004

for funding education in kindergarten through 12th grade, but provides no such security for higher education. With the sharp cuts to public colleges in Colorado in recent years, Hoffman believes that all state funding could dry up by the end of the decade." Rome is burning," Hoffman said. "If this bill does not pass, it could well be the end of public higher education."

President Hoffman's comments might be viewed as histrionic were in not for the fact that her situation is not unique. A three inch thick volume could be dedicated to a telling of similar stories in all of the remaining states. These recent budgetary difficulties and the varying responses to them by colleges and universities in different states have obscured the fact that there has been a systematic withdrawal of state support for the operating expenses of public colleges and universities *relative* to other items states spend money on, over a period of nearly 30 years. Amidst the scrambling by institutions to stay afloat and by states to respond to ever increasing demands on their budgets (most notably by providing health care for low-income families and by a boom in prison building and incarceration rates) gets lost two important questions. How did we get here? And what are the implications?

This dissertation will focus largely on the first of these two questions. The attention paid to recent funding changes in higher education obscure the dramatic long-term systematic withdrawal of public support for higher education. Chapter one will present data that shows that higher education funding has been lagging since the mid-1970s and will discuss the reasons the general public might be concerned about this. The second chapter will present a theoretical model that provides a basis for thinking about how funding decisions are made at the state level. While the model I present is a simple application of consumer demand to a situation where state legislatures follow a multi-stage budgeting process, it does not prevent me from explicitly considering the political economy of the questions I am asking. Embedded

in the resulting empirical analyses are many of the political economic factors that one would expect to impact how budget levels are set in different states.[3] The remainder of chapter two describes in detail the data and empirical specifications that I will estimate as well as the expected impacts of the variables included in the models. Chapter three presents econometric estimates of models that seek to answer the question of why, within a particular state, budget shares have changed over time the way that they have. Chapter four uses similar econometric techniques to seek answers to the question of why budgetary equilibriums are so different across the United States at a point in time. Chapter five compares the results from chapters three and four by presenting the results of statistical tests which examine whether differences in cross-state and within-state estimates are due to systematic differences in unobserved state characteristics (which are time-invariant, such as an inherent preference for funding education) or due to random variation in the data. Chapter six concludes.

[3] These factors would act as "taste shifters" in the consumer demand framework.

CHAPTER ONE

INTRODUCTION

> *"In general, however, my impression is that the great danger is not so much institutional extinction, or even that there will be a sudden, dramatic downward shift from one level of quality to another. The greater danger, I believe, is that there will be a slow, unspectacular, but cumulative decline in what it is possible to achieve – and then, as a next step in the process, in what one tries to achieve. Gradual changes of this sort are, in their nature, impossible to measure with any precision, and they may not even be noticeable to quite experienced observers until some considerable time after they have occurred."*
>
> *-- William Bowen, President of Princeton University (1977)*

Considerable time has passed since Bowen made these ominous comments to the American Economic Association. While there is nothing unusual about university administrators crying out for more funds, a dramatic decline in support for public higher education in the intervening time period suggests that Chicken Little can no longer be ignored.

Few observers would disagree that America's stellar economic, scientific, political and cultural standing is largely a result of the proliferation of its system of education throughout the states since the nation's founding. Further, it is not a coincidence that America's permanent place among the global powers occurred only after public monies from our various legislative entities began spilling into a growing higher education system, changing it from largely a private domain of the elite aristocracy, to a tool for the lower and middle class public to achieve the "American Dream" as well.[1] Despite this and despite the large literature espousing the many benefits of investing in education, public higher education seems to be increasingly falling out of favor with both voters and governments alike.

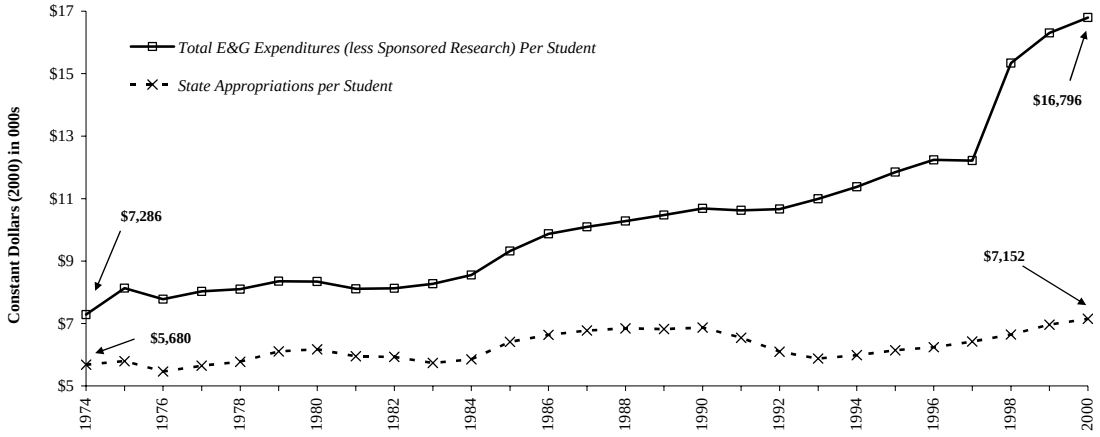
[1] Goldin and Katz (1999) present an excellent analysis of the shaping of American public higher education during the time that it is commonly believed that America took its place on the world stage, 1890-1940.

The goal of this dissertation is to explain why public higher education *institutions* find themselves in the precarious budget situations they are in today. Among my findings are that changes in observable state characteristics can explain little of the observed fall in higher education budget shares. Generally speaking, public higher education spending has been crowded out by increasing demands for state support of K12 education as a result of court mandated equalization programs, but more importantly because of the great deal of discretion legislatures have over higher education spending. That institutional efforts to raise private money and to increase tuition rates have been met with sharp cuts in budget shares, coupled with projected future enrollment pressures and the political popularity of non-need based aid program expansion, casts a pall on the ability of our public institutions to maintain accessibility and quality much longer into the future.

It should be emphasized that public universities are accustomed to their state funding being at the mercy of economic cycles. In bad budget times, higher education typically bears a disproportionate burden of state funding cuts, with the full expectation that it will be compensated during a recovery. This is not surprising given that higher education is the single largest discretionary item in state budgets. Higher education is also an attractive target for the legislative axe due to its ability to draw revenue from a variety of sources, most prominently tuition – a feature unique to this state budget item. That higher education funding *levels* fluctuate so much is well known and is not the focus of this dissertation. Rather I emphasize that, in *relative* terms, higher education funding has not fluctuated with the business cycle. Public higher education has faced a continuous precipitous drop in state governmental priority for nearly three decades.

In real terms, the level of state funding for public higher education doubled from $30 billion in 1974 to nearly $60 billion in 2000. However, due to the growth in

public enrollments, the bottom line in figure 1.1 shows that per student funding increased in real terms by less than 1% per year (25.9% overall). Real current educational and general expenditures per student (less dollars spent on sponsored research) in public higher education, shown in the top line of figure 1.1, grew by over 3% per year (130% overall).[2] As a result, while state appropriations in 1974 were generous enough to cover 78% of the cost of schooling, in 2000 this support has fallen to just 43%.[3] That public universities and colleges are turning to tuition to more than make up for lost state appropriations has raised the ire of taxpayers and politicians alike.



Sources: US Department of Education's IPEDS & Illinois State's GRAPEVINE System

Figure 1.1
Growth in State Appropriations vs. Current Educational and General Expenditures (net of Sponsored Research) per FTE Student at All Public Universities, 1973-74 – 2000-01AY

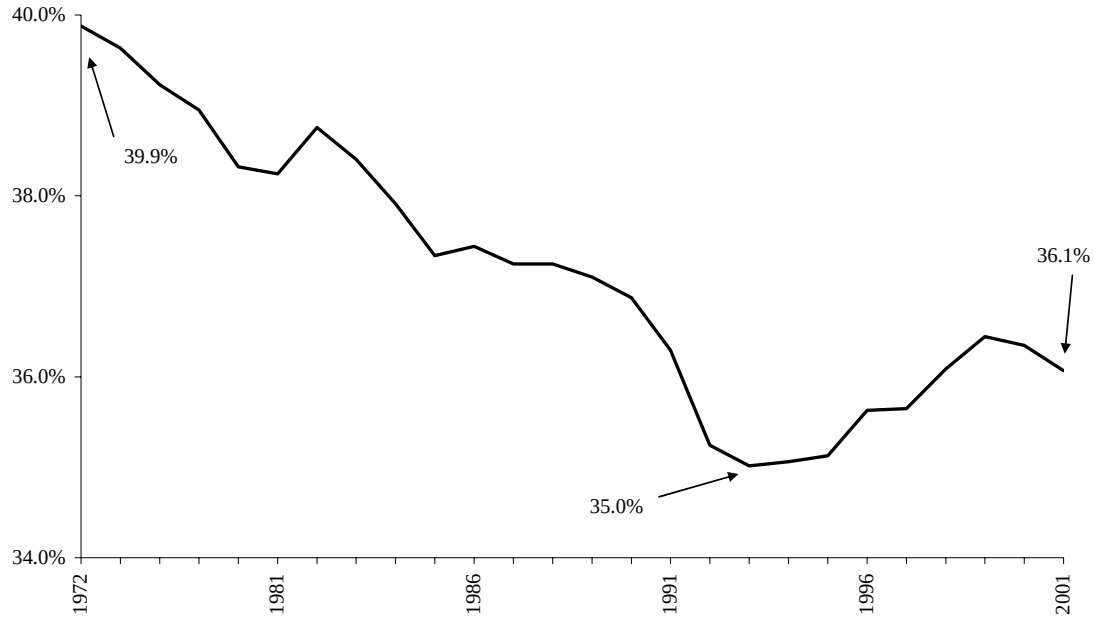
[2] The sharp increase in reported expenditures may be due to differences in accounting and institutional reporting beginning with the 1997 academic year. Data prior to this year are reported in a different source than later data. However, even if in the unlikely event that actual expenditure levels were flat since 1997; overall growth for the period would have been approximately 70%.

[3] A large body of literature has been devoted to this phenomenon. I will not examine the reasons for expenditure growth in any detail in this paper. While this growth may be a reflection of improvements in quality, it is also likely a result from the increasingly fierce competitive environment institutions are operating in. For a detailed discussion on this matter, see Ehrenberg (2000).

What is less well known is that public education has undergone a sea-change in public priorities during this time period. While most laypeople, administrators and even statehouse representatives focus on the dollar values of the state appropriations, very little attention is paid to how higher education fares in relation to other budget items within each state. It is to this *relative* funding that I now turn.

As figure 1.2 indicates, between the fiscal year (ending) FY1972 to FY2001, the average (across states) share of total state general fund expenditures on education fell from a high of 39.9% in 1972 to a low of 35.0% in 1993, with a slight recovery to 36.1% over the remainder of the decade.[4] While the decrease has not been monotonic, there is a clear downward trend; the cyclical behavior appears to revolve around this trend and the slight recovery in the late 1990s does not return shares anywhere near their pre-1990s levels. The average general fund budget size (in 1998 dollars) in FY2001 was $19.7 billion. Had education been able to maintain its budget share at 1972 levels, the "average" state would have spent a whopping $750 million more for education in 2001. Given that there are on average one million public school students in each state, this represents an additional $750 of resources that could have been devoted to every single elementary, secondary and college student in a state.

[4] I analyze expenditures made from state general fund budgets because this is the fund where legislatures and governors have the most appropriative discretion. This is the predominant fund for financing a state's operations. Revenues coming into the general fund derive from a variety of broad based state taxes. The trends that I present below look similar if one were to analyze total state expenditures as well. I will discuss this in more detail later.



Source: US Census "State Government Finances" Selected Years. See ftp://ftp2.census.gov/pub/outgoing/

Figure 1.2
Average Share of State General Expenditures on Education
1971-72 to 2000-2001

The decline in relative state support for education has occurred throughout the distribution of states – in those that have traditionally devoted a large share of resources to public education (North Carolina's share has fallen from 51% to 41%) and those that have not (Massachusetts' share has fallen from 30% to 22%). In fact, only 11 states have seen increases over this period, with an average increase of about 4 percentage points.

There is nothing particularly sacred about education's share of the budget and the many factors thought to be responsible for its decline are well known. Medicaid expenditures have skyrocketed due to large increases in caseloads (it is a means-tested entitlement program), escalating prescription drug costs and lagging support from the federal government. An aging and growing population is putting further stress on health care expenditures and other state services. Corrections expenditures have been

growing due to more vigilant prosecution, mandatory sentencing laws and the resulting expansion of prison capacity. Whether education's falling out of favor represent demographic changes alone or a shift of funding priority is unclear and is analyzed in the empirical section of the dissertation.

In addition to these trends, there is a wide disparity across states in their budget commitment to education. To give readers a sense for what the current equilibrium looks like, figure 1.3 presents a map where more darkly shaded states are those that allocate a larger share of their budgets to education.[5] The range of budget shares in FY2001 is rather dramatic - with New York and Massachusetts spending approximately 25% of their budgets on education and Utah, Georgia, Michigan and Oklahoma all expending approximately 45% for education. The regional patterns are hard to ignore – the Eastern and Northern Plains states expend a much smaller share of their budgets on education than do their Midwestern, Mountain and Southwestern counterparts.

[5] The categories were defined using a means clustering analysis described by Everitt (1993). This is an exploratory data technique meant to find natural groups in the data. I chose to employ a partition method that breaks the observations into k-non-overlapping groups. Multiple iterations suggest that the most natural partition was 4 groups. States near the average include Nebraska and Arizona, expending about 36% each.

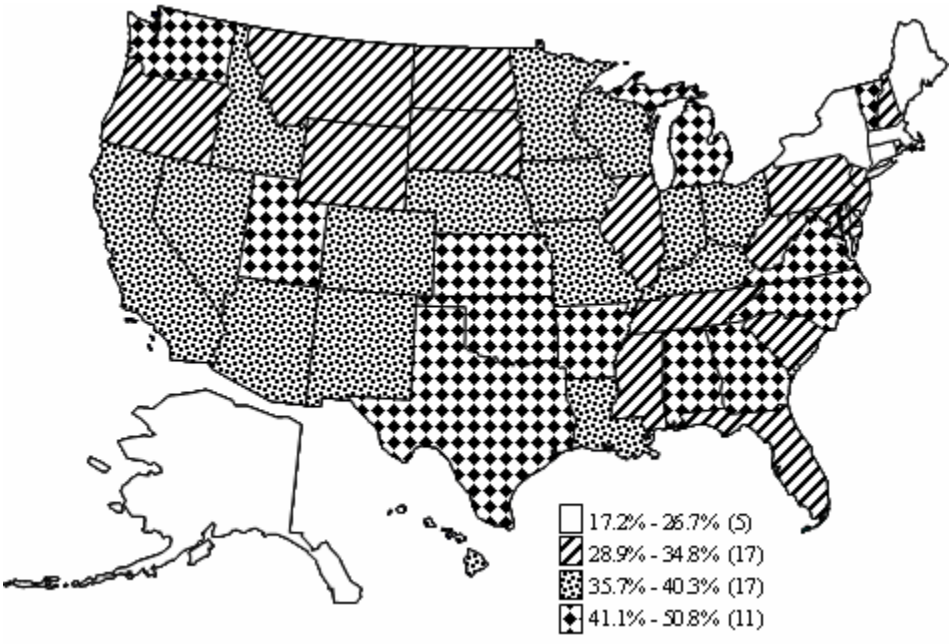
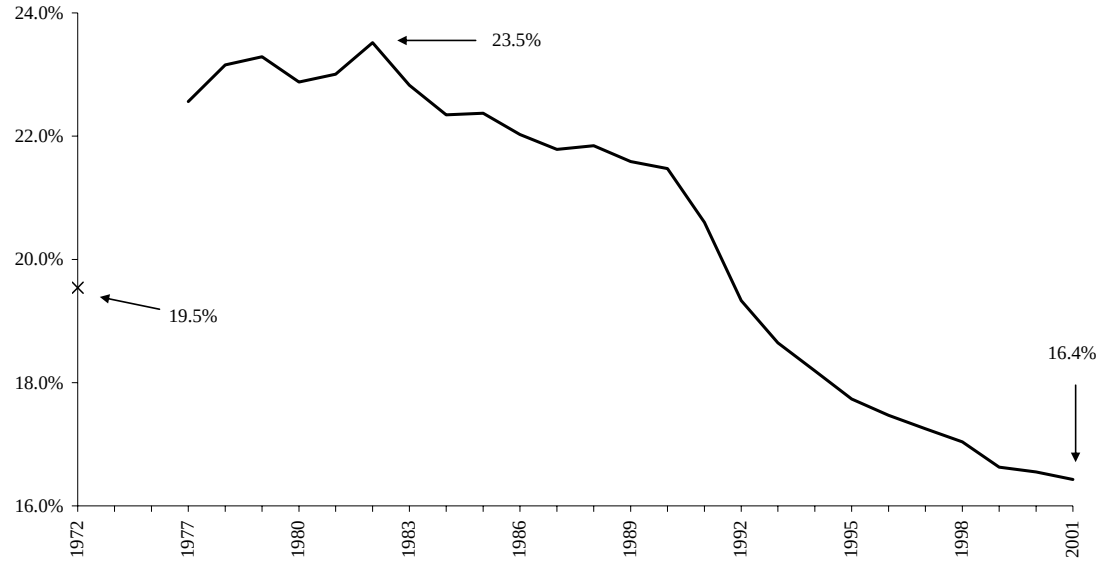


Figure 1.3
Share of State General Fund Expenditures on Education
2001 Fiscal Year

Figure 1.4 describes how the average share of state educational budgets allocated to public higher education has changed in the United States between FY72 to FY01. After a sharp increase in the early 70's, higher education's share has fallen steadily.[6] Since 1977, the average share of education budgets allocated to higher education across states fell over six percentage points, from 22.6% to 16.4% after peaking at 23.5% in 1982 (a 27% drop). While the most precipitous drops occurred during the recessions of the early 80's and 90's, the lush budget environment in the 1990's was insufficient to halt the bleeding.

[6] Allow me to begin the discussion of the "fall" with 1977. The rise in the early 70s can be attributed to a number of factors. Chiefly among them are states preparing for the children of the baby boomers attending college and leaving the K12 sector, accommodation of the enrollment surges as a result of the Vietnam War draft deferments and a residual effect of the space and arms race that culminated in the moon landing in 1969.



Source:s US Census "State Government Finances" Selected Years and Illinois State's GRAPEVINE.

Figure 1.4
Average Share of State Education Expenditures on Higher Education
1971-72 to 2000-2001

This decline occurred in the vast majority of states. States like Oregon, Wisconsin and California that initially expended well over 25% of their education budget on higher education have all cut their higher education share by over 40% (12 percentage points) while states like Vermont, Massachusetts, New Hampshire and Delaware that initially expended less than 19% of their education budget on higher education, have also cut their shares by over 35% (6 percentage points). Even those states where advances were made (only four states increased their share overall during the period) have seen much of it weathered away by the end of the period. In fact, only one state saw its higher education share increase since 1990 (New Mexico).

The average public education budget size (in 1998 dollars) in FY2001 was $7.1 billion. Had it been able to maintain its budget share at 1977 levels, public higher education in an “average” state would have received $439 million more than it actually received in 2001. Considering that average overall full-time equivalent (FTE)

enrollment in public two- and four-year institutions, including all graduate and professional students, was approximately 160,000 students in 2001 (up from 125,000 in 1977), this would have meant an additional $2,744 per FTE student in support in the average state. To appreciate the magnitude of this loss, recall from figure 1.1 that average expenditures per student across the U.S. in public higher education in FY2001 was $16,796. Thus, the decline in higher education's share of state public education budgets represents over 16% of the cost of educating a FTE student. In fact, the monies this loss represents would have been enough to cover 83% of the cost of instate tuition at a public four year institution in 2001![7]

Figure 1.5 shows that in 2001 there is also a wide disparity across states in their commitment to higher education. The more darkly shaded states are those that allocate a larger share of their education budgets to the higher education sector. This map also shows clear regional patterns with states in the Northeast and in the rust-belt spending smaller shares for higher education (New Hampshire, Vermont, Michigan and Rhode Island each under 13%) than their Midwestern and Southern counterparts (Nebraska, Iowa, Mississippi and North Carolina each over 20%). These patterns are suggestive of the historical and private influences that many have attributed to the shaping of U.S. public higher education.[8]

[7] The Digest of Education Statistics (2001) reports that average instate tuition at all public four year institutions across the US was $3,314 in 1998 dollars. An enrollment weighted average (my calculations) suggests this figure is closer to $2,850. In addition, the "loss" alone would have been more than enough to allow institutions to keep their real tuition rates at 1977 levels, when, in real terms, weighted average four year public tuition was $1,693.

[8] See John M. Quigley and Daniel L. Rubinfeld, "Public Choices in Public Higher Education" in Clotfelter and Rothschild, eds *Studies of Supply and Demand in Higher Education*, 1993, University of Chicago Press.

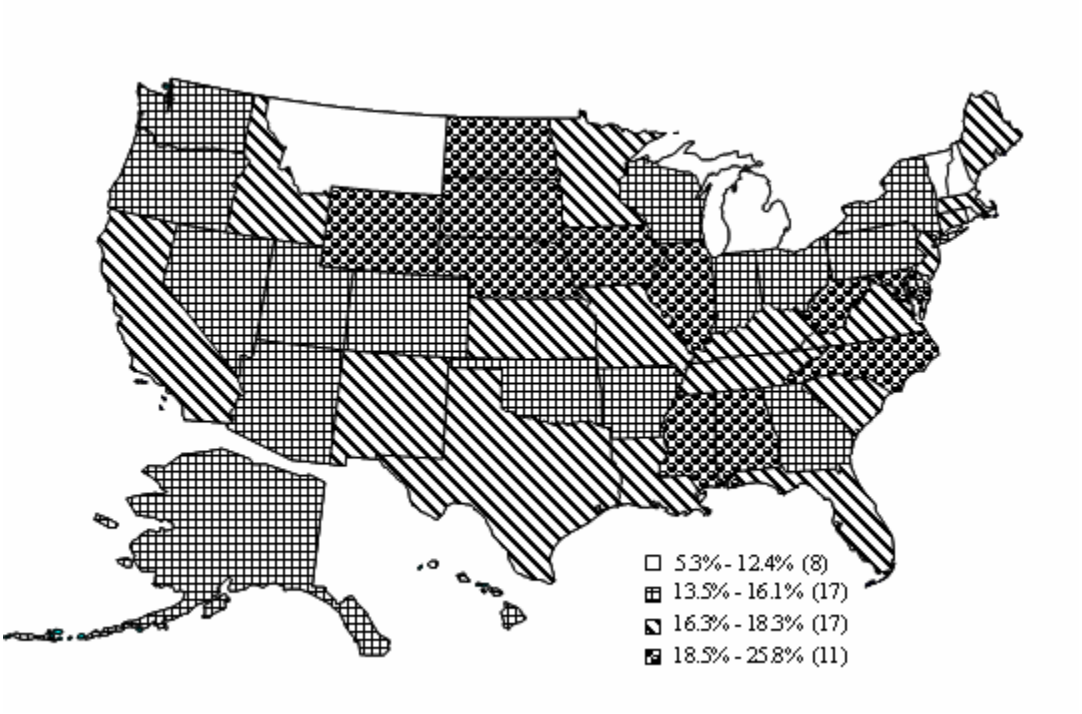


Figure 1.5
Share of Education Expenditures on Higher Education
2001 Fiscal Year

A further strain being placed on public higher education institutions is revealed in figure 1.6. Fueled by the popularity of merit-based aid programs in the 1990s, the share of higher education funding going directly to institutions (as opposed to students) declined over the period, from 97.2% in 1977 to 93.5% in 2002, with most of the decline occurring after the implementation of Georgia's HOPE scholarship program in 1993.[9] While ultimately student aid dollars make their way back to the institution that an aid recipient attends, this aid travels with the student and cannot be depended upon to support institutional operations.

[9] By then end of FY2001, 13 states had instituted merit based aid programs similar to Georgia's HOPE program (Krueger 2001). These states are Arkansas, Florida, Georgia, Kentucky, Louisiana, Maryland, Michigan, Mississippi, Nevada, New Mexico, South Carolina and West Virginia. While some states have had small merit programs for over 30 years, which were targeted to specific ethnic groups or students with specific skills, the popularity of broad based programs and their growth did not begin until Georgia's HOPE program exploded on the scene in 1993. The concurrent growth in need-based aid awards may signal that a paradigmatic shift away from broad-based in-kind aid policies is underway.

Source: Illinois State's GRAPEVINE and National Association of State Student Grant and Aid Programs various years.

Figure 1.6
Average Share of State Higher Education Expenditures to Institutions
1976-77 to 2001-2002

The average public higher education state appropriation (in 1998 dollars) in FY2002 was $1.3 billion. Had institutions been able to maintain their budget share at the 1977 level, public higher education institutions in an "average" state would have received $43 million more than they actually received in 2002. Considering that average FTE enrollment in public two- and four-year institutions, including all graduate and professional students, was approximately 160,000 students in 2002, this "loss" represents an additional $270 per FTE student in support in the average state.[10] States that were initially less generous to institutions have continued to increase their support for students. For example, New York, Vermont, Illinois and Pennsylvania all decreased their shares to institutions from 83-90% to under 77-85%. On the other hand, there were many states changing their funding strategies and moving aggressively to expand student aid programs from nearly nonexistent in 1977 to rather

[10] For comparison purposes, the real value of the maximum Pell grant awarded fell by $465 over this period.

substantially sized in 2002. Among these states are Georgia, Louisiana, Florida, South Carolina, New Mexico and Arkansas – averaging an 11 percentage point drop in the share allocated to institutions over the entire period and 8 percentage points since 1993 alone.

Though the magnitude of the "loss" is far smaller than that represented in figures 1.2 and 1.4, this trend should be worrisome nonetheless. Proponents of direct student aid programs champion its cause for two primary reasons: student access and to ensure an accrual of economic benefits within a state. However, recent empirical evidence suggests that the ability of student aid programs to achieve these two goals is very limited. With regard to student access, policymakers have long feared that more generous student aid packages would encourage institutions to capture these additional revenues through higher tuition and other fees, thereby negating the impact of the aid programs. Bridget Long (2003) and Michael Rizzo and Ronald Ehrenberg (2004) provide evidence that supports this view.

With regard to economic development, there is a belief that increasing the generosity of direct student aid awards (and merit programs in particular) would both increase the propensity for students to attend colleges in their home states and increase the propensity for these talented students to remain in-state after graduating.[11] While a number of studies have found that generous student aid programs result in more talented students remaining in-state to attend college, Jeffrey Groen (2003) finds that although students that attend college within a state are more likely to remain in the state, the magnitude is much too small to justify using economic development as a rationale for merit-based student aid programs.

[11] It is believed that areas with a more highly educated workforce have higher wage levels than other areas – and with more highly educated people earning more and therefore paying higher taxes (Moretti, 2003). It is also believed that more highly talented students are most likely to attend colleges outside of the home state and do not return upon graduating (Hoxby, 1997).

Just as with the first two trends above, on average, the share of higher education budgets going to institutions varies widely across states. Figure 1.7 displays the FY2002 cross-sectional variation in the relative popularity of student aid programs. Clear regional patterns emerge with the Northeastern, Southeastern and Great Lakes states committing a relatively larger share of funds to students while the more rural states west of the Mississippi River commit almost all of their resources to institutions.

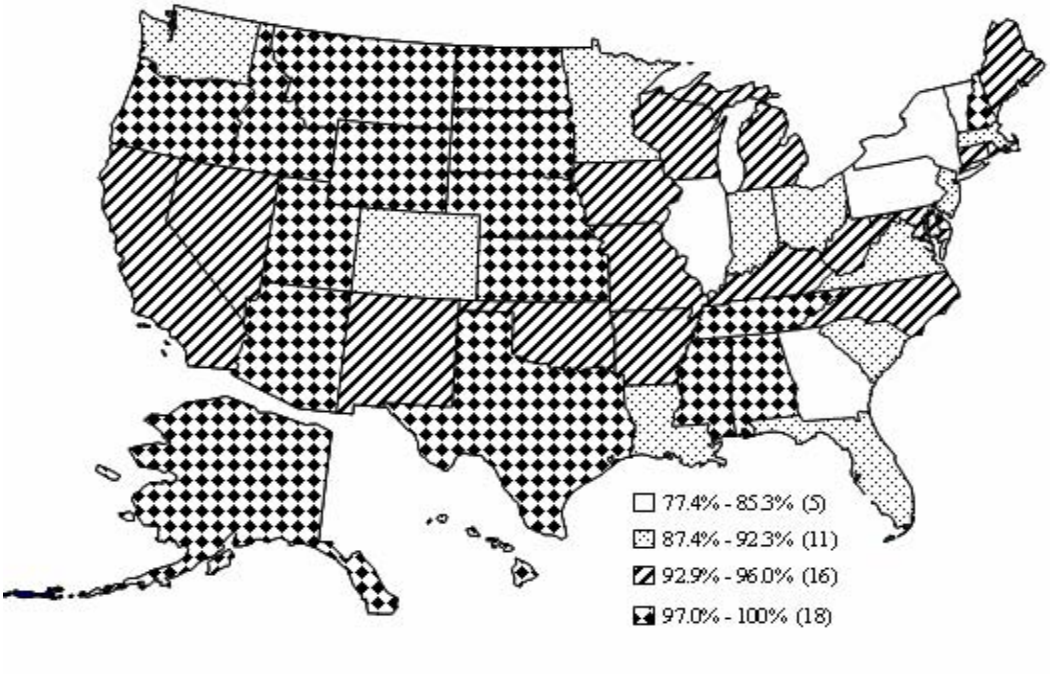


Figure 1.7
Share of Higher Education Expenditures to Public Institutions
2002 Fiscal Year

The combined effect of the trends depicted in figures 1.2, 1.4 and 1.6 indicates that if public higher education institutions had been able to simply maintain their budget shares at 1977 levels, in an average state, institutions would have garnered an additional $605 million per year. To appreciate the magnitude of this sum, consider that it represents fully 50% of the *total* public higher education budget in an average

state ($1.2 billion). Had states been able to retain these dollars, the $3,781 per full time equivalent student it represents would have been sufficient to cover an additional 23% of institutional expenditures or 114% of in-state undergraduate tuition at an average public four year institution in 2001. These declines have occurred steadily and almost unnoticeably for over 20 years; however institutional responses to this funding withdrawal have enjoyed no such anonymity.[12]

Why I Focus on Budget Shares

That budget shares, as opposed to levels, are a metric of interest is not driven alone by analytical convenience. Empirical and behavioral evidence suggests that legislatures behave in a way that is amenable to an analysis of shares. In prior empirical work examining levels, the only consistent interest group found to have an impact on higher education expenditures is elementary and secondary education. While empirical analyses of levels might show that the volatility in per student funding levels reflect business cycles, underlying demographic trends and the ability for public institutions to raise money from other sources, they cannot easily explain why public higher education has steadily fallen out of favor as a budgetary priority – even during robust economic times.

Behaviorally, there are a multitude of examples that demonstrate that states explicitly tradeoff K12 funding for higher education funding. A recent, well publicized debate in the South Carolina Capitol in Columbia highlights such a battle.[13]

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[12] It must be emphasized that the national averages presented in figures 1.2, 1.4 and 1.6 above are not driven by any one particular state or group of states. Appendix figure 1 combines the information in these figures to present, for each state, the share of general fund expenditures directly allocated to public higher education institutions from 1977-2001. The steady declines are remarkably similar across all states. Even in states where there had been some recovery during the mid-1990s (California, Louisiana, Florida, Massachusetts), the budget shares never returned anywhere near their initial levels, and began to fall again as the economy turned south in 2001.

[13] *Chronicle of Higher Education,* 5/24/02. In November of 2001, South Carolina voters approved a lottery to raise funds for "education" which is expected to raise $172 million annually. As the state

Despite the statutory requirements in most state constitutions that legislatures and budget officers practice "zero-base budgeting," it is a rare scenario where states weigh and balance the recurring needs annually or biennially from the askings of the administrative officers of the respective departments. What actually happens is that budget directors and governors obtain a reliable estimate of what state revenues are likely to be for the ensuing fiscal period, mindful of the political consequences of increasing taxes or imposing income redistributions. Then, they place this figure on a chalkboard and draw a circle around it. All that remains is to parcel the slices to the different departments and institutions. This intensifies competition because all departments assume that the total available funding is limited to the figure placed on the chalkboard. If any slice is enlarged, it means other slices must shrink. Major attention is therefore paid to defending the allocations of the previous fiscal period, the status quo. In this atmosphere it is very difficult to get a hearing for the funding of any entirely new needs or for expansion of any existing services.

Budget share analysis is not immune from criticism. Focusing solely on shares leaves an observer yearning for more information about what optimal economic equilibria should look like. For example, does the fact that Nebraska spends 26% of its education budget on higher education mean that it spends "too much" or that New Hampshire spends 7.6% of its education budget on higher education mean that it spends "too little?" Without studying the level of higher education expenditures in

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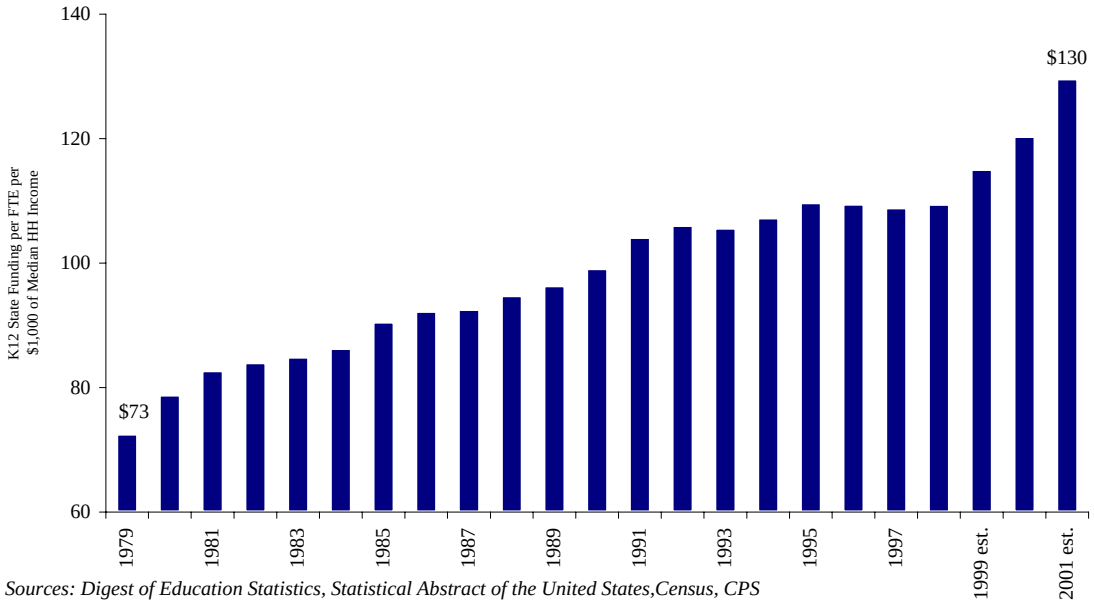
faced a $350 million budget deficit, the Senate proposed that the bulk of the money be spent on college scholarships and endowed professorships at research universities while the House wants to focus the spending on reading, math and science programs for elementary-school pupils. House opponents of higher education spending cite the Bennett Hypothesis as a defense and that increasing college scholarship awards would only encourage colleges hamstrung by tight state budgets to increase tuition – even citing Clemson's decision in 2001 to increase tuition by 42% ($1,500) in response to a $6.5 million reduction in state appropriations as a harbinger of things to come. Even lottery revenues are uncertain lawmakers say – which just highlights the fact that overall state revenues are uncertain. They claim that scholarships and professorships are harder to eliminate in tough times than are elementary school grants – indicative of the dilemma states face in wanting to strengthen universities through these means.

each state, as well as acknowledging that marginal productivities and marginal costs likely differ greatly across states, one cannot make an accurate assessment here. However, there is insight to be gained from the fact that these shares have declined across all states over the time period I am considering.

Data on budget shares might also mask potential nonlinearities in the educational production function in a state. Hence, there are two ways that observed recent declines in budget shares may not indicate a fall in funding priority. First, as higher education budgets expand in real dollar terms, economies of scale may be able to be taken advantage of. Second, the observed declines in budget shares may only be a reflection of cyclical patterns in seating capacity. States aggressively built capacity in the late 1950s and the 1960s in anticipation of college attendance of the baby boomers. As the population bulge has subsided over the past two decades, states have not needed to expend a great deal of resources building capacity. Therefore, the declining shares may merely represent a trough in the capital cycle.

All along, I have emphasized that declining higher education budget shares represent states' falling commitment to public higher education institutions. Though it might be argued that this measure is fraught with ambiguities, other measures also signal that something has gone awry for public higher education institutions. A common measure of a state's commitment to a particular budget item in the public finance literature is a notion of "tax effort" – how much of a state's available resources are allocated to that particular budget item. Figures 1.8 and 1.9 below present the state average tax effort for elementary and secondary education and higher education respectively. The figures represent how many dollars out of every $1,000 of median household income in a state are allocated to public elementary and secondary state expenditures per full time equivalent student (figure 1.8) and how many dollars are

allocated to public higher education appropriations per full time equivalent student (figure 1.9).[14]



Sources: Digest of Education Statistics, Statistical Abstract of the United States,Census, CPS

Figure 1.8
K12 Education Tax Effort
50 U.S. State Average, FY79 - FY01

[14] Data for 1999-2001 are estimated due to a lack of complete enrollment data for both elementary and secondary schooling and higher education by state. Estimates are based on growth rates in the relevant age group in the population during that time period and I have also assumed that the college enrollment rate was constant across states. Each data series begins in 1979 due to availability of detailed state income data from the Current Population Survey.

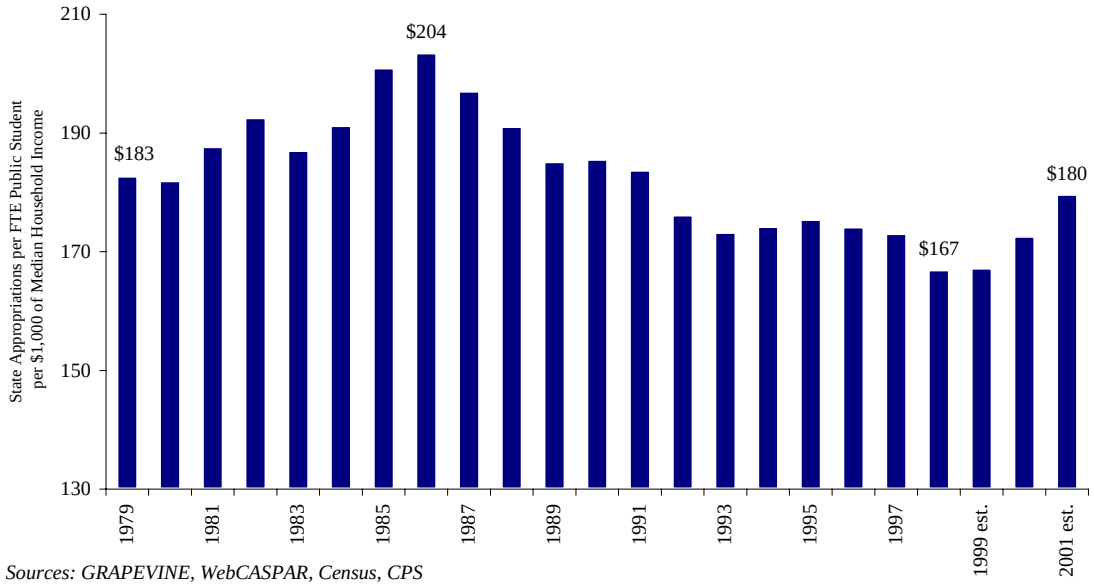


Figure 1.9
Higher Education Tax Effort
50 U.S. State Average, FY79 - FY01

Taken together these figures indicate that the driving force behind the fall of education's share of the general fund budget (figure 1.2) has been the falling out of favor of public higher education. While a steadily increasing share of household income is being allocated to the elementary and secondary sector throughout the states (figure 1.8), higher education has enjoyed no such increase. After a period of relative prosperity in the early 1980s, the share of median income devoted to public higher education fell from $204 per student out of every $1,000 in 1986 to $167 per student in 1998, with a slight rebound in recent years. This 18% drop from 1986 to 1998, and flat "growth" otherwise result in this picture eerily resembling that of the higher education budget share depicted in figure 1.4 above.

Figure 1.10 plots the *change* in higher education tax effort versus the *change* in elementary and secondary tax effort over the period 1986 to 2001. Noting the tight distribution of points along the vertical axis and the wide distribution along the

horizontal axis is informative.[15] This figure indicates that while states remain nearly uniform in their commitment to elementary and secondary education (or exceedingly generous), commitment to higher education is subject to a great deal of variability across states. Therefore, the trends observed earlier in the budget shares are also mirrored in other measures of educational commitment as seen in figures 1.8 through 1.10.

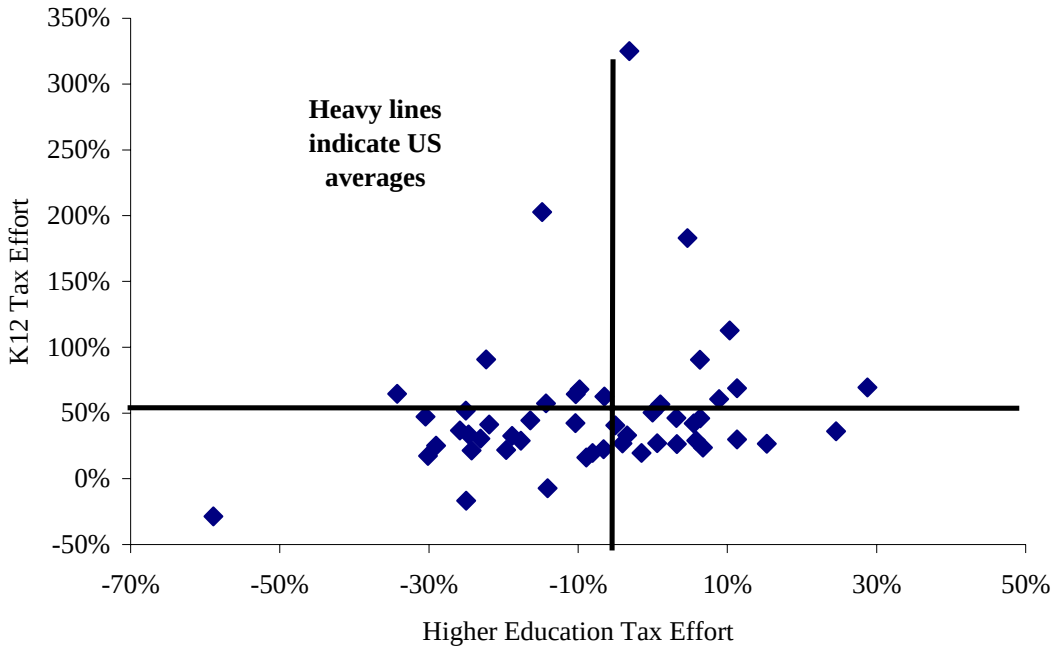


Figure 1.10
Change in Higher Education Tax Effort vs. K12 Tax Effort
1986-2001

Why is this Issue So Important?

The raw data underlying figure 1.1 conceals the troublesome financial situation facing public higher education institutions. While a cursory glance at this figure

[15] In fact, the coefficient of variation for higher education effort is twice that for elementary and secondary effort (2.0 to 1.1). The difference in coefficient of variation is even larger for the longer time period between 1979-2001 due again to the relatively steady commitment to elementary and secondary education.

indicates that public higher education receives larger sums of money today than it did 25 years ago, by any other measure it is alarmingly evident that higher education is receiving an ever shrinking piece of a shrinking pie. An analysis of this decline is important for a several reasons.

Tax Support for Public Higher Education

Were a researcher to look solely at expenditure data published by the National Association of State Budget Officers (NASBO), they would think that figures 1.2 and 1.4 were fabricated. Their expenditure calculations indicate that higher education's share of the education budget has remained flat since 1990. However, 42 of the 50 state budget officers include student tuition and fees and 39 also include student loan dollars in their calculations of higher education expenditures. These student payments represent $20 billion in higher education spending that NASBO reports as coming from the states (out of a total of $60 billion) that is not actually appropriated from tax sources. I am not arguing that NASBO is intentionally misleading people, rather that their data is often the data that policymakers have access to and is not indicative of how well each state supports its institutions of higher education.

Rates of Return to Public Expenditures

When you see dramatic withdrawal of support for one budget item in favor of others, one would expect that the shift be due in part to changing relative rates of return to spending on each budget item. Were states to behave as *homo economicus* would, they would spend money on each budget item until the marginal social benefit equals the marginal social cost (which should also equal the shadow price of a state's wealth) of each budget item. At face value, it does not appear that legislatures are behaving this way. Dozens of studies indicate that the private rates of return to

investments in higher education are substantial and growing (believed to be on the order of 15%, which exceeds the 13% historical average rate of return provided by investments in the stocks of companies in the Dow Jones Industrial Average). It is difficult to obtain reliable estimates of the social rate of return to higher education. However, a recent economic impact study by the National Association of State Universities and Land-Grant Colleges (NASULGC) provides evidence that the social returns are substantial. Based on a survey of its member institutions it finds that for every dollar invested by a state in a NASULGC institution, there is an average return of $5. Considering the large investment value of higher education expenditures it is concerning to see this withdrawal and it begs the question of what is happening to the returns to other items states spend their money on.[16]

Tuition Receives the Lion's Share of Attention

Since market forces do not encourage many institutions to manage costs effectively, financial pressures are not necessarily bad all the time, as they work to make institutions focus on increasing efficiency.[17] As higher education outputs are hard to measure, and the aforementioned budget cuts likely don't translate into dollar for dollar paring of institutional budgets, I want to focus on budget shares in order to place higher education in a larger relative context of public priorities. Though I can't put a finger on exactly by how much institutions have suffered, I want to emphasize that the continued decline in budget shares makes it impossible for institutions to adjust to long-term losses of budget priorities without corresponding attenuation in quality. Once again, William Bowen (1977) summarizes the issue perfectly:

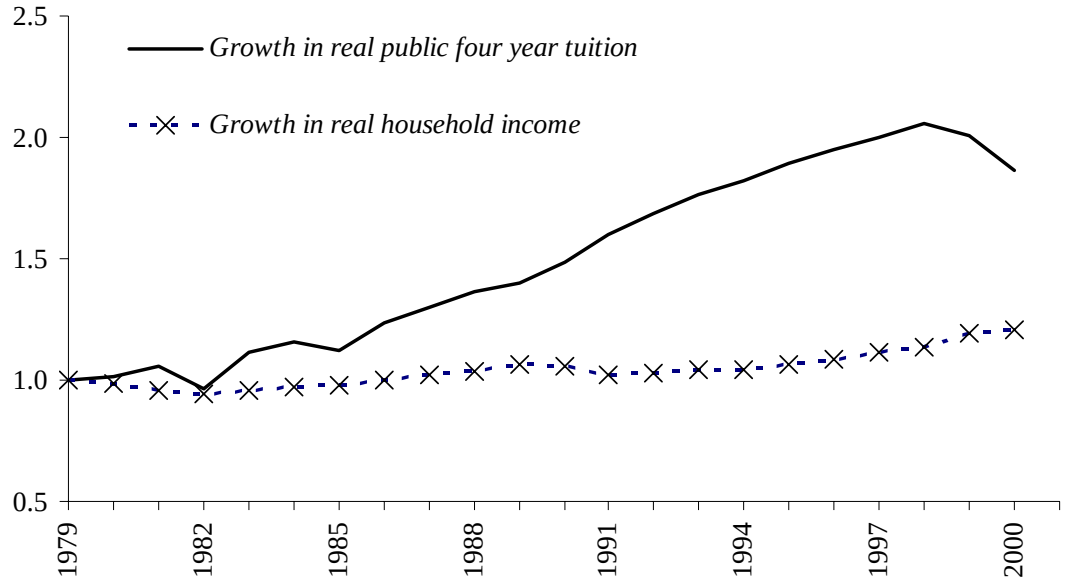
[16] The NASULGC report cites significant job generation, additional spending and substantial increases in tax revenues for both local and regional economies.

[17] See Ehrenberg (2000) for an analysis of why this is the case at elite private universities.

> *"Some savings are one-time cuts and there is a limit to the number of additional windows that can be found each year to be left unwashed. The related danger is that too many people seek to achieve temporary financial equilibrium by marginalizing the future. In fact, it is scary that there is a fear among university administrators that legislatures think of these as sustainable and healthy equilibria and may be loathe to finance institutions fully when times improve. There are many ways legislators see this happening – schools can allow their physical capital to depreciate, can spend endowments at unsustainable rates, or use annual giving to supplement revenue shortfalls, to not building infrastructure with an eye on long-term quality, to not being tough enough with tenure decisions to insure a minimal number of positions being open in the future for top academics, etc."*

In the past, public institutions have been able to freely increase tuition as governors have long sympathized with their budgetary volatility. However, in today's sensitive political environment schools are looked upon with extreme scorn by both legislatures and voters if they raise tuition in response to appropriations cuts because while in dollar terms the tuition increases haven't been large, due to the low levels at which it starts from, the increases make for dramatic percentage changes. Legislatures are also becoming wary of institutional behavior as they feel schools have been increasing tuition excessively in an attempt to capture the revenues generated by the increasingly generous student aid awarded by the state.

Higher education institutions are vilified for raising tuition rates to cover these increased costs and to make up for funding shortages. While tuition rates have increased at more than the rate of inflation for several decades, it has not been until recently that these increases have drawn substantial attention. Figure 1.11 provides some insight. Tuition rates at public colleges and universities have not only outpaced the growth of inflation since 1979, but have significantly outpaced the growth in family incomes. For students that must pay the full cost of a college education, the tuition bill makes up an ever increasing portion of their family's incomes.



Sources: IPEDS and CPS

Figure 1.11
Comparison of Growth in Median Household Income and Four Year Public University Tuition Levels (1979 values normalized to = 1)

Schools are hesitant to cut costs (and hence keeping tuition down) because of a fear that legislatures think they can run forever on a pared budget. Their ability to fundraise is limited because so many start from such a low base and if a school happens to be successful (e.g. the University of Texas-Austin) a state may in turn cut appropriations further or redistribute the giving revenues to other schools in the system. Finally, while public institutions have struggled to remain afloat during the past two decades, they have had the luxury of using a large portion of their revenues to fund ongoing operations. However, many states do not have the capital capacity to accommodate the expected enrollment boom in the next decade (due to changes in migration, birth rates and enrollment rates) and will have to find a way to build

classrooms, dormitories and other facilities in addition to providing adequate funding for instruction, salaries, research and other essential services.[18]

Even as support has fallen, state appropriations are still the largest single source of funding for current operating expenses of public universities, averaging just less than 40% of current fund revenues nationally.[19] This high degree of reliance on the state makes it very susceptible to the whims and politicking of legislatures and other (non)interested parties. Gordon Winston (1999) has indicated that the price that students pay for public education covers a tremendously small portion of the costs of providing education (he estimates that less than 20% of the true cost is covered by the price) and their subsidies from other sources are so large a part, that even a small percentage reduction in state support means large percentage increases in "sticker prices" and bold headlines.

The Broader Economic Picture is Not Bright

Higher education budget shares have fallen during a period of astonishing economic health in the United States. From 1977 through 2001, real GDP more than doubled, the unemployment rate fell by 2.3 percentage points, prices have remained relatively stable and low, and in aggregate states posted budget deficits in only three years during this period.[20] Currently forty states are running structural budget deficits and these are expected to continue for at least two more fiscal years.[21] State debt

[18] Full-time attendance in four year public institutions is expected to grow between 14%-17% by 2011 (Tables 10 and 15-22 in *Projections of Education Statistics)*. The growth, however, will largely occur in areas without the capacity (western and southwestern states) and among ethnic minorities or first-generation students.

[19] Intergrated Postsecondary Education Data System (IPEDS) via WebCaspar (http:// caspar.nsf.gov).

[20] 2003 Economic Report of the President, Tables B-2, B-42 and B-85.

[21] National Association of State Budget Officers (www.nasbo.org). A structural budget deficit is a deficit in the state *general fund*.

service levels have reached all time highs, "rainy day funds" have already been depleted and the increasing priority of homeland security and other federal initiatives at the state level are putting enormous pressure on previously unstressed budget items.

Elementary and secondary school finance court challenges are expected to continue, placing more pressure on state budgets to maintain funding for K12 education, a record number of people are in prison[22] and demographic shifts aren't working in higher education's favor.[23] While the increasing demand for state support of these and other budget items has been dramatic and well documented, there have been no equivalent pushes for higher education institutional support. These budget pressures are compounded by the fact that many states have rapidly decaying infrastructures, have significant security concerns post-9/11, have entrenched and deadlocked state congresspersons all during a time when a rapidly changing economy has rendered most state tax codes obsolete. Given that higher education experienced a sharp cutting of the knife during plush times, concern about its fate would be justifiable during these leaner times.

Most Students are Educated in the Public Sector and These Institutions are Falling Behind their Private Counterparts

Throughout the past 25 years, roughly ¾ of all students enrolled in American colleges and universities and $^{2}/_{3}$ of all students enrolled in four-year institutions have been enrolled in public institutions.[24] The Census Bureau and Department of

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[22] *Ithaca Journal*, 08/17/03.

[23] Medicaid expenditures have skyrocketed due to large increases in caseloads (it is a means-tested entitlement program), escalating presciption drug costs and lagging support from the federal government. An aging and growing population is putting further stress on health care expenditures and other state services. Corrections expenditures have been growing due to more vigilant prosecution, mandatory sentencing laws and the resulting expansion of prison capacity. In the K-12 education sector, a rash of court mandated state school finance equalization programs in 26 states has led to an increase in aggregate state spending on K-12 education in these states, typically funded through higher state taxes.

Education estimate that the majority of the enrollment expansion in higher education in the coming decades will be from current under-represented minorities and/or students that are first generation college matriculants. Inasmuch as the vast majority of these students will attend public higher education institutions, what is happening to public higher education is much more important to our nation's well-being than what is happening to selective private colleges and universities.[25]

A dependable revenue stream is essential for universities to preserve instructional services, continue in their public service mission, make plans for the future and most important, to maintain quality.[26] As William Bowen predicted, enough time has passed for us to begin to observe a subtle decay in institutional quality due to higher education's declining budget share. Table 1.1 shows how the withdrawal of state support from the public higher education sector has resulted in a growing divergence of academic quality across the private and public sectors. For each of the four outcome measures shown (expenditures per student, associate professor salaries, student-faculty ratios and the share of faculty members that are part-time), the quality premium in the private sector is growing. Real expenditures per student in the public sector have increased by 56.4% since 1977. At the same time, their private counterparts have increased spending by 79.9%, causing the expenditure gap to grow from $3,100 per FTE in 1977 to $7,400 per FTE in 2000.

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[24] Digest of Education Statistics, various years.

[25] As such, one should recall why the public universities and land-grant colleges were founded in the first place. The first Morrill Act of 1862 and the expansion of the public system after World War II created public institutions precisely because the private marketplace underprovided higher education services to the general public and those generally not from wealthy families. If this notion still prevails in the general public, it brings into question the increasingly private nature of public university revenue generation (tuition and fees, fundraising and entrepreneurial activities).

[26] It is not surprising that most of the top 25 schools in the U.S. News and World Report rankings are privates. More money allows schools to purchase the inputs that affect educational quality (top faculty, technology and training, infrastructure that attracts top students, etc.)

Table 1.1
Higher Education Quality Measures by Sector and Changes over Time

	Year	**Public**	**Private**	**Private Premium**
Expenditures Per Student[1] ($1,000)	*1977*	8.1	11.2	3.1
	2000	12.6	20.0	7.4
	growth	*56.4%*	*79.7%*	*140.6%*
Faculty Salaries ($1,000 - Assoc.)	*1978*	54.3	55.9	1.6
	2002	61.5	74.1	12.6
	growth	*13.3%*	*32.6%*	*687.5%*
Faculty[1] - Student[2] Ratio	*1977*	49.0	37.9	-11.1
	1999	39.4	41.5	2.1
	growth	*-19.6%*	*9.5%*	*-118.9%*
Part-Time Faculty Share	*1989*	38.1	33.3	4.8
	1998	43.5	37.8	5.7
	growth	*14.2%*	*13.5%*	*18.8%*

Sources: Integrated Postsecondary Education Data System (IPEDS) via http://caspar.nsf.gov.

1. *Faculty are measured by full-time ranked faculty members, lecturers and instructors.*

2. *Students are measured in thousands by full-time equivalent undergraduate, graduate and professional school enrollments.*

The ratio of average faculty salaries at public institutions to private institutions has fallen dramatically since 1978. In 1978, the average associate professor salaries in the two sectors were nearly identical. By 2002, the average salary in the public sector was nearly $13,000 lower than salaries in the private sector. In addition, Ehrenberg (2003) has pointed out is that there has also been a dramatic increase in the dispersion of faculty salaries (at all ranks) within the public sector, largely driven by changes in state appropriations across these institutions. Thus, it is becoming increasingly

difficult both within the public sector and relative to the private sector, for universities to attract and retain high quality faculty.

Between 1977 and 1999, the enrollment weighted average faculty-student ratio across all states fell from 49.0 faculty members per thousand students to 39.4 faculty members per thousand students in the public sector. While the decrease in any one year may not have been noticeable, over the intervening period, the 20% decrease is sizable. At the same time, faculty-student ratios have been increasing in the private sector. Last, for the limited time period that data are available, between 1989 and 1998 the weighted average (by enrollments) share of the faculty that is comprised of part-timers and graduate students (i.e. "cheaper") across all states rose from 38.1% to 43.5% in the public sector.[27] These increases are similar to what has happened in the private sector; however, since class sizes and enrollments in publics continue to rise and are larger than in the private sector, it is likely that a much larger percentage of students are being instructed by part-time faculty members in the public sector than in the private sector.

The quality measures in table 1.1 are readily observable. It should be noted that during every budget crunch, institutions take many additional steps to cut expenses until funding can be returned to normal levels. Among the steps taken by the typical public institution include reducing library acquisitions and services, cutting custodial services, eliminating landscaping programs, reducing building maintenance, eliminating or combining courses, holding faculty positions open, cutting nonacademic and academic support staff, and many other actions. Each individual action may not seem very dramatic, but over the course of many years these may translate into larger concerns. These concerns include a fall in graduation rates, a

[27] IPEDS Fall Staffing Surveys. The survey does not indicate the number of courses taught by each type of faculty member, nor does it indicate the percentage of the total credit hours taught by each type of faculty member.

decrease in public service expenditures, a change in the composition of undergraduate and graduate degrees awarded, an inability to pay start-up costs for new scientists, limiting enrollments, changing composition of enrollments, a change in the way tenure decisions are made, and alarmingly perhaps a change in the composition of the student body. If it is true that student college choices have a significant affect on future outcomes, and if such a large portion of our population attends public universities, then where students choose to attend college will increase in importance in the future beyond what it does today.[28]

Control and Conflicts of Interest

The fall in state support has also led to a number of institutional concerns about the nature of non-state sources of support. Many publics fear that if they go out and successfully obtain outside funding, the state will simply rely on those funds rather than providing continuous support. Even if states institute programs for matching grants, tax breaks to corporations that donate, etc. fundraising is costly. Unlike with state appropriations, not nearly 100 cents to the dollar collected in outside funding are kept due to the large expenses incurred by development offices in soliciting donations.

Another major concern with non-state sources of funding is related to control issues. Many observers fear that the nature of private fundraising may encourage a suboptimal move from basic to applied scientific research. Private fundraising also generates a fear that curricula will be influenced, a fear of an imbalance between a university's public service commitments and corporate interests, and changing expectations for university presidents and trustees. There is also a concern about how

[28] Very little empirical research has been done linking these institutional outcomes to long term depression in student outcomes and is a fertile area for future study.

intellectual property rights are assigned and what returns privates expect on their investments in higher education.

Finally, institutions find themselves backed into a corner as federal legislators are becoming frustrated that colleges continue to increase prices just as they increase spending on Pell grants and reduce interest rates on student loans. In March 2003, Representative (R-CA) Buck McKeon announced that he intended to bring forth legislation that would punish colleges that raised their prices too high by rescinding their eligibility to participate in federal student aid programs.[29] While such a move is dramatic and extremely unlikely, it is significant because it would disproportionately hurt the publics and also because it would signal the arrival of yet another interest group in the operations of our public universities.

Higher Education as a Catalyst for Economic Growth

Economist Caroline Hoxby (2000) has noted, "several factors underscore higher education's role as an economic growth engine for the nation, including: a) the high correlation between educational attainment and economic growth in the US; b) the fact that the United States has a comparative advantage in producing goods and services with high skill content; and c) the extent to which growth of technology related sectors of the economy depends on an ample supply of educated labor." As Alexander (2001) points out, there are literally dozens of studies showing that rates of return to higher education are significant for private persons and society as a whole.[30] Thus, it is important that policy-makers ensure that investment in higher education is high enough (and also equitable). Given the unique abilities for universities to

[29] *Chronicle of Higher Education,* 03/06/03. This proposal has subsequently been withdrawn.

[30] In the study *Education at a Glance 2002* completed in October 2002, the OECD determined that the private rate of return to higher education in the United States was 15%.

produce both basic and applied research, adapt quickly to a changing economy, prepare students to work in a large variety of industries, provide job training and re-training for displaced workers, etc., it is very surprising the extent to which higher education has fallen out of favor at the state level. These benefits do not appear to be lost on the federal government however, as its agencies have tripled the amount of support for science and engineering research and development at public institutions, committing $4.7 billion (real dollars) in 1977 to $13.9 billion in 2001.

Distributional Concerns

Public universities, in particular the land-grants, were founded to challenge the elite private institutions and provide an education for the people as a whole, not the privileged classes alone. The publics were built to provide training in wide spans of disciplines and bring the fruits of university research to the nation's fields and factories. In this way, publics were to serve society and to make vertical mobility more than just an American dream. The recent dramatic fall in state support for public higher education and the resulting consequences put this mission in jeopardy. Dramatic increases in tuition disproportionately hurt the lower and middle classes, whose incomes have not kept pace with either those at the top of the income distribution or with these tuition increases.

The method by which states choose to finance higher education may affect the distribution of income within a state. The prominence of merit-based aid programs and the movement away from broad-based in-kind aid policies effectively redistributes income to the middle- and upper-classes – to people that would have attended colleges even if such aid was not available. Empirical research on the distributional effects of institutional subsidies has been mixed. Hansen and Weisbrod (1969b) found that the financing scheme in California favors upper income families and Fernandez and

Rogerson (1995) describe a more general model where income is also regressively redistributed. However, Lee, Ram and Smith (1999) find that the system in Illinois favors lower- and middle-income groups with most significant transfer going from high income families to those with incomes below $40,000. Fortin (2002) finds that increases in public expenditures for college reduce wage inequality in the United States (likely due to the increased supply of college graduates it generates). Though I will not analyze this issue in great detail, it is clear that the declining budget shares will not result in a benefit to the less fortunate members of society unless states aggressively expand their need-based aid programs in the face of cutting institutional appropriations.[31]

Challenges in the Public Higher Education Finance Research Environment and Prior Research

Given that public higher education is one of the largest budget items in a state, the dearth of economic research (both empirical and theoretical) devoted to its determinants is surprising. The few empirical pieces that have been completed have yielded little in the way of policy relevance as very few explanatory variables have been found to be statistically significant. In fact, the most consistent finding across studies is that findings are inconsistent and that more analysis is needed. The sparseness of theoretical treatments derives from two important realities.[32] First, due

[31] Even if states generously fund need-based aid programs, since private school tuitions are much higher and the quality of the privates is increasingly better than the publics, it is likely that aggressive need-based aid programs would constitute a redistribution of money from the low-cost (relatively) public sector to the higher cost private sector. From a positive economic perspective this may be desirable, but from a normative perspective taxpayers may like this implicit transfer of public monies to the private sector.

[32] All of the papers that I have seen treat the higher education funding process in a partial equilibrium framework. That these treatments are necessarily simplistic may be contributing to the dearth of significant findings in the literature. More complete computable generate equilibrium (CGE) treatments are still in their nascent stages. The top researchers in this area (Tom Nechyba, Dennis Epple, Richard Romano and Holger Sieg to name a few) are only beginning to turn their attention to the higher education sector.

to the large number of interested agents and competing factors at the state level, a single model of state budget determination has proven to be elusive. Second, the awkward economics of the higher education process itself make modeling institutional behavior and pricing extremely tricky.[33] The coupling of these factors makes modeling public higher education at the state level a daunting task for theoretical economists and an analytical morass for empirical researchers. Below, I outline some of the general difficulties and common threads in the public higher education finance literature.

No universally accepted behavioral model of state expenditures exists. The most common assumption is that funding decisions can be described by a median voter framework[34] (in order to general empirical tractability), though a variety of other models have been employed.[35] Little consensus has been reached on a number of additional salient issues, which has contributed to the dearth of significant empirical findings. Researchers have been unable to agree upon the proper measurement of higher education funding – using higher education appropriations in levels, in per student terms, per capita terms, per voting-age population terms, and even annual percentage changes in the levels. Nor has a consensus been reached on the proper unit of analysis, with some researchers focusing on the states, while others use institutional level data for all public institutions, all public research institutions, or even a single public research institution over a long time series. Further, higher education finance

[33] Rothschild and White (1993) analyze the difficulty in writing down an economic model of higher education. The most significant challenge lies in the fact that the major inputs in the production process (students) are also the primary consumers of the output of that process.

[34] The work of Borcherding and Deacon (1972), Clotefelter (1976) and Peterson (1976) falls squarely in this category.

[35] Cohen and Noll (1998) and Hoenack and Pierro (1990) are good examples of competing interest group studies while Clotfelter (1976) and Strathman (1994) include measures of out-migration in their regressions to represent a state's ability to capture benefits from investments in higher education in a human capital motivated model.

researchers have differed widely in their objectives. Many set out to test whether specific theories of legislative behavior apply to higher education while others intend to find whether statistical relationships between particular variables exist (for example, between public tuition and state aid for education, between state aid and enrollments, between migration and state aid, and many more).

Data availability is a significant constraint. Due to the difficulty of assembling a panel data set on state level variables, a majority of studies use cross-sectional analyses.[36] There is nothing inherently "wrong" with doing this, but there are three points worth noting. First, due to the very small number of degrees of freedom, cross-section econometric models that use state level data are forced to be parsimoniously specified. Even in cases where relationships exist in the underlying population, there may not be enough variation in such a small sample of data for it to be realized statistically. Second, cross-sectional estimates tell us why higher education funding levels differ across states; they do not provide any information on how changes in various factors have affected changes in funding within any given state. Third, omitted unobserved state-specific, time-invariant variables may lead to biased estimates if they are correlated with the included variables.

Endogeneity issues also create particularly difficult problems for researchers. The level of state funding for higher education likely affects a number of factors thought to also affect funding levels, in particular enrollments and prices. For example, if higher state support translates into higher enrollments, then estimates of other parameters in a model that includes enrollments as an exogenous determinant of state funding would be biased upward if they are correlated with enrollments.[37] In

[36] Very little state data on demographics, budgets, economic conditions, etc. are found in a single source. In addition, even as we speak, most of the data one would need to do a detailed budget study have yet to be put in easily retrievable electronic form.

addition, state institutions themselves may be endogenously determined. For example, legislators in states with a higher education funding formula may react differently to changing economic and demographic climates than those in states without them or states that operate on a biennial budget cycle may behave differently than those on an annual budget cycle. It is likely that budget cycles and funding formulas are a result of prior spending habits in the states. With very few exceptions, the literature does not recognize these complications.

The multitude of difficulties described above has forced the empirical work on higher education finance in the literature to be largely atheoretic. Though the models I estimate in the following chapters are approximations to underlying demand functions, I carefully address each of the above challenges. Finally, prior research has not considered an analysis of the determinants of the *shares* of state budgets allocated to higher education. That is, there has been no empirical work done to explain why higher education has fallen in priority at the state level. My focus on explaining these budget share outcomes allows me to sidestep the difficult decisions of choosing which behavioral model to subscribe to and the relevant measure of state higher education expenditures, and it also provides me with a logical set of restrictions to place upon the underlying structural demand system.

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[37] While Clotfelter (1976) and Toutkoushian and Hollis (1998) attempt to correct for the fact that enrollments are likely determined by the level of state support, many papers simply include enrollments exogenously on the right hand side of their regressions, or ignore them completely.

CHAPTER TWO

EXPLAINING BUDGET SHARES

Theoretical Model of State Decision Making - The Utility Tree

The empirical estimates I present in chapter three and chapter four are derived from a simple application of the classical theory of consumer choice to collective decisions made at the state level that determine expenditures for various categories of public services. Broadly speaking, such a model requires that a utility function exists that can logically describe the preferences of some effective decision making agent(s) over a bundle of public sector and private sector goods and services.[38] The agent is assumed to choose expenditure levels for the various categories to maximize this satisfaction, subject to the constraint on total resources in the state. However, in order to estimate any demand functions that result from this process, there are two major issues that I must confront.

First, it is not entirely clear who the single decision making agent within a state is. The public finance and political economics literature contain hundreds of studies aimed at determining just whose preferences are being maximized by the aforementioned utility function, with absolutely no consensus reached. Since it is the legislators who ultimately cast budget votes in statehouses, I abstract from the countless interest groups and decision-making entities within a state and consider them as the single optimizing agent, though there is nothing sacrosanct about this selection.[39]

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[38] By logically, I mean that the preferences are rational and that the function describing these preferences is well-behaved.

[39] It could very well be that a median voter is the effective decision maker, but it may also be any number of other entities. For instance, in many states the governors have substantial powers to cut line items from budget bills; can veto entire budgets, etc. As I am interested in understanding what specific

Second, I need to describe the process by which the optimum amounts of expenditures on each of the available public and private goods and services are chosen by this representative agent. The legislature will maximize its utility by allocating expenditures to the various categories of public services until the marginal utility generated by that public service equals the marginal utility they receive from wealth times the price of that service, taking the total available resources in the state and the prices of all of the various services as constraints. Without imposing any structure at this point, the resulting demand equations are virtually inestimable since the demand for any one service will depend upon the prices of *all* of the services in the system.

That the legislative demand for a particular public service in an unconstrained structural model depends on a large number of prices presents a number of challenges. Even if prices for the various public services were easily obtainable,[40] the data requirements for empirical estimation on a sample of only 50 states are simply too demanding.[41] It is also likely that a vector of prices, if found, would be highly collinear – making it unlikely that all could be included in a single demand equation. Further, in the event that all prices could be included, concerns about endogeneity and interpretation need to be addressed.[42]

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factors determine education budget outcomes, whether my empirical results are consistent with any underlying theory is of secondary importance.

[40] Determining a single price for any one aggregate budget item is an extremely difficult task. For instance, what is the proper measurement for the cost of road maintenance in a state? Is it the wages paid to construction workers? Or the per-capita cost of the machinery used to pave roads? Or the cost of the administrators in the capital making decisions about road construction? Something else? The task would be easier if I were analyzing state expenditures at a more disaggregated level – for instance, in studies of public employment, the relative prices are the wages in each employment category.

[41] Too demanding in two respects: First, it is not inconceivable that a state spends money on more than 50 budget items. In this case, there simply aren't enough degrees of freedom to include the prices of all 50 budget items in a demand equation with only 50 observations. Second, it is simply not plausible that all prices *directly* affect the demand for all budget items. For example, would anyone believe that an individual decision maker considers the increase in the price of highway paint when determining scholarship awards to top high school achievers in science? The number of choices confronted by our representative agent is overwhelming in this unconstrained framework.

In order to generate an empirically tractable model, I need to impose some behavioral structure on the legislatures. Following the lead of Strotz (1957) and subsequent application by Ehrenberg (1973) and others, I employ a "utility-tree" approach. Rather than assuming that legislatures allocate resources to budget items in a single step, I assume that legislatures follow a multi-stage choice process. Figure 2.1 graphically depicts this choice process.

Legislatures will optimally follow this multi-stage process only if I make a critical assumption that the utility function represented in each stage of the budget process is *strongly* separable. Intuitively, this assumption means that in each stage of the budget process, the legislature considers only the budgeted expenditures and prices of specific goods *for that stage alone* when allocating funds to specific categories. Formally, this assumption requires that the marginal rates of substitution between different categories of goods and services within a budget category, are independent of consumption levels of goods and services outside that category.

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[42] In terms of endogeneity, it is not unimaginable that the level of state expenditures for a budget item affects the measure "price" of that budget item. For example, if the price of higher education is measured by faculty salaries, it is also likely that public universities can increase faculty salaries more when state funding is higher. In terms of interpretation, many prices likely reflect quality, so it would be difficult to disentangle changes in quality and changes in technology from changes in the actual cost of providing a service (e.g. think medical advancements). Instrumenting for prices or controlling for technology and quality is not a simple task. In estimation, the quality component seems to dominate the cost component, making inference difficult (see Clotfelter 1976 for an example).

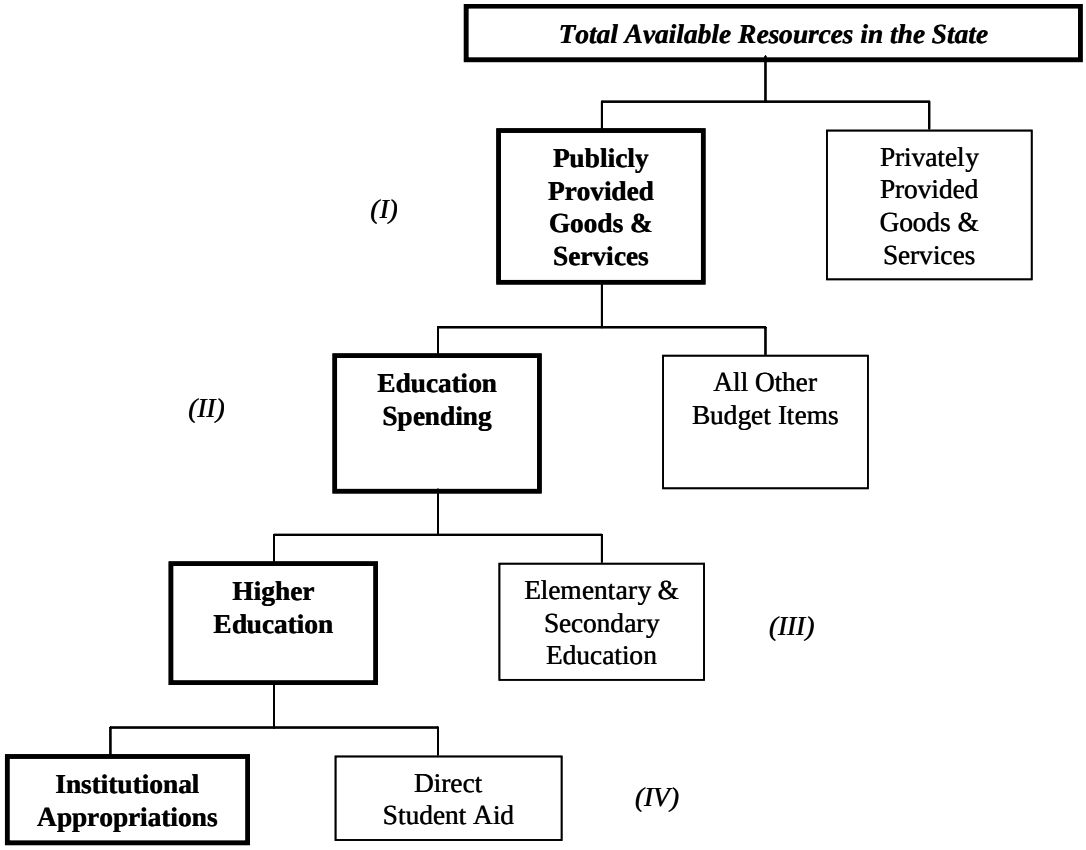

Figure 2.1
Legislative "Utility Tree"

To illustrate, if I can bundle all public education expenditures into one group and non-education public expenditures into another (level (II) above), the legislature can rank different spending bundles within public education with a well defined ordering which would be independent of the level of public provision of budget items outside the group. Thus, legislative preferences between public higher education and public elementary and secondary education are independent of spending on corrections, Medicaid, welfare, and anything else outside the education group.[43] Each

[43] As Deaton and Muellbauer (1980) point out, there is "no reason why each sub-utility function could not have one or more deeper sub groupings within it, nor should we rule out the possibility that some sub grouping may only have one unit." Thus, the categorical groupings in figure 5 are elastic. As I describe in more detail below however, the validity of this assumption depends on which level of the utility-tree I am analyzing.

group is said to have a sub-utility function with the values of each sub-utility function adding up to yield total utility to the legislature.

A complete description of the process begins with branch (I) on the "tree." The legislature derives utility from both publicly and privately produced goods and services, which can be written as:

$$U = U\left[V^1\begin{pmatrix}\text{publicly provided}\\ \text{goods \& services}\end{pmatrix}, V^2\begin{pmatrix}\text{privately provided}\\ \text{goods \& services}\end{pmatrix}\right]. \tag{2.1}$$

The legislature is constrained by the total available resources in the state, which include all tax revenues per capita, per capita personal income and transfers from the federal government.[44] The split between private and public goods provision is implicitly decided by the determination of the tax code. Strong separability imposes that the utility the legislature derives from the provision of any publicly provided good or service is independent of the level of private goods and service provision. More formally, the marginal rate of substitution between any two publicly provided goods is unchanged by a change in a privately provided good or service. It is at this top level of the tree that the separability assumption is most tenuous. Among other things, it implies that funding decisions between public education and public health care should not be affected by the level of private expenditures on education and health (i.e. strong separability is not a great assumption if goods and services produced in the public sector have valid private substitutes).[45]

Given the budgeted expenditure on public goods and services determined by the process in (2.1) above, the legislature then budgets for each of the various

[44] I will assume that all grant aid is fungible (though block grants from the federal government are becoming a rarity).

[45] V^1 would also include any publicly purchased, but privately produced goods and services.

categories of publicly provided goods and services (education, corrections, health care, transportation, etc.) based only on this income and aggregate price indices for each category. The branch sub-utility function, V^1, is a function of public education spending and spending on all other goods and services and can be expressed as:[46]

$$V^1 = V^1\left[Z^a\begin{pmatrix}\text{education goods}\\ \&\text{ services}\end{pmatrix}, Z^b\begin{pmatrix}\text{all other state provided}\\ \text{goods \& services}\end{pmatrix}\right]. \qquad (2.2)$$

Strong separability in (2.2) imposes that the utility the legislature derives from the provision of any education good or service is independent of the level of other public good or service provision. More formally, the marginal rate of substitution between higher education and elementary and secondary education is unaffected by a change in any other publicly provided good or service. The restrictions placed on preferences in this branch of the utility function are less objectionable than in (2.1). For example, an increase in the cost of road construction should not affect the share of education dollars allocated to higher education, wealth constant.

Moving "down the tree," I assume that the legislature derives utility from each of the various categories of publicly provided education goods and services. I am focused on two particular categories, higher education (HE) and elementary & secondary education (K12).[47] In this step of the process, legislatures maximize utility

[46] Note, the analysis would be unchanged by separately budgeting for all other state items at this level. Grouping them into one allows me to use a composite price in the empirical analysis as opposed to finding prices for each particular budget item. As you will see, the pricing doesn't much matter in the empirical results that follow as I try to account for other public budget items by including variables that affect state preferences for these items, aside from prices. This isn't too objectionable. Educational services make up nearly half of state payrolls and it is plausible that educational services satisfy wants independent of non-educational services.

[47] Since I am focused on higher education's share of the total education budget, included in K12 expenditures are actually all dollars spent on education that are not higher education institutional appropriations or student grant aid. Therefore, the K12 expenditures include funding for special education, for programs like New York State's BOCES, etc.

subject to the budgeted expenditures on public education decided in (2.2), and only the relative prices of HE and K12. The branch sub-utility function, Z^A, is a function of only HE and K12 and can be written as:

$$Z^A = Z^A\left[\theta^1\begin{pmatrix}\text{higher}\\ \text{education}\end{pmatrix}, \theta^2\begin{pmatrix}\text{elementary \&}\\ \text{secondary education}\end{pmatrix}\right]. \tag{2.3}$$

Strong separability in (2.3) imposes that the utility the legislature derives from the provision of any public higher education good or service is independent of the level of K12 provision. More formally, the marginal rate of substitution between funding categories *within* higher education (for example, between student grant aid and institutional appropriations) is unaffected by a change in the level or price of K12 provision. While the restrictions placed on preferences in this branch of the utility function are less objectionable than in (2.1), they may still cause concern. For instance, a decrease in the cost of high school advanced placement instructors is assumed to have no affect on the share of higher education dollars allocated to fund student grant aid programs.

The lowest branch on the tree indicates that the legislature derives utility from each of the various categories of publicly provided higher education goods and services. Legislatures allocate higher education dollars in two ways. First, they may award money directly to the institutions – these dollars are typically referred to as state appropriations. Second, rather than providing an across the board subsidy to all students, they can use more targeted programs (both means-tested and merit based) of direct student aid, which I will refer to simply as grant aid. The branch sub-utility function θ^1 can be written as:

$$\theta^1 = \theta^1\left[\psi^A\begin{pmatrix}\text{institutional}\\ \text{appropriations}\end{pmatrix}, \psi^B\begin{pmatrix}\text{grant}\\ \text{aid}\end{pmatrix}\right]. \tag{2.4}$$

The split between state appropriations and grant aid will be constrained by the total allocation to higher education determined in (2.3) and the relative perceived prices of grant aid and state appropriations. Note that the estimation of the within branch allocations in this model depends upon the separability imposed in the branch above it. Since the split in (IV) is as far "down the tree" as I am interested in exploring, I do not need to place additional restrictions at this level.

Justification

As alluded to above, the utility tree approach is attractive due to its analytical convenience. Since I cannot rely on an external factor such as prices to naturally group commodities, I look to preferences themselves to provide a natural structuring. I emphasize that these restrictions were not made solely to suit the data. Rather, in the higher education setting, this preference structuring is quite natural and is supported by both legislative behavior and prior empirical research.

Abstracting from the many examples across the 50 states, in Alabama there was a recent explicit debate as to whether the shortfall in the education trust fund should be borne equally by K12 or higher education or simply all of it should be borne by the latter. Nearly 50% of the states cut higher education appropriations midway through the 2003 fiscal year, leaving other budget items untouched.[48] Further, as of the summer of 2003, only six states spent any money on direct institutional appropriations to private schools, and in very small amounts at that.[49]

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[48] *Chronicle of Higher Education,* 6/05/03.

[49] NY, MD, IL, MI, MN and PA – data from Integrated Postsecondary Education Data System Peer Analysis System via National Center for Education Statistics website. In fact, the aid is not in the form of block grants to any institution, but rather is a function of resident and nonresident enrollment and

In addition to the behavioral evidence, empirical work provides support for the separability assumption. Very few papers have found any evidence that competing interest groups affect higher education when higher education is modeled as a separate budget item at the state level (e.g. Hossler, et al 1997, Lydell and Lyddon 1997). A recent paper that does find some evidence, Toutkoushian and Hollis (1998) indicates that the only competing interest group that seems to affect higher education appropriations is K12. In fact, the broader public finance literature rarely (if ever) considers higher education as a separate budget item when analyzing demand at the state level (Painter and Bee 2001, Poterba 1997, Ashenfelter and Ehrenberg 1975, Ehrenberg 1973 to name a few).[50]

The Empirical Model

In order to explain the budget share outcomes depicted in chapter one I move to a multivariate analysis. I estimate three equations using panel data, with the state-year as my unit of analysis, in which the share of the public general fund budget allocated to education (in state *i* and year *t*), the share of the education budget allocated to higher education (in state *i* and year *t*) and the share of the higher education budget allocated to institutions (in state *i* and year *t*) are specified to be functions of the total available resources in that branch, demographic characteristics, enrollment pressures, economic conditions, competing interests in that branch

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graduation rates. In the state with the largest private expenditure (Maryland) the largest allocation goes to Johns Hopkins, where state appropriations make up only 1% of their operating budget.

[50] As Ashenfelter and Ehrenberg (1975, p.62) point out about multi-stage budgeting: "although this description of the consumer's budgeting process seems generally plausible, it has special appeal for the problem of allocation within and to the public sector. In this decentralized budget process, there is no reason why the detailed choices of purchases within a broad category need be made by the consumer at all … … these are, however, precisely the types of information that elected officials are expected to have; indeed, it is presumably the reason for their election. The framework we set out for economic choices is thus consistent with the existence of a role for the political process."

(including private alternatives), political factors, state institutional characteristics and random error terms.

$$Outcome_{it} = f(\beta X_{it}) + u_{it} \quad (2.5)$$

The random error terms, u_{it}, are specified in several ways throughout this dissertation. In chapter three, the error terms are decomposed into a fixed time component, a fixed cross-sectional component and a random component varying over time and across observations. Models are then estimated assuming several possible treatments of the random components and cross-sectional components of the error terms.[51]

The education budget share (EDSHARE) is assumed to result from the maximization of equation 2.2, subject to the budget constraint in that branch (a function of potential total tax revenues collected, prices and any transfers from the federal government). The higher education share of the education budget (HESHARE) is assumed to result from the maximization of equation 2.3, subject to the total dollars allocated to the education sector from the EDSHARE equation. The institutional share of the higher education budget (INSHARE) is assumed to result from the maximization of equation 4, subject to the total dollars allocated to the higher education sector from the HESHARE equation. My empirical specification of equations 2.2, 2.3 and 2.4 depends on the separability of utility in equations 2.1, 2.2 and 2.3 respectively.[52]

[51] Baseline models assume that the random errors are uncorrelated across each equation and uncorrelated over time. Models are then estimating controlling for auto-correlated error terms and / or with the error terms correlated across equations. Additionally, models are also estimated assuming that that error variances are both independent of, and dependent on, the explanatory variables in the model.

[52] I don't specify the form of the utility function beyond the separability notion. Though I'd like to estimate as flexible a form as possible, lack of information on prices and a smallish data set do not permit this.

An outgrowth of this key assumption is that different relative price variables enter into the different levels of the model. All of the "other prices" are captured by the inclusion of a wealth measure in each equation. In other words, all budget items outside a branch are assumed to only have an income effect, and zero cross-substitution effects, with budget items within the branch. Only budget items within a particular branch are assumed to have non-zero cross-substitution effects.[53]

Despite my intention to model legislative demand, variables included on the right hand side of each equation may also capture supply factors. Therefore, the estimated equations likely represent equilibrium conditions in the underlying structural demand and supply model. The empirical specifications should also be viewed as approximations to the underlying demand functions that would be generated from maximization of equations 2.2 - 2.4 given appropriate budget constraints.[54]

Empirical estimates should therefore be interpreted with caution. For example, it might be difficult to assess whether my results in the EDSHARE equation arise from differences in legislative demand for educational spending, or differences in the technology of supplying educational services to states with different demographic characteristics. It might seem reasonable to exclude the ethnic share of the population from the education production function – which suggests that the demographic effects associated with these variables are likely to result from demand side factors alone. Interpretation of the effect of fluctuations in the school-age population is more

[53] Imposing such a structure on my model is not without faults. The elimination of substitution effects from changes in prices across branches may not such a horrible assumption for some branches, but it may do violence to common sense in others. For example, an increase in the price of health care is assumed to not have a substitution effect on the amount of K12 vs. HE spending in a state. However, if the state universities are all medical colleges and undergraduate nursing schools, this is surely an inaccurate assumption. The only change my structure allows is that an increase in health care prices generates an income effect that would be captured by the size of the education budget being smaller.

[54] In actuality, legislatures choose expenditure levels, not budget shares. However, shares are implied by this choice. My model should be viewed as reduced form approximations to the true expenditure model because I do not derive these budget shares formally.

difficult, for example, because economies of scale in education could make it possible to deliver the same education to a larger cohort with a less than proportional expansion in education spending.[55]

Public choice and public finance theories of legislative demand abound and may be grouped into five broad categories. Researchers typically subscribe to one of these theories to place structure on their empirical models, as they amount to different specifications of a state legislature's utility function (and hence the form of the demand equation to be estimated). Indeed, many researchers set out to explicitly test the validity of a given theory. As I am interested in explaining *outcomes* and not *behavior*, my empirical analysis is not derived from any one theory in particular, but the theories are useful for guiding the selection of explanatory variables in my analysis nonetheless. These political economic considerations fit seamlessly into the consumer demand framework described above. Rather than estimating pure reduced-form outcome models as is common in the empirical public economics literature, I include political economic variables as "taste shifters" in the demand model, which are linear augmentations of the demand functions derived from equations 2.2 through 2.4. Before I describe the variables that are included in the estimating equations, I briefly describe the political economic theories that empirical researchers typically invoke.

[55] Since the "amount" of higher education services captured by voters is not observable, but expenditures are, it may be necessary to model the production side of the market for public higher education services. It would be extremely difficult to formulate a model of institutional supply however. State higher education is not likely to be produced efficiently (meaning that individual schools deliver services at minimum cost). Measuring higher education outputs is also notoriously difficult. Quality is an important output, but how can one effectively measure it? If a state focused on measured tangible outputs, universities might focus on minimizing quality and maximizing some tangible output, but this is at odds standard models of prestige maximization. So, what I do above should be viewed as a partial equilibrium analysis.

Political Economic Theories – Direct Democracy

This is a system where fiscal decisions are made by referendums among individual voters. In actuality, most state budgeting is not done in this manner. The most common voting rule under this system is majority rule, which results in a much researched theory in the literature, the median voter theorem. The theorem says that when all voters preferences are single peaked the outcome of majority voting reflects the preferences of the median voter. Therefore, legislators should act in ways that appeal to the majority of voters by making choices consistent with that of the median voter. Analytically, simple regression models subscribing to this theory need only contain the quantity of a public good as the dependent variable and the relative per unit price of the good and the income of the median voter as explanatory variables. The regressions can also include variables that affect states' tastes for education.[56]

Political Economic Theories – Representative Democracy

This system is one where fiscal decisions are delegated to legislative representatives who seek election as nominees of political parties. The behavioral translation of this system is a vote maximization model. It states that political representatives are self-interested, and as such will seek to maximize votes so as to win election or reelection - and will offer programs and support legislation that most closely match the desires of their constituents. As legislators aim to please voters, the empirical specification should emphasize voter characteristics as opposed to legislator behavior.

[56] The work of Borcherding and Deacon (1972), Clotefelter (1976) and Peterson (1976) falls squarely in this category.

Political Economic Theories – Leviathan

This view holds that the public sector has a systematic bias built in its fiscal system toward overexpansion. The explanations for this bias guide the empirical testing of this model. Included among these explanations are: that voting majorities only realize the part of public goods costs that they must bear directly, ignoring those incurred by the minority; theories also suggest that the actual tax burden is underestimated by each voter; other theories are related to deficit financing perceptions, public employee voting, bureaucrats and politicians imposing their own will instead of that of the voters, campaign financing schemes, political business cycles, and alternative taxation schemes. A simple objective function would specify that legislatures seek to maximize the size of state budgets subject to some state resource constraint.

Political Economic Theories – Classes and Interest Groups

This is a simple modification of the median voter model indicating that elected officials are in effect "hired" to represent the interests of special interest groups. The pressures applied by interest groups to fire politicians or repudiate their choices forces politicians to not deviate from the interests of these groups. Empirical tests of this theory include demographic or monetary variables that proxy for the size of the interest group in question.[57]

Political Economic Theories – Human Capital

Legislative demand for a particular budget item depends on the expected future public benefits / externalities from investing in all budget items. Proxies for the public benefits are included in regressions to test this theory. For example, both Clotfelter

[57] Cohen and Noll (1998) and Hoenack and Pierro (1990) are good examples.

(1976) and Strathman (1994) include measures of out-migration in their regressions to represent a state's ability to capture benefits from investments in higher education.

Variables Common to All Baseline Equations

I take a heuristic approach in determining a baseline model from which to begin my analysis. Measures of wealth (INC) and its square (INC2) are included in each regression not only to represent a state's financial ability to provide public goods and services, but also to capture the income effect of prices that have been excluded because of separability.[58] Therefore, the wealth measures in the EDSHARE equation also capture the impact of changing prices of private goods in the branch above it. The wealth measures in the HESHARE equation capture the impact of changing prices of other public budget items such as corrections, transportation, etc. from the branch above it. Similarly, the wealth measures in the INSHARE equation capture the changing price of K12 education.

There is no requirement specifying that higher education is a normal good in the eyes of the legislature. When income increases, one might expect holding all else constant, that state support for higher education increases; however, there may be a perception among legislators that as economic conditions improve (and income increases), that individuals are better positioned to pay their own educational costs. In fact, previous research on state support for higher education budgets (in levels) has been inconclusive about the role of income. While work by Borcherding and Deacon (1972), Strathman (1994) and Goldin and Katz (1999) find that higher education is a normal good, Clotfelter (1976), Coughlin and Erekson (1986) and Hoeneck and Pierro

[58] As I will discuss in the results section, I test a variety of different specifications for many variables in each equation, which is why I do not specify a definition for many items here. For instance, I analyze three different wealth measures in my regressions: median household income in the state, state tax revenues per capita and real gross state product per capita. Median income is preferred because it is less likely to be affected by state tax policies or other state institutional characteristics.

(1990), find no significant impact and Toutkoshian and Hollis (1998) even find some evidence that higher education is an inferior good. Further, theory does not indicate how budget *shares* will react to changes in state income, and its impact is left as an empirical exercise.

Preferences for different public goods are likely to depend upon the *distribution* of income within states. For instance, states with income distributed tightly around the mean might be expected to support public higher education due to the large subsidy that would be available to the middle class. States with wide income dispersion may be less likely to support higher education because wealthy families are more likely to pursue private alternatives while less fortunate families may prefer scarce resources be allocated to other public goods (for instance, for public transportation).

On the other hand, it may also be the case that states with more unequal distributions tend to over-support higher education. Fernandez and Rogerson (95) determined that increases in the level of income inequality make it more likely that poorer individuals are excluded from obtaining an education and that their tax payments help offset the cost of education obtained by others. This echoes much of the early research on the distributional impacts of higher education such as that done by Hansen and Weisbrod (1969a). If it is the case that the structure of state higher education systems effectively redistributes income to the upper- and upper-middle class, then one expects to find states with wide income distributions disproportionately supporting public higher education. This issue has been studied in the development literature as well. UNESCO (2003) reports a concern that in countries where income is very unevenly distributed, investments in higher education may exacerbate any inequalities that are already there. Further, they express a concern that “These challenges include both ensuring that educational opportunities are equitably

distributed at all levels of schooling and that the expansion of higher levels of education does not come at the expense of maintaining good-quality primary education." I include an ordinal measure of the income distribution in each regression, measured by the ratio of household income for people at the 75th percentile of the income distribution to those at the 25th percentile (INEQU).[59] I also include an interaction term between the income level and income distribution (INCINEQU) to capture the differential impacts of income dispersion on education budget shares in wealthy versus poorer states.

Each of the regressions also includes measures of a variety of demographic factors.[60] If a particular demographic group places substantial demands on the public sector, and this raises non-educational government spending, then the shadow cost of funds for education spending will rise, and this spending program is likely to contract. It is also possible that certain groups do not place high priority on spending for education or higher education. In this case, jurisdictions where these voters are more important will spend less on education as a result of the different tastes of their voting population.

Discrete measures of the population age distribution are included to capture the competing demands of different cohorts within a population. For instance, college and K12 aged children and their parents are likely to support education, while the older population (in the absence of preferences for intergenerational transfers), would tend not to. Some of the costs of public higher education inevitably fall upon households that do not receive any direct benefits from these services. For example, elderly

[59] I am limited by the CPS data in how I measure income inequality. I also analyze the impacts of including different order statistics, such as the 90-10 ratio, the 90-50 and the 50-10.

[60] Median voter models say that demographic variables should not affect state expenditures unless they affect the preferences of the median voter. Despite this, many spending demand studies include demographics by claiming that they shift the level of spending that is needed to achieve a given level of output, rather than the political support for such spending.

households pay sales taxes that are used to finance appropriations. Elderly residents are unlikely to attend college and K12 schools, or have children who attend either, but do benefit a great deal from other state programs such as medical expenditures and public transportation. One would then expect to find a negative effect of this variable in the first two equations and a positive impact in the third.[61] However, what is not understood is how changes in the share of the population that is aged are likely to affect higher education funding. The rising number of elderly in a state may result in an increase in federal transfers in a state and the elderly may wish to support the education and training of state residents to expand the pool of money from which federal dollars can be redistributed and also to raise the quality of services received in that state.

Measures of the racial composition within a state are included to test whether racial mix affects support for public spending, but they might also proxy for higher moments of the income distribution that I may not have captured properly, such as the fraction of households with low income levels or the demand for other public budget items (e.g. many lower income families reside in large cities and this may increase the demand for public spending on transportation).[62] A key related explanatory variable is how the racial composition differs across different age cohorts. Independent of a group's own preferences for a public good, they may be more or less willing to support funding for a good benefiting another cohort because members of that cohort "look like them."

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[61] If there is a relationship, I would expect the elderly population to support institutions rather than students in the INSHARE equation because in many communities the institutions provide services to the general population to take advantage of.

[62] An explicit measure of urbanity could be included to capture the differences in the cost of delivering school services as well as the differential preferences for school services between urban and rural residents. This variable was highly collinear with unemployment and the racial composition variables and is heretofore dropped from the analysis.

Out- and in-migration measures are also included. Rates of return to education by states depend upon the fraction of the people a state educates that move out of the state and the impact of state expenditures on the migration of educated people. In other words, legislative demand for university instruction depends on the discounted future benefits from investing in human capital, which are lower in states with significant out-migration (OUTMIG - the state can no longer capture the positive externalities and future tax payments from educating a resident). In addition, the form of the state subsidy for higher education would likely depend on the location decision of university graduates. More targeted student aid programs may engender loyalty in residents that broad based appropriations may not be able to accomplish.[63] I include the level of in-migration (INMIG) because higher education spending may not represent a fixed benefit to those directly being educated, and may in fact affect the decision to move to another state.[64]

Different measures of the unemployment rate are included in all three equations (UNEMP). In the EDSHARE equation, unemployment rates capture the competing interest for welfare funding and other social programs in a state. In the HESHARE and INSHARE equations, changing unemployment rates reflect changing student demand for particular higher education services. As economic conditions worsen, the opportunity cost of attending a university falls, but so too does a student's ability to pay.

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[63] Groen and White (2003) find that attending a public university increases a marginal in-state student's probability of locating in the state after graduation by more than for similar nonresidents. However, the marginal instaters earn less when they stay than do the nonresidents and hence pay less in taxes. The former effect is larger – so states should prefer residents. However, nonresidents pay higher tuition – which they find more than offsets the tax losses mentioned above.

[64] Strathman (1994) finds strong evidence that out migration proxies for benefit spillovers in higher education funding, but no evidence that in migration affects higher education funding.

Variables Specific to Each Baseline Equation

The EDSHARE equation includes a measure of the relative price of educational services (EDPRICE). This relative price is calculated as the weighted average earnings of public K12 and higher education instructional faculty divided by the average earnings of non-educational public employees in a state. While relative cost increases lead to decreased demand, the impact on expenditures and budget shares is *a priori* indeterminate. The empirical impact of pricing is also clouded by endogeneity concerns. Implicitly my model assumes that legislatures are free to purchase as much education and other public goods as they want without affecting the price; the only manner by which education expenditures can vary is via shifts in the demand function or through variation in prices that shift supply curves vertically. This means that the quantity of education services demanded will primarily change expenditures as opposed to the quality of services delivered. However, the salaries that are paid to K12 and higher educational instructors are clearly a function of the level of state support provided, and higher salaries likely reflect higher levels of educational quality as well.

While the relative price variable intends to capture the (combined) effects of competing budget items in this branch of the utility tree, I also include non-price measures that reflect the demand for the largest remaining budget items in the states. The demand for medical services (HEALTH) is measured by a variable interacting the national health care consumer price index with the share of the population in each state that is 65 years old or older.[65] The demand for correctional facilities and services

[65] Medicaid is a medical assistance program for those who have no other means to pay for necessary medical care. Entitlement is based upon need alone. While Medicaid is operated primarily by the states, the federal government reimburses 50-80% of the funds paid out by a state for Medicaid, as long as the state complies with requirements in the federal Medicaid statute regarding services, eligibility, estate recovery and other matters. There has been concern in recent years about reductions in federal reimbursements, which is but one reason why Medicaid expenditures have grown the fastest of any budget item. Inasmuch as 10% of Medicaid participants are in the 65 year old and older demographic

is proxied by the crime rate (CRIME).[66] To control for the impacts of the private sector, I include the share of full-time equivalent enrollments in higher education that attend private institutions (HEPRV) and the share of K12 enrollments in private institutions (K12PRV). Families that send their children to private schools may oppose the use of their tax dollars to support public education. These variables may also capture the importance of historical factors on public education provision.[67]

Currently 24 states have had their K12 education finance system shifted toward more centralized funding as a result of court mandated reforms (to equalize spending across districts). With court decisions pending in many more states, this clearly is an important determinant of state education budget shares. Fernandez and Rogerson (1998) constructed a dynamic, general equilibrium model of public education provision, calibrated using US data, to determine that moving from locally to state financed K12 education leads to both an increase in average income in the state and the share of income spent on education. A secondary analysis in a seminal paper by Murray, Evans & Schwab (1998) estimates that a court ruling in a state caused a 23% spending increase on K12 education.[68] However, they find no evidence that states reduced funding of other budget areas in order to offset this increased spending on K12 education. Though my analysis is not as rigorous as theirs, it is worth turning

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and 46% are dependent children under age 21 (www.stateline.org), I'd like to include an interaction for the latter. However, I cannot get demographic data by this age grouping. In the future I hope to find participant data by state to include in the regressions.

[66] The crime rate is calculated as the number of murders, rapes, robberies, assaults, burglary, larceny and motor vehicle thefts per capita. Admittedly, this measure may also be affected by the level of expenditures for corrections, but less so than other measures, such as the number of prisoners in a state.

[67] Goldin and Katz (1999) show that state funding for education in a given year is a negative function of private enrollments in previous years. Their paper details the historical influences on public higher education provision that are likely to be captured by these share variables. For example, Massachusetts may not need to provide as much public education services as Arizona because of the large private infrastructure that has been there since the birth of the nation.

[68] Their intention was to determine whether court mandated reform resulted in the stated goals of equalizing expenditures across districts within a state.

attention to since the number of states that have had their K12 systems overturned since the time their paper covers has doubled (there were 12 in 1992).

I capture the effect of court-mandated equalization of K12 financing by including a dichotomous variable equal to one in state-years with a mandated reform and zero otherwise (COURT). There are two important considerations. First, the court decisions in each state are very different and this measure does not capture differences in reforms across states. My estimates therefore reflect the average effect of court decisions, but cannot capture the effects of any particular decision. Second, whether a state was ordered to reform its finance system may have been a function of low previous levels of state support. Inclusion of state fixed-effects may alleviate some of this concern and will allow me to estimate the impact of a program on a state's budget share as it moves from being a non-reform state to being a reform state.

Finally, per capita transfers from the federal government (FEDTRAN) are included because they expand the budget constraint for public sector goods and services.[69] These transfers are not included in lower branches of the model because their impact is captured by the expenditure decision in the branches above it.

The HESHARE equation is similarly specified. However, the variables relating to non-educational budget preferences and resources are excluded because separability implies that the only factors affecting the higher education – K12 funding decision are the relative prices of each and the total level of expenditures allocated to education. The price variable that is now included (HEPRICE) is calculated as the ratio of average earnings of public higher education instructors to the average earnings

[69] There is a large public finance literature studying whether these dollars replace state dollars or whether the presence of federal dollars causes state expenditures to expand (i.e. the "flypaper effect"). I will not address these issues in this paper. M Poterba (94) finds evidence that increasing federal generosity does not result in significant state expenditure increases, and only small state tax decreases.

of public K12 instructors in a state. As with the EDSHARE equation, endogeneity of the relative price measure is a concern.

The bottom branch of the utility tree describes the INSHARE equation. Since separability implies that K12 funding factors should not influence the share of higher education budgets allocated to public institutions, I exclude the K12 court decision dummy and the share of K12 enrollments in privates. There is no price variable in this equation however, because it is not clear what the "prices" of higher education institutions and students are. The baseline specification for this model also includes variables that capture the composition of enrollments and student characteristics within a state, and other higher education specific variables – though endogeneity may be a small concern with some of them.

While it is not theoretically clear why states would prefer one form of financing to another, student grant aid awards are more visible than broad based in-kind aid policies. Further, states may believe that they are better able to retain top talent through generous grant aid programs. The average SAT score in a state is included (SAT) and is expected to be negatively correlated with the INSHARE, as states are likely to use grant aid awards to retain top talent.[70] The share of full-time equivalent public enrollments that attend two year institutions (TWOYEAR) is included as is the number of PhDs relative to the number of bachelors degrees awarded at public institutions in the state (PHDBA).[71] Each is included to represent

[70] As Caroline Hoxby (1998) has pointed out, American higher education has experience a dramatic change in market structure during the last 60 years. In 1949 about 93% of all undergraduate college students attended college in the state in which they went to high school, this figure fell to about 75% by the mid 1990s, and among other factors has been driven by the increased competition for top students at the national level. Rizzo and Ehrenberg (2004) find evidence to suggest that flagship public institutions enroll nonresident students in an effort to augment quality.

[71] Whether I should include the share of enrollments that are graduate students in any equation is debatable. Graduate students are more expensive and therefore might cause the share allocated to higher education to lag. However, their impact also depends whether *a priori* they are more likely to remain in states than undergraduates. In addition, the research that is produced by graduate students

student demand for financial aid. Two year institutions are low cost and largely funded through local taxes, with states facing lower demand for need-based aid awards. Graduate students (especially in the sciences) are often sponsored by federal grants and receive less than 0.7% of need-based and less than 5.0% of non-need based aid awards nationwide.[72]

Though historically many states have had small merit-aid programs, funding problems in the late 70s and early 80s nearly extinguished them.[73] However, by 2001, 10 states (re)introduced serious merit based aid programs (AR, FL, GA, KY, LA, MI, MS, NV, NM, SC) and their political popularity make them an attractive alternative to broad-based state institutional appropriations. I include a dichotomous variable taking a value of one in the state-year where merit-based aid programs are prevalent (MERIT). The presence of merit aid would both reduce student demand for need-based aid and reduce a state's pool of available resources from which it might fund both need-based and institutional aid. I suspect the substitution effect will dominate the income effect in this case, though this is speculation that requires empirical confirmation.

Also included are the proportion of households with incomes below the maximum for which they would be eligible to receive a Pell grant (PELL) and an interaction between this term and the share of the population that is college-aged (PELLPOP). These are included to determine whether states make explicit attempts to

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and their advisors may be viewed as more or less useful to the states than the general education of an undergraduate.

[72] National Association of State Student Grant and Aid Programs 32nd Annual Survey (2001), Table One.

[73] For example, the once substantial NYS Regents Scholarship Program ended in 1982 due to lack of available funds (Source: various NASSGAP Annual Surveys).

capture additional revenues by allowing tuition to rise as more families become eligible for federal Pell grants.

Last, I include the enrollment weighted average nonresident tuition at four-year public institutions in the geographical region that the state is located in, excluding schools in that state (REGTUIT). When tuition at public institutions in neighboring states is higher, it allows public institutions in the state to increase tuition, increasing the demand for need-based aid by instate residents. Further, Rizzo and Ehrenberg (2004) find that nonresident students tend to migrate more when the average tuition in their region is higher. Since state residents do not want to subsidize the children of non-taxpayers, it is likely that institutional support will lag under these conditions.

Variables Added to Baseline Models

The baseline models above were determined through a heuristic process, guided by intuition and the goal of econometric stability. The latter implies that the included variables in each equation were largely invariant to different econometric specifications and variable definitions. For efficiency reasons, it was necessary to keep these baseline specifications are simple as possible. However, I also estimated equations that included additional variables. These variables were excluded from the baseline specifications because of suspected endogeneity, extreme multicollinearity or due to objections over whether they belonged in the models at all. The following is not intended to read like a laundry list, but rather is indicative of the large number of factors that affect state funding for education.

Were one to peruse the relevant literature, it would be apparent that the most glaring omissions from the baseline specifications are explicit measures of enrollments. Enrollments in both public K12 and higher education institutions are very likely a function of government revenues and expenditures themselves, and are

also likely heavily correlated with many explanatory variables in the baseline models. Since there are no obvious exogenous instruments for enrollments, I address this issue in four ways.

First, the baseline regressions include variables that capture enrollment pressures, such as HEPRV and K12PRV as well as measures of the age distribution in the population. Second, I test whether treating explicit measures of enrollment as exogenous affect parameter estimates. I include the level of full-time equivalent public higher education enrollments (HE_ENROLL) and the level of public K12 enrollments (K12_ENROLL) in the EDSHARE equation; I include the ratio of these variables in the HESHARE equation and HE_ENROLL alone in the INSHARE equation. Third, I instrument for enrollments using public university tuition, measures of the age distribution in the population and the education level of the population as exogenous variation.[74] Last, I include a measure of a state's higher education seating capacity to proxy for enrollment pressure – which is calculated as the ratio of a state's predicted enrollment in public higher education institutions to its actual enrollment in these institutions in a year (CAPAC).[75]

One might expect political factors to shift legislative preferences among different budget items. I estimate equations using a variety of combinations of the political variables. Liberal governments might be expected to spend more than

[74] It is not clear that these instruments are really exogenous. Since the IV estimates look identical to the non-instrumented regressions including enrollments treated as exogenous (with much higher standard errors) I will not report these results.

[75] Predicted enrollments are calculated by dividing a state's full-time equivalent public enrollments in 1970 by the size of the college-age population in the state in 1970 (ages 18-24) and then multiplying this ratio by a weighted cohort size in each year of the study. If both the share of students going to publics and college enrollment rates in a state remained constant over time, then the weight used to calculate predicted enrollments in year t would simply be the size of the college age population in year t. Between 1970-2000, the share of students attending publics was stable (between 75-80%), but enrollment rates increased nationwide from 28.8% to 42%. To account for the enrollment rate expansion, I allow the population weight to grow as the enrollment rate grows in each year. I would prefer to have used the ratio of seats available in public colleges to the number of its high school graduates as a capacity measure, but did not do so because of endogeneity concerns.

conservative governments, or prefer one type of education service to another. I therefore include an indicator variable which takes a value of one in the state-years when the governor is a democrat (GOVDEM). To determine if political control of the statehouse affects funding priorities, included is a dummy variable taking a value of one if both the assembly and the senate are controlled by a single political party (UNIPARTY). I also include a dummy variable to control for governor election years (GOVELECT) because research has found that political business cycles are marked by increased spending and other reflationary policies in periods immediately before and after an election (Nordhaus 1975) and that tax hikes and spending cuts are smaller in these years (Poterba 1994).

There may be political benefits associated with the provision of different types of education. According to this view, politicians use logrolling to trade for forms of public education that benefit their constituencies.[76] For example, logrolling may have led to the creation of a large number of new two year colleges in a sufficiently large number of legislative districts in California so as to make the entire education package politically viable. Since most state assemblypersons have a K12 school system and/or a community college in their district, they might be expected to support programs in the legislature that directly benefit their district. Many state senate districts include multiple K12 school systems and likely include regional public colleges and universities. Thus, state senators might be expected to support more broad based

[76] Paul Johnson provides a useful definition of the process on his web page at http://www.auburn.edu/~johnspm/gloss/index.html?http://www.auburn.edu/~johnspm/gloss/logrolling.html. He describes it as "a practice common in the U.S. Congress and in many other legislative assemblies in which two (or more) legislators agree for each to trade his vote on one bill he cares little about in exchange for the other's vote on a bill that is personally much more important to him. Logrolling is especially common when the legislators are relatively free of control by their national party leaders and are trying to secure votes for bills that will concentrate sizable benefits on their own home districts while spreading most of the costs out over taxpayers in the rest of the country. Local projects such as federally funded dams, bridges, highways, housing projects, VA hospitals; job-training centers, military bases and the like are often pushed through by logrolling." Some papers infer that a positive impact of two year enrollments on higher education funding as evidence of logrolling.

educational and other initiatives. To control for these factors, I include a measure of the number of assembly seats per the number of senate seats in a state (LEGSEAT).

Finally, I include the percentage of the voting age population that cast votes in congressional elections (VOTE). High levels of voter interest force legislators to more accurately represent their preferences. In addition, voters may favor more or less spending on K12 and higher education because the funding schemes for these budget items are largely more transparent than that for other state budget items. The *a priori* impact of an active populace is unclear however.[77]

Goldin and Katz (1999) discuss the importance of a state's industrial composition on the structure of its higher education system. To control for these impacts, I include measures of the share of gross state products generated by broad industrial categories (GSP*).[78] For example, states with significant mining industries have historically benefited from the research and extension services produced by public land-grant institutions in their state. On the other hand, states with a majority of their productivity generated from financial services may not depend on universities for anything more than producing pools of talented individuals to fill its employment ranks – which need not come from in-state. More highly developed states are also assumed to require increased levels of societal interdependence, greater need for police protection, and externalities requiring governmental regulation and intervention that may draw resources away from education (Garland 1988).

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[77] I'd like to analyze models of bureaucratic behavior by including the number of government employees in each budget category (i.e. bureaucrats) in the regressions. These self-interested bureaucrats are likely to push government spending beyond the level represented by median voter preferences and may also push spending disproportionately to areas where their numbers are strongest. However, government employment is also a function of expenditures and the data I was able to find were not sufficient to address this issue.

[78] (1) Agriculture, Forest, Fisheries and Mining; (2) Construction, Manufacturing, Transportation and Utilities; (3) Finance, Insurance, Real Estate and Service; (4) Government Spending; (5) Retail and Wholesale Trade.

To control for the structure of the tax system in each state, I include measures of the share of state general fund tax revenues generated by different sources (TAX*).[79] Some taxes are more transparent to voters than others and these measures may partially pick up the effects of fiscal illusion.[80] These measures may also capture a state's ability to raise additional revenues during difficult financial times.

Among the other variables tested in the models are the education level of the population (EDLEVEL), the quality of high school students in a state as measured by average SAT scores (SAT), college enrollment rates (ENRATE), and variables specific to the higher education system in the state. These higher education variables are included because outcomes are notoriously difficult to measure (and likely endogenous) and state government funding for public higher education may well depend on the following: total expenditures on research and development at public institutions per capita (RND), total annual giving per student at the publics in the state (GIVE), total market value of endowment per student at publics in the state (ENDOW), the mix of PhD degrees awarded relative to undergraduate degrees (PHDBA) and the share PhDs awarded in sciences (SCIPHD).

Splitting the Sample

The regression estimates from above produce average state responses to changes in the various included variables. However, since there are important institutional and demographic differences across states (most if which are time invariant), I will test for the presence of identifiable differences in short-run state budgetary dynamics that are related to these institutions by splitting my estimation

[79] These sources include individual income taxes, corporate income taxes, motor fuels taxes, license taxes, lottery revenues, general sales taxes, and other taxes.

[80] Voters-taxpayers may not be fully aware of the true composition of government expenditures because all types of taxes and expenditures are not equally visible.

sample along a number of dimensions. In other words, while institutional characteristics may explain differences in budget outcomes across states, they also suggest that educational funding in a state like New York, for example, may respond differently to a widening income distribution than a state like Iowa.

Splitting the sample is preferred to including explicit controls for institutional characteristics for four reasons. First, doing so will increase the homogeneity of each estimated sample. Second, including explicit controls that do not vary over time will wash away in panel estimation as all of the variation in fixed-effects regressions are identified off of within state changes. Third, including explicit controls, even if they vary over time and are estimable, constrains parameter estimates of the other explanatory variables to be the same across different states. I want to be able to test whether different states react differently to changes in the other explanatory variables. Fourth, it is very likely that the fiscal institutions represented by these variables are themselves endogenous. For example, states with funding formulae for higher education may have also been the states with historically low levels of higher education funding – spurring the need for a formula. Again, to highlight just how difficult estimating legislative demand is, I cut the sample according to nine different structures.

Funding formulae were instituted (in 29 states) to assist states in setting higher education appropriations levels and to ensure institutional funding continuity by linking state funding to enrollments based on pre-defined ratios and expenditure rates.[81] One might expect EDSHARE and HESHARE to be more affected by variables reflecting enrollment pressures in funding formula states than in non-funding

[81] MGT of America. www.mgtofamerica.com . This does not mean that states with funding formulae have predictable funding levels. Quite the contrary occurs. The determination of the funding formulae themselves has become part of the political process, as opposed to determination of funding levels directly. In addition, these funding formulae themselves are not binding as actual appropriations can vary from the prescribed amounts.

formula states. Further, one may also expect the impact of income, other demographics and competing interest groups to be lessened in these states. Leslie and Ramey (1986) found that the relationship between funding levels and enrollments was stronger in the formula states while Toutkoushian and Hollis (1998) found just the opposite.

Lowry (2001) points out that most studies on higher education do not account for the ability of public universities to lobby the legislature. States where there are fewer governing boards should be able to coordinate lobbying efforts more effectively and prevent the lobbying of one institution to cannibalize support for another. Therefore, one would expect to find a larger HESHARE in these states than in those with less coordinated governance, ceteris paribus. For example, CA has 2 governing boards and a 17% HESHARE while MI has 13 governing boards and a 12% HESHARE. Based on Lowry's estimates, I split the sample classifying half the states as having "relatively autonomous" institutions and the remaining half as having "relatively non-autonomous" institutions. Institutional autonomy comes at the expense of state support and one would expect that the link between demographic and economic factors and budget shares to be weaker in these states.

The structure of state budget processes also likely affects how budget shares are determined. Currently 23 states operate on a biennial budget cycle and 37 states have granted their governors powers to reduce appropriations levels without legislative approval.[82] The latter may prevent pork-barrel spending or political logrolling while the former might limit the year-to-year variations in the budget shares that might otherwise be observed as demographic or economic conditions change.

I also split the sample based on political institutions. It might be the case that in states where there is less political competition, historical factors play a larger role,

[82] National Association of State Budget Officers, *Budget Processes of the States*.

or that higher income individuals and competing interest groups have influence in the political process. In more competitive states, budget outcomes are likely determined by representatives taking measures to insure their reelection – we would therefore expect the impact of median voter type variables to be larger in these states. As a result, I split my sample in half based on a political competition index created by Holbrook and Van Dunk (1993).[83] One might also expect that fiscal behavior is different when the state executive and legislative branches are controlled by a single party. Multiparty governments are unlikely to reach a consensus on many issues. Further, when the government is multiparty, both the governor and legislature are politically vulnerable and may be unwilling to take unpopular actions, such as raising taxes or cutting spending and would therefore be more responsive to the demands of the median voter. Single party governments may be able to pursue agendas independent of voter desires, or have budget outcomes influenced by interest groups that help them remain in power.

Last, I split the sample according to demographic structures. Estimating equations according to population density allows me to capture the scope and dispersion of a state's economic activities as well as to increase the homogeneity in the demands for particular public services within each sample. High density states are much more homogeneous in character than the low density states and one would expect the impact of competing interests to dominate in states with more dense populations. I also split the sample according to the time periods representing inflection points in education funding from figure 1.2 that closely match the timing of the previous decades' recessions. It will be interesting to determine if education funding behavior has significantly changed after each of the earlier recessions – which

[83] They calculate an index for each state where 100 represents perfect competition and 0 represents no competition. The average is 38.2 with states in the Southeast generally near the bottom and states in the Midwest and Northwest near the top.

may provide us with some insight into how states might respond to the current and future economic difficulties. Regressions are also run separately for states in the South and the Northeast to better control for historical economic and private market factors.

Data

The analysis in this dissertation involves a broad panel data set which was assembled from over 30 different sources. Appendix table 1 provides a description of how each variable was calculated and the sources from which each originated.[84] The large number of variables, permutations thereof, and assumptions used in creating them would merit a volume unto itself. Therefore, I will limit this discussion to some general comments about the data set and the outcome variables I am interested in explaining.

Table 2.1 reports summary statistics for six categories of variables used in the analysis. The income and budget measures and the demographic characteristics are derived largely from U.S. Census sources, while the enrollment pressure, competing interests, political, and higher education specific characteristics are derived from less prominent sources. The table presents data for two representative years (1977 and 2001) to highlight how each of the explanatory variables has changed over time. All year references represent fiscal years ending on June 30 of the corresponding year while all dollar values used in the analysis herein represent constant 1998 dollars.

[84] Unfortunately, there does not exist a comprehensive "state data book" for all of the information I was interested in collecting. Since much of the data was collected manually, there no doubt exists measurement error in many of the variables, though any errors are likely to be unsystematic.

Table 2.1
Summary Statistics for Baseline and Selected Variables and Years

	1977			2001		
	Mean	Min	Max	Mean	Min	Max
Income and Budget Measures:						
Median Household Income (1980 earliest)	33,457	24,321	51,100	40,402	28,445	52,744
75-25 Income Ratio (1980 earliest)	3.1	2.7	3.7	3.3	2.8	4.0
Per Capita Federal Transfers	557	302	1,587	992	533	1,869
Demographics:						
Median Age	28.4	23.8	33.5	35.5	27.1	38.9
Share of Population 5-17	25.6	22.0	29.4	20.3	17.6	25.2
Share of Population 18-24	14.4	12.3	17.5	10.5	8.5	15.7
Share of Population > 65	11.4	2.7	17.9	13.4	6.2	18.7
Percent Nonwhite (1981 earliest)	16.9	1.4	67.0	20.5	3.1	75.7
Share 5-17 Population Nonwhite	20.4	0.6	70.7	25.8	4.3	83.8
Share 18-24 Population Nonwhite	20.0	2.5	63.4	25.3	4.8	75.2
Share >25 Population Nonwhite	15.7	1.2	68.9	21.2	2.2	63.0
Share > 65 Population Nonwhite	11.6	0.4	72.0	11.6	1.0	77.2
Share Pop 25 and Older w/ HS Degree	65.5	50.0	81.5	85.4	78.2	91.7
Share Pop 25 and Older w/ College Degree	15.3	8.3	22.7	25.2	14.8	36.2
In-Migration % (All) (1980, 1990, 2000)	13.0	5.6	32.1	12.0	6.4	27.5
Out-Migration % (All Ages)	10.9	6.3	29.6	9.6	5.7	20.0
In-Migration % (College Age)	21.1	8.4	45.3	21.5	10.3	39.3
Out-Migration % (College Age)	10.8	6.2	29.8	9.5	4.8	20.7
Enrollment Pressure						
Share HE Enroll Privates (1999 latest)	21.0	0.0	56.7	23.9	5.0	61.5
Share K12 Enroll Privates (1981 earliest)	9.4	1.6	19.0	9.2	2.4	16.7
Share HE Enroll 2-Years (1999 latest)	22.5	0.0	53.0	27.3	3.6	56.0
Enrollment Rate (1999 latest)	53.5	6.9	140.0	58.4	30.1	101.2
FTE HE Enrollment (2000 latest)	161,464	9,082	1,074,346	214,367	16,290	1,329,270
K12 Enrollment (2000 latest)	871,775	89,295	4,313,926	934,034	91,757	6,050,609
Capacity	1.23	0.80	2.08	0.82	0.33	2.14
SAT (1980 earliest)	945	784	1,062	1,069	974	1,196
Competing Interests & Economic Conditions:						
Crime Rate (per 100,000) - (1998 latest)	4,968	2,391	8,461	4,714	2,469	7,272
Health (Share >65 x Health CPI) (2000 latest)	6.0	1.4	9.5	32.7	14.9	45.8
Unemployment Rate	7.0	3.3	10.4	3.9	2.2	6.6
Unemp. Rate Nonwhites (1978 earliest)	12.3	0.0	22.2	7.3	0.0	16.7
# States with Court K12 Reform	2			24		
GSP Share Finance, Ins, Real Est, Svc (1978 earliest)	25.4	18.4	46.6	37.9	23.1	56.1
Share GF Revs - Corp Income Tax	6.1	0.0	13.7	4.0	1.3	12.4
Share GF Revs - Indiv Income Tax	18.3	0.0	41.9	23.9	0.0	47.1
Share GF Revs - Lotteries	0.4	0.0	3.1	1.8	0.0	8.0
Share GF Revs - Sales Taxes	35.4	4.8	62.4	29.9	1.6	66.7
Political Factors:						
# States with Democrat Governor	37			17		
Assembly Seats per Senate Seats	3.02	1.67	16.67	2.95	1.67	16.46
Assembly Seats per 100,000 Population	5.9	0.0	47.3	4.6	0.0	32.0
Senate Seats per 100,000 Population	2.1	0.0	7.9	1.6	0.0	7.3
Voting Participation Rate	52.0	22.4	69.5	51.4	33.4	67.4
Higher Education Factors:						
Endowment per Student (1996 latest)	1,562	58	11,432	2,850	72	21,997
Giving per Student	526	0	2,047	2,824	0	7,282
Ph.D degrees / BA degrees	3.12	1.18	6.78	3.14	1.03	5.57
Proportion HH w/Inc. Below Pell Max	64.4	43.0	76.8	56.7	42.0	71.0
Research Expenditures per Capita	36	8	203	82	29	174
Share Ph.D awarded in Science and Eng.	61.3	33.0	100.0	67.4	35.1	96.3
Avg Instate Tuition at 4-Years (1999 latest)	1,637	829	2,968	3,225	1,960	6,894

Note: All dollar values are constant dollars

Table 2.2 displays the level of general fund budget expenditures, education budget expenditures and higher education budget expenditures for four representative states and the national average, and is useful for assessing the magnitude of the impacts of regression estimates presented in the next section. These data indicate that even very small percentage changes in budget shares translate into very large dollar amounts. For instance, a one percentage point increase in the HESHARE in an average state would result in an additional $75 million for higher education, and as much as a quarter-billion additional dollars in New York.

Table 2.2
Representative Budget Measures in $millions for FY2001

	General Fund	Education *(share)*	Higher Education *(share)*
National Average	*20,867*	*7,491*	*1,231*
		35.9%	*16.4%*
Iowa	11,199	4,397	871
		39.3%	*19.8%*
New York	89,237	23,569	3,353
		26.4%	*14.2%*
North Carolina	28,860	11,960	2,452
		41.4%	*20.5%*
Texas	58,183	24,805	4,087
		42.6%	*16.5%*

The choice of the general fund as my unit of analysis was made with great care. A state receives revenues from a variety of sources including federal government appropriations, bond sales, broad based taxes and earmarked programs.

Though average general fund expenditures account for slightly less than 50% of total state expenditures, what happens in the state general fund is the best single gauge of the financial position and commitment of a state.[85] This is because the general fund does not include any special funds restricted by law for specific government activities or functions, nor does it include monies used to fund ongoing capital projects or from other branches of governments. Therefore, the general fund is the portion of state budgets that legislatures and governors have the most appropriative power over in order to fund the ongoing operations of the various state budget items.

Though the Census Government Finance data files report separately budgeted expenditures on higher education, the information I use to construct the HESHARE and INSHARE variables is obtained from the Center for the Study of Education Policy at Illinois State University (called Grapevine). Grapevine makes great efforts to capture the most discretionary portion of state higher education budgets. The data do not include appropriations for capital outlays and debt service, no appropriations from monies derived from federal sources, student tuition or fees, auxiliary enterprises and other non-tax sources. For example, all tuition revenues in Texas are collected by the state and redistributed to the schools in the Texas system. These expenditures are included in the Census finance files, but not in the Grapevine data.[86] From this data, I subtract the total amount allocated to private colleges and universities, as reported by the NCES' Integrated Postsecondary Education Data System.

[85] NASBO State Expenditure Report, 2001 p.2.

[86] One might argue that tuition redistribution is up to the discretion of state legislatures as well, but I want to capture the allocation of tax dollars to higher education. Nonetheless, regression estimates that use only census data to compute budget shares are very similar to estimates using the Grapevine data and their presentation is therefore suppressed.

CHAPTER THREE

WITHIN STATE ECONOMETRIC ESTIMATES

This chapter presents empirical findings that explain why public education, and public higher education in particular, seems to be a diminishing state priority. The estimates should be viewed as linear approximations to the underlying demand models discussed in chapter two. Using state level data for 26 years between 1972 and 2001, the first sub-section presents baseline regression results. The second sub-section presents estimates of a model that reconsiders the context in which budgetary decisions are made by estimating the extent to which states practice incremental budgeting. The third sub-section discusses a number of simple extensions while the fourth summarizes statistical and interpretive challenges.

For each of the three outcome measures I specify the error term from equation 2.5 to be ($u_{it} = c_i + \gamma_t + \varepsilon_{it}$), and propose the following model:

$$Outcome_{it} = \sum_{k=1}^{K} B_k X_{itk} + c_i + \gamma_t + \varepsilon_{it}. \tag{3.1}$$

This is akin to restating the data as deviations from state means and estimating the following equation:

$$Outcome_{it} - \overline{Outcome}_i = \sum_{k=1}^{K} B_k (X_{itk} - \overline{X}_{ik}) + \gamma_t + (\varepsilon_{it} - \overline{\varepsilon}_i). \tag{3.2}$$

The parameters of interest, β_k, answer the question, "holding all other factors constant, what is the expected change in the HESHARE within a state if some observable factor increases by one unit?"[87]

[87] The within estimator (often referred to as a "fixed effect" estimator) is a convenient choice to control for state specific omitted variables because it allows for arbitrary correlation between the unobserved state effect and observed explanatory variables that other estimation strategies do not permit (it is very

The inclusion of state effects (c_i) and year effects (γ_i) allow me to take full advantage of the panel nature of the data and understand why budget shares *change within a state* over time. Inclusion of state effects controls for unobservable state-specific factors that are constant over time. These factors might include: climate, presence of national parks, high levels of average wages, historical factors, etc. – each presumed to vary across states, but to have a constant impact over time within states. If the state effects were excluded from these regressions, the answer may be misleading if the excluded state effects were correlated with explanatory variables in the model. For example, states with no parkland will have more resources available to devote to higher education. However, if the level of out-migration is negatively correlated with the number of state parks, then the estimated effect of out-migration on the HESHARE would not only pick up the investment decision that states face, but also the impact of a state park system on higher education budgets.

Year effects are included in the models to control for unobserved, time-specific factors that are constant across all states. These factors include: changes in federal laws, federal court decisions, international conflicts and trade patterns, changes in the value of the Pell grant, changes in technology and the education production function, etc. – each presumed to change over time, but to impact all states in the same way.[88]

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likely in this setting that unobserved fixed factors that affect budget shares also are correlated with observed time varying factors. For instance, the year of statehood is very highly correlated with the percentage of college students enrolled in private schools). Though other strategies may be more efficient (which would be important in such a small data set such as the one I employ), the within estimator is still consistent. The unobservable effects are treated as parameters to be estimated in this model, which is useful to analyze state preferences for particular budget items. Further, the within estimator is useful for making predictions about how states will respond to changing demographic, economic or political conditions within a state.

[88] Since the explanation of cross-sectional differences in state budgeting for higher education or K12 education are largely understood (historical factors, private influences, industrial composition in the state, demographic structure, etc.), I present these results in the next chapter for comparative purposes. The distinction between the within estimator presented in this section and the between estimators is worthy of more attention, and is largely ignored in the related empirical literature. In most cases, it would be a large coincidence to observe the same difference in budget share outcomes from observation of two different states with a one unit difference in an explanatory variable between them versus

Inclusion of time effects also removes the impacts of systematic changes in the explanatory variables so that the results presented below reflect within-state responses to idiosyncratic shocks alone. For example, when systematic changes in enrollment pressures are controlled for, one might expect to observe smaller changes in budget shares when there are idiosyncratic shocks to enrollment pressure, due to competitive tax pressures, institutional capacity and other factors unique to a given state.[89]

Baseline Econometric Estimates

I estimate equation 3.2 via ordinary least squares (OLS) for each of the three outcome measures I am interested in. Table 3.1 presents OLS regression estimates for the education share (EDSHARE) and higher education share (HESHARE) equations while table 3.2 presents OLS estimates for the institutional share (INSHARE) equation. The dependent variables are each defined in percentage point terms, so that an estimated coefficient of 2.5, for instance, indicates that an increase in an independent variable of 1 unit results in an increase in the relevant share by 2.5

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observation of a single state that experiences a one unit increase in that same explanatory variable. While it might be true that some variables act like this, there is no theoretical reason why all of them should. For example, if I observe two different states, one with a court-reformed K12 finance system and the other without, I might expect the HESHARE to be larger in the reform state because this state likely had lower state support for K12 education, resulting in the court decision. On the other hand, if I observe a single state before and after the reform decision, I expect the HESHARE to be smaller, because this is implicitly what the court mandates.

[89] For example, impacts of K12 enrollment changes on HESHARE changes would be net of any national trends in K12 enrollments. It is agreed that rising K12 enrollments were a key factor in the growth of state and local spending in the late 50s and 60s as well as in the 90s. Allowing for year effects removes such systematic changes in the size of the school-age population from affecting the results in this analysis.

percentage points.[90] All of the results discussed below are *ceteris paribus*, holding all other factors constant.[91]

The results in column (i) of table 3.1 suggest that changes in the distribution of income and age composition within a state are responsible for changes in the EDSHARE depicted in figure 1.2. Each $1,000 increase in real household income (INC) results in a 1.3 percentage point loss in education's share of the overall budget. This relationship is nonlinear however and reaches a minimum at $58,000, just beyond the distribution of income observed in 2001 (Maryland = $53,000). The results also suggest that the increasing inequality of income (INEQU) has resulted in a fall in preferences for public education. Together, these estimates suggest that changes in the distribution of income have accounted for over 100% of the observed changes in the EDSHARE since 1972.[92]

[90] Models were also estimated using a variety of definitions for most of the independent variables and produced qualitatively similar results. For example, in models where the age distribution is entered continuously, I find that the EDSHARE decreases as the median age of the state increases, ceteris paribus. These and other models are available upon request.

[91] Though some state level variables do not exhibit great variation year over year, over the entire 30 year period of the sample there is considerable variation. Regression results using 3 year moving averages or 5 year intervals of data are qualitatively similar to the results reported below. Further, a cursory analysis of the outcome data indicates that the largest changes have occurred for the HESHARES. If one were to rank the states according to the budget share measures, one would observe that the rank order correlation on each outcome is not constant over time for the HESHARE, and is much more constant for the EDSHARE and INSHARE. For example, the correlation of state rankings on EDSHARE between 1977 and 2001 is 0.67 while the correlation of state rankings on HESHARE is 0.36 – indicating that changes at the macro-economic level are not solely responsible for changes in the HESHARE, but rather state specific factors are important.

[92] Real income increased by approximately $6,000 over the entire period, the ratio of income of the 75th percentile to the 25th percentile increased by 0.2 points since 1977.

Table 3.1
OLS Baseline Regressions for Education's Share of General Fund Budgets and Public Higher Education's Share of the Education Budget - Within Estimates

***Bold 95% significance,** *** italics = 90%*	*EDSHARE* (I)		*HESHARE* (II)	
Median Income in $1,000 (INC)	**-1.27**	*	**0.61**	*
	(0.28)		**(0.23)**	
Squared Income (INC2)	**0.011**	*	**-0.004**	*
	(0.002)		**(0.002)**	
75-25 Income Ratio (INEQU)	**-5.13**	*	**4.12**	*
	(1.81)		**(1.52)**	
Share of Population > 65 Years Old (ELDERLY)	**-0.41**	*	*0.22*	**
	(0.18)		*(0.13)*	
Share of Population Aged 5-24 (SCHOOLAGE)	**0.62**	*		
	(0.12)			
Share Pop. 18-24 / Share Pop. 5-17 (COLRATIO)			**0.13**	*
			(0.04)	
Nonwhite schoolage / Nonwhite non-schoolage (SCHOOLRACERATIO)	1.42			
	(1.10)			
Nonwhite college pop / Nonwhite K12 pop (COLK12RACE)			-0.15	
			(0.14)	
(Nonwhite college pop / Nonwhite K12 pop) *Share Adult Population Nonwhite (RACEINTERACT)			**0.04**	*
			(0.01)	
In-Migration (share population in state today that did not reside here 5 years ago) (INMIG)	0.02		-0.02	
	(0.05)		(0.03)	
Out-Migration (share of population in state 5 years ago that does not reside here today) (OUTMIG)	0.06		**-0.13**	*
	(0.06)		**(0.06)**	
Federal Transfers per Capita ($1,000) (FEDTRAN)	-0.56			
	(0.36)			
Unemployment Rate (UNEMP)	-0.05		**-0.22**	*
	(0.06)		**(0.05)**	
Health Costs (HEALTH)	-0.02			
	(0.06)			
Crime Rate (CRIME)	0.03			
	(0.12)			
Court Reform State (COURT)	**1.18**	*	**-1.19**	*
	(0.30)		**(0.25)**	
Within R^2	0.319		0.663	
Observations	1300		1300	

Notes: All regressions include year effects and dummy variables correcting for missing values that equal 1 when the relevant explanatory variable is missing and 0 otherwise. All also include interactions between income level and distribution and EDSHARE and INSHARE include relative price measures, none of which are statistically relevant and measures controlling for private enrollment pressures. In-migration and out-migration for EDSHARE equation are rates for entire population while for HESHARE and INSHARE are calculated for college aged population alone. The missing values of the explanatory variables take a value of 0 when the missing dummy equals one. All within R2 represent proportion of within variation in outcome explained by changes in explanatory variables exclusive of the state effects. Standard errors in (parentheses).

The changing age composition within a state produced expected changes in the EDSHARE. Changes in the fraction of the population that is school-aged (SCHOOLAGE) were positively correlated with the EDSHARE while an increase in the share of the population that is elderly (ELDERLY) caused a fall in the EDSHARE. Prior research by Poterba (1997), Case et al (1993) and Borge and Rattso (1995) all find a negative correlation between student cohort size and per pupil education funding levels. Though I find a strong positive effect of student-cohort size on budget shares, one cannot infer how expenditures per student will fare. While the point estimate on the elderly share does not appear large, it implies that by the year 2025, when the elderly share is expected to increase by an average of 5 percentage points, that education will lose an additional 2 percentage points in state budgetary priority – representing nearly a half-billion dollars in an "average" state (2001 dollars).[93]

An important finding is that in state-years after a court rules that a state's K12 education finance system is unconstitutional (COURT), the share of the general fund budget allocated to education increases by 1.2 percentage points. This result is consistent with Murray et al's (1998) finding that court reforms in 16 states led to an average increase in per capita K12 spending of 23%.

Turning to the HESHARE results in column (ii), I find that in addition to the factors that affect EDSHARES in column (i), changes in demographic heterogeneity, migration patterns and economic conditions help explain why public higher education has been crowded out by K12 education. While changes in the income distribution have worked in HESHARE's favor, the effects are offset by the losses suffered through education's declining priority in the overall budget process. Increases in household income of $1,000 (INC) result in increases in HESHARE by 0.6 points

[93] http://www.census.gov/population/projections/nation/summary/np-t3-f.pdf. This may also partially be picking up the impacts of the increasing Medicaid burden within states, as the elderly make up a large fraction of beneficiaries.

throughout the entire range of observed income (the maximum is reached at $79,000).[94] The estimates also suggest that an increase of income inequality within a state (INEQU) results in a larger share of the available education dollars being allocated to higher education. This result, while a positive one for higher education, may not be in the best interests of society at large. Previous research by Hansen and Weisbrod (1969), Windham (1970), UNESCO (2003), suggest that the economic middle and upper class have been able to shift income toward itself in the political process using the higher education finance system, and that in places where inequality is severe, investments in higher education will exacerbate the existing income differentials.[95]

Age demographic shifts have also worked in higher education's favor. While states are favorably responsive to changes in the relative size of the college aged cohort to the K12 aged cohort (COLRATIO), there is also modest evidence that aging populations (ELDERLY) look more favorable on higher education than K12 education. This result may reflect a lower perceived relative tax price for higher education by the elderly or a more immediate public benefit perceived to be available through financing university research.[96]

Taken together, income distribution and age demographic shifts indicate that higher education's share of the education budget should have gone up by nearly 5

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[94] To highlight, an increase in median income in an average state of $1,000 would result in higher education reaping 17% of the education budget as opposed to 16.4%. However each $1,000 increase in median income also results in a decline in the EDSHARE to 34.9% from 36.1% in 2001. Therefore, higher education's share of the overall budget remains roughly constant at 5.9%.

[95] However, Lee, Ram and Smith (1999), Cardak (1999), Hight and Pollock (1973) and Biggs and Dutta (1999) present evidence that the system of higher education finance can also be useful to redistribute income toward the economically less advantaged.

[96] A majority of elderly wealth is concentrated in home equity, from which property taxes are assessed to finance local schools. Further, since income levels are smaller – they pay less (or no) income taxes and are often granted discounts on state sales taxes which might be used to finance higher education appropriations.

percentage points since 1977. Since the HESHARE fell by approximately 6 points, other factors must account for an 11 percentage point fall.

There are two estimates that will help predict why higher education may face difficulties in the future, but are not able to explain the observed changes in the past – out-migration and unemployment. While the estimated coefficient on the out-migration of the college-aged population (OUTMIG) suggests that increases in out-migration lead states to devote fewer resources to higher education, over this time period the average level of out-migration across states has remained fairly constant.[97] Similarly, I find that as the unemployment rate (UNEMP) increases by one percentage point, states respond by cutting the HESHARE by .22 points; however, the average unemployment rate over this time period fell by 2 ½ percentage points.

The estimates in column (ii) suggest a trend that demographic heterogeneity can have a very important effect on education spending. I have included two variables in this equation to capture these impacts. First, I include a variable for the ratio of the college-aged population that is non-white relative to the K12-age population that is non-white (COLK12RACE). To see whether the impact of this heterogeneity varies according to the racial make-up of the non-school age population in the state, I also interact it with the share of the population aged 25 and older than is nonwhite (RACEINTERACT). While not statistically significant, an interesting result is that as the college-aged population becomes more nonwhite relative to the K12 population, states devote more resources to the population that is "whiter." However, the impact of this heterogeneity becomes statistically significant and larger when the non-school age adult population is more homogeneous.[98]

[97] Though, wages and other factor prices may fall when out migration increases, so lower higher education expenditures may not necessarily indicate that lower levels of service are being provided in the face of out-migration patterns.

K12 court reforms have had a large impact on the HESHARE. The estimates suggest that as a state moves to more centralized methods of K12 financing (COURT), the average impact over time has been to decrease the share of the education budget allocated to public higher education by 1.2 points. In an average state in 2001, this represents $90 million more that public higher education would have been allocated in the absence of the reform program. This result somewhat contradicts the work of Murray et al (1998). While they conclude that the increased expenditures on K12 education did not come at the expense of any other budget item, their study concluded in 1994. Taken together with the EDSHARE result, I find that public higher education spending has been partially crowded out by the increased K12 expenditures resulting from the K12 court reforms.[99]

The estimated effects of the independent variables on INSHARES in the left hand column (i) of Table 3.2 can be described briefly. The relationship between demographic changes and the share of higher education budgets appropriated directly to institutions is strong. Increases in the share of the population that is college-aged (COLLAGE) result in higher INSHARES, so that the subsidy is received by a larger pool of people than would otherwise be the case. However, the size of the college aged cohort fell markedly between 1972 and the early 1990s, resulting in a one point loss in the INSHARE. Aging populations tend to support institutions rather than students as well. The Pell grant variables yield interesting results. As more

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[98] In other words (ignoring the fact that I am estimating changes for a moment), higher education funding falls more in states with more heterogeneous racial compositions across different school age cohorts. The more white the non-school age population gets, the more precipitous this fall will be. Only a couple of researchers have looked into this variable. Poterba (1997) finds that different racial mix affects funding for K12 education at the state level while Ladd and Murray (2001) do not find evidence at the local level.

[99] The total loss is near $60 million according to 2001 figures for the average state. In the absence of the reforms, higher education in an average state received 16.4% of the education budget which received 36.1% of the overall budget, or about 5.9% of the overall budget. After the reform, higher education receives only 15.2% of the education budget, which received 37.2% of the overall budget, or about 5.6%. The general fund budget in an average state in 2001 was approximately $20 billion.

households become eligible for federal Pell grant awards (PELL), it appears that states respond by reducing the share of aid awarded to institutions, and that this effect is larger when the share of the population that is college-aged (PELLPOP) is larger, though the overall magnitude is minimal. Since more students would be eligible to receive Pell grants (and federal subsidized and unsubsidized loans) when tuition rates are higher, there is a perverse incentive built into the federal financial aid system that encourages states to behave strategically. I am not being pedantic. The Chancellor of the State University of New York, Robert King, was recently quoted saying, "I would suggest that there should be (a tuition increase) … … for students whose family's incomes is $50,000 or less, the state's tuition assistance program picked up the entire $950 of last year's hike … … students from most needy families are pretty much insulated from this … … for those families that can afford to pay, eventually, we're gonna say, you gotta pay a little more."[100]

[100] *Ithaca Journal*, 12/3/03

Table 3.2
OLS Regressions for Institutional Share of Public Higher Education Budgets - Within Estimates

***Bold 95% significance,** ** *italics = 90%*	*Baseline* (I)		*"Psuedo-Experiment"* (II)	
Median Income, in $1,000 (INC)	0.23		0.27	
	(0.16)		(0.17)	
Squared Income (INC2)	-0.001		-0.002	
	(0.001)		(0.001)	
75-25 Income Ratio (INEQU)	1.59		1.67	
	(1.09)		(1.07)	
Share of Population > 65 Years Old (ELDERLY)	**0.38**	*	**0.38**	*
	(0.10)		**(0.10)**	
Share of Population Aged 18-24 (COLLAGE)	**0.275**	*	**0.374**	*
	(0.116)		**(0.076)**	
Nonwhite college / Nonwhite non-college (COLRACERATIO)	**-0.009**	*	-0.005	
	(0.003)		(0.007)	
In-Migration (share population in state today that did not reside here 5 years ago) (INMIG)	0.01		0.02	
	(0.02)		(0.02)	
Out-Migration (share of population in state 5 years ago that does not reside here today) (OUTMIG)	*-0.09*	**	**-0.11**	*
	(0.05)		**(0.05)**	
Unemployment Rate (UNEMP)	0.03		0.02	
	(0.04)		(0.04)	
Share College Enroll Privates (COLPRV)	0.019		**0.033**	*
	(0.012)		**(0.012)**	
Share College Enroll Two-Years (TWOYEAR)	-0.006		-0.005	
	(0.012)		(0.012)	
Proportion Below Pell (PELL)	**-0.06**	*	**-0.07**	*
	(0.03)		**(0.03)**	
PELL x COLLAGE (PELLPOP)	*0.0037*	**	*0.0039*	**
	(0.0022)		*(0.0022)*	
Regional Nonresident Tuition ($1,000) (REGTUIT)	**-0.21**	*	-0.14	
	(0.09)		(0.09)	
PhD Degrees Awarded per BA Degrees Awarded (PHDBA)	-0.15		-0.14	
	(0.12)		(0.11)	
SAT (100 points) (SAT)	*0.29*	**	*0.31*	**
	(0.18)		*(0.17)*	
Merit Aid State (MERIT)	**-2.86**	*	**-6.89**	*
	(0.27)		**(3.49)**	
MERIT x INC			0.06	
			(0.09)	
MERIT x COLRACERATIO			**0.12**	*
			(0.03)	
INC x COLRACERATIO			-0.0001	
			(0.0002)	
MERIT x INC x COLRACERATIO			**-0.0029**	*
			(0.0009)	
Within R^2	0.390		0.411	
Observations	1250		1250	

Notes: All regressions include year effects and dummy variables correcting for missing values that equal 1 when the relevant explanatory variable is missing and 0 otherwise. All also include interactions between income level and distribution and EDSHARE and INSHARE include relative price measures, none of which are statistically relevant. In-migration and out-migration for EDSHARE equation are rates for entire population while for HESHARE and INSHARE are calculated for college aged population alone. The missing values of the explanatory variables take a value of 0 when the missing dummy equals one. All within R2 represent proportion of within variation in outcome explained by changes in explanatory variables exclusive of the state effects. Standard errors in (parentheses).

As with the HESHARE, ethnic heterogeneity across age cohorts has an important impact on the INSHARE, with the share going to institutions falling when the college-aged population becomes more nonwhite relative to the adult non-college-

aged population (COLRACERATIO).[101] Whether this decline is due to an effort to direct merit aid away from nonwhites, or because nonwhites have a larger demand for state need-based aid cannot be immediately discerned from this result. I return to this important issue in a moment below with a "psuedo-natural experiment" treatment.

Looking to the bottom panel of the table, the estimates suggest that movement to a merit aid program (MERIT) reduces the INSHARE by nearly 3 percentage points. Also, as the nonresident tuition rates at public four year institutions in the geographic region (REGTUIT) increase, states are increasingly turning to student aid rather than institutional appropriations – explaining approximately one percentage point in the INSHARE drop. Again, the reasons for doing so are unclear. It may be the case that higher regional tuitions permit instate publics to charge higher tuitions as well, reducing the pressure on direct state support, or reduce the demand for own residents leaving the state. It may also be the case that higher regional tuition signals an improvement in school quality, and in an effort to compete with these institutions, the state induces its resident students to stay by providing them with larger student aid packages.

Column (ii) presents regression estimates that try to explain the motivation for the increasing popularity of state student merit aid programs. Taking liberty with nomenclature and variable interpretation, I accomplish this by including four additional variables to the specification in column (i): second order interaction terms between the merit aid variable (MERIT) and the median income level (INC); MERIT and the relative nonwhite college age population (COLRACERATIO); INC and COLRACERATIO; and finally, a fully-interacted variable of MERIT x

[101] In results not reported in Table 3.2, it appears as though the effect of the racial heterogeneity is felt most acutely by states that are aging fastest. When an interaction between the share of the population aged 65 with the ethnic heterogeneity variable is included in this model, the first order impact of the ethnic heterogeneity disappears, but I find that the elderly support for institutions falls as the college aged population becomes more nonwhite.

COLRACERATIO x INC.[102] This fully interacted model is akin to a natural experiment approach that answers the question, "Do merit aid states that have heavily nonwhite college populations favor broad based institutional aid or more targeted student based aid?" The results are disheartening. While the impacts of the variables in the baseline specification are largely unchanged by the inclusion of the interacted variables, the first-order impact of moving to merit aid programs grows dramatically to nearly 7 percentage points. The variable of interest, MERIT x COLRACERATIO x INC, which can be viewed as a continuous analog to a "difference-in-difference-in-differences" estimator, yields a statistically significant negative result. Considered liberally, this implies that while merit aid states with large nonwhite college aged populations favor institutional support, these states only do so when income is low. When income is high in these states, student aid is preferred – with the somber implication that the increasing popularity of merit aid programs has not been altruistically motivated. Targeted, non-means tested programs seem to be used to redistribute income to middle- and upper-income families and to avoid providing broad-based support to economically disadvantaged members of the populace.

[102] For the sake of brevity, I do not present the estimates from intermediate regressions that introduced the second order interactions independently. In each of these regressions, the second-order interactions were each statistically significant and of the expected sign. MERIT x COLRACERATIO yielded positive and statistically significant results – indicating that states that move to merit aid tend to favor student aid less when the college aged population is increasingly nonwhite – providing support for the notion that the rising importance of merit aid programs has been largely a political scheme to attract middle and upper class white votes and dollars. MERIT x INC yields statistically significant negative results – which can be interpreted as when income increases in the merit aid states, support for student aid is more dramatic than when income increases in the non-merit aid states. INCx COLRACERATIO yields a statistically significant negative result – indicating that when income increases in states with relatively more nonwhite college age population, broad based institutional support falls more than when a state is less nonwhite in its college age population.

Econometric Estimates – Incremental Budgeting

The results presented in tables 3.1 and 3.2 have implicitly assumed that legislators receive utility from every single dollar budgeted for a specific agency. In other words, the baseline specifications allow the entire budget share to be a decision variable. The inability of the explanatory variables in these models to explain all of the declines in the observed budget shares signals that this may not be the case in practice.

It has been suggested that states make funding decisions on an incremental basis, with previous budget levels taken as given when determining current budget allocations.[103] Consider the HESHARE equation as an example. The interpretation is that for any level of budgeted funds for education, the legislators first make expenditures for the minimum level of services required to be provided by K12 and higher education. Then with the remaining budgeted funds, they choose the increments to these budget levels so as to maximize the branch utility function (branch III in figure 1.5), which depends only on the increments to the minimum expenditures, not on the absolute levels.

The empirical implications of this behavior are that rather than estimating an equation for the HESHARE that resembles:

$$HESHARE_{it} = a + \beta X_{it} + c_i + \gamma_t + e_{it} \ , \qquad (3.3)$$

I would need to estimate an equation that resembles:

[103] It has also been put forth that budgetary decisions may transition away from incremental budgeting in scarce times due to the increased competition for resources when resources are limited. In these cases, other practices may be adopted. (The Profession of Budgeting. *Public Budgeting and Finance* v10, n2 (Summer 1990): 102-06 Standard No: ISSN: 0275-1100.)

$$HESHARE_{it} - \theta HESHARE_{it-1} = a + \beta X_{it} + c_i + \gamma_t + e_{it} \ , \qquad (3.4)$$

If (3.4) is the correct model, then shifting the lagged dependent variable to the right hand side and estimating within state changes will lead to a correlation between the error term and the lagged dependent variable, even if the error terms themselves are not auto-correlated. This violation of the orthogonality assumption will not only result in biased estimates of θ, but will likely introduce bias in many of the other parameter estimates in the model.

Fortunately, techniques have recently been developed that allow for a satisfactory treatment of this complication.[104] The even numbered columns of Table 3.3 present estimates of the baseline equations using the Arellano-Bond dynamic panel estimation technique. While there is some efficiency loss due to the necessity of using lagged dependent variables as instruments, as long as the error terms are well behaved, the results will be consistent.[105] For completeness, I present the results of uninstrumented models in the odd numbered columns. State budgeting would be strictly incremental if the estimated effects of the lagged dependent variables were each equal to one. If the coefficients equal zero, then it is the case that the entire budget is determined "from scratch" each budget cycle. Therefore, values of θ

[104] To be consistent with the estimates in Tables 3.3 and 3.4, I want to preserve my "fixed effects assumption" that the unobserved state specific effects are correlated with the observed explanatory variables. Until recently, dynamic panel estimation techniques were unable to accommodate this assumption. They required an explicit specification of the distribution of c_i, and also required that its conditional expectation (on X) to be zero. Instrumental variables generalized methods of moments techniques have recently been developed that take first differences of equation (5) and use lagged differences or lagged levels of the dependent variables as instruments for the endogenous lagged dependent variable. See Greene (pp. 582-584) and Wooldridge (pp. 412 and 493-495) for more detailed discussions.

[105] One key assumption is that there is no second order auto-correlation in the first differenced idiosyncratic errors. If errors are auto-correlated, even if only first-order, specification (3.4) is subject to bias as both $HE_{i,t-1}$ and $e_{i,t-1}$ appear on the right hand side of the equation.

Table 3.3

Dynamic Panel Estimation on Baseline Regressions: Uninstrumented Fixed Effects Estimates (Odd Columns), Instrumental Estimates using Dynamic Panel GMM Estimator (Even Columns)

	EDSHARE				HESHARE				INSHARE			
***Bold 95% significance, ** italics = 90%**	(1)		(2)		(3)		(4)		(5)		(6)	
1-Period Lagged Outcome (LAG)	**0.81**	*	**0.73**	*	**0.62**	*	**0.56**	*	**0.75**	*	**0.53**	*
	(0.02)		**(0.03)**		**(0.02)**		**(0.03)**		**(0.02)**		**(0.03)**	
Median Income in $1,000 (INC)	**-0.39**	*	**-0.45**	*	**0.31**	*	0.17		-0.057		-0.105	
	(0.17)		**(0.23)**		**(0.16)**		(0.21)		(0.115)		(0.134)	
Squared Income (INC2)	**0.003**	*	*0.003*	**	**-0.003**	*	0.000		0.001		0.001	
	(0.001)		*(0.002)*		**(0.001)**		(0.002)		(0.001)		(0.001)	
75-25 Income Ratio (INEQU)	-1.72		*-2.39*	**	1.49		1.78		0.09		0.23	
	(1.09)		*(1.45)*		(1.08)		(1.36)		(0.76)		(0.87)	
Share of Population > 65 Years Old (ELDERLY)	-0.01		0.12		0.01		-0.07		0.095		0.002	
	(0.12)		(0.22)		(0.10)		(0.21)		(0.074)		(0.173)	
Share of Population Aged 5-24 (SCHOOLAGE)	0.03		-0.09									
	(0.08)		(0.15)									
Share of Population Aged 18-24 (COLLAGE)									**0.15**	*	**0.44**	*
									(0.06)		**(0.08)**	
Share Pop. 18-24 / Share Pop. 5-17 (COLRATIO)					0.03		0.04					
					(0.03)		(0.05)					
Nonwhite school/collage / Nonwhite non-school/collage (SCHOOL/COLRACERATIO)	0.90		0.72						-0.003		*-0.005*	**
	(0.72)		(1.09)						(0.002)		*(0.003)*	
Nonwhite college pop / Nonwhite K12 pop (COLK12RACE)					-0.06		-0.19					
					(0.10)		(0.13)					
(RACEINTERACT)					*0.015*	**	**0.04**	*				
					(0.009)		**(0.01)**					
In-Migration (share population in state today that did not reside here 5 years ago) (INMIG)	0.04		0.04		**-0.05**	*	-0.03		0.003		0.004	
	(0.03)		(0.04)		**(0.02)**		(0.03)		(0.016)		(0.016)	
Out-Migration (share of pop. in state 5 years ago that does not reside here today) (OUTMIG)	0.03		0.03		-0.01		-0.03		-0.052		**-0.07**	
	(0.05)		(0.05)		(0.05)		(0.05)		(0.033)		**(0.03)**	
Federal Transfers per Capita ($1,000) (FEDTRAN)	-0.33		-0.36									
	(0.22)		(0.28)									
Unemployment Rate (UNEMP)	-0.05		0.01		**-0.13**	*	**-0.15**	*	-0.032		-0.027	
	(0.04)		(0.06)		**(0.04)**		**(0.06)**		(0.029)		(0.041)	
Health Costs (HEALTH)	-0.02		0.00									
	(0.04)		(0.05)									
Crime Rate (CRIME)	*-0.13*	**	0.01									
	(0.08)		(0.10)									
Court Reform State (COURT)	**0.44**	*	**1.04**	*	**-0.56**	*	**-0.92**	*				
	(0.20)		**(0.34)**		**(0.19)**		**(0.33)**					
Share College Enroll Two-Years (TWOYEAR)									0.001		**0.029**	*
									(0.008)		**(0.011)**	
Proportion Below Pell (PELL)									0.001		0.008	
									(0.022)		(0.025)	
PELL x COLLAGE (PELLPOP)									-0.001		-0.001	
									(0.002)		(0.002)	
Regional Nonresident Tuition ($1,000) (REGTUIT)									-0.082		*-0.158*	**
									(0.066)		*(0.096)*	
PhD Degrees Awarded per BA Degrees Awarded (PHDBA)									-0.086		**-0.246**	*
									(0.083)		**(0.120)**	
SAT (100 points) (SAT)									0.072		0.215	
									(0.137)		(0.215)	
Merit Aid State (MERIT)									**-1.39**	*	**-0.83**	*
									(0.19)		**(0.29)**	
Within R2	0.733				0.806				0.708			
Observations	1200		1150		1200		1150		1200		1150	

Notes: All regressions include year effects and dummy variables correcting for missing values that equal 1 when the relevant explanatory variable is missing and 0 otherwise. All also include interactions between income level and distribution and EDSHARE and INSHARE include relative price measures, none of which are statistically relevant. In-migration and out-migration for EDSHARE equation are rates for entire population while for HESHARE and INSHARE are calculated for college aged population alone. The missing values of the explanatory variables take a value of 0 when the missing dummy equals one. All within R2 represent proportion of within variation in outcome explained by changes in explanatory variables exclusive of the state effects. Standard errors in (parentheses).

between 0 and 1 provide for the possibility that expenditures within any budget category can be cut to some extent during that budget cycle.

It is not surprising the that estimates in Table 3.3 indicate that budget shares are determined in part by an incremental process, and in part by a discretionary process. Looking to the EDSHARE results in column (ii), including the lagged EDSHARE diminishes the importance of the income distribution and court reform variables, while removing the influence of demographic changes on changes in education budget shares. The coefficient on the lagged variable (LAG) indicates that in each period, 73% of the EDSHARE budget is preserved, with the remaining 27% left to legislative discretion.

Including the lagged dependent variables in the HESHARE equation (column iv) has a similar impact on its baseline estimates. Compared to the results in Table 3.1, column (ii), the impacts of the changing income distribution are removed and the magnitude of the court rulings on budget share changes is smaller. However, the ethnic heterogeneity result is robust to this specification change. As one might expect, it appears that legislatures exercise more discretion over the higher education budget share determination than they do to the process one branch above, with only 56% of the HESHARE determined by the level of HESHARE one period earlier.

Moving to the INSHARE equation in column (vi), it appears that legislatures exercise discretion over about ½ of this budget decision. Inclusion of this lag results in the loss of importance of the elderly demographic on INSHARES, but also causes many of the higher education specific variables to become important. In particular, I find that as the share of college students that attend two-year institutions (TWOYEAR) increases, and as the number of bachelors degrees awarded relative to graduate degrees (PHDBA) increases, states look more favorably upon institutional funding. This may reflect preferences for undergraduate education, or simply

represent the fact that two-year colleges are less expensive to operate than four year colleges and that undergraduates are less expensive to educate than graduates.

To summarize, table 3.3 suggests that legislatures do in fact exercise a great deal of discretion over all three budget shares, with the least amount of discretion taken at the highest branch on the tree.[106] Further, treating the process as incremental as opposed to fully discretionary diminishes the impacts of some of the results in tables 3.1 and 3.2, but does not have a substantial qualitative impact on the interpretation of those results.

Econometric Estimates – Extensions

This section presents three simple extensions. First, I present results from augmented specifications of the baseline models. Second, I summarize relevant findings from estimation of the baseline models on different sub-samples of the data. Third, since the previous estimates indicate that the falling HESHARE cannot be fully explained by changes in demographic, economic or income characteristics, I explore this issue in a bit more detail by considering the impact of tuition changes.

Augmented Specifications

Tables 3.4 - 3.6 present results that are similar to those in tables 3.1 and 3.2, but added to each baseline specification are groups of variables that capture political and voting characteristics (column 1), the sources of state general fund revenues (column 2), the composition of gross state product by industry (column 3), higher education specific variables (column 4 of tables 3.4 and 3.5) and other demographic characteristics (column 4 of table 3.6 and column 5 of tables 3.5 and 3.6). Since

[106] Statistical tests with the null hypothesis that the coefficient on each of the lags is equal to one are easily rejected.

inclusion of any single group of variables had virtually no impact on the original baseline estimates, I have suppressed their presentation.[107]

The augmented EDSHARE regressions in Table 3.4 yield few notable results. The only important political variable is that as the state government moves from multiparty control to single party control (UNIPARTY), the education budget share increases.[108] States' increasing dependence on individual income taxes (REVINC) bodes well for education, though its impact is small. Each percentage point increase in the share of revenues generated from this source results in an EDSHARE increase of 0.07 points (the average share of revenues generated from individual income taxes increased by 4.6 points from 1977 to 2001). The results in column (3) suggest that the changing industrial composition within a state has had an important impact on education budget shares. Without exception, the results indicate that as the importance of all industry sectors increases relative to that of the sectors aside from Finance, Real Estate, Insurance and Services (GSPFIRE), education budgets expand. However, all of these sectors have seen dramatic *decreases* in their contributions to state economies since 1977. The results indicate that the changing industrial composition has contributed to a 1.6 percentage point drop in the EDSHARE.[109]

[107] I do not present models with all of the explanatory variables included due to the enormous multicollinearity in the data. Further, adding this many variables rapidly diminishes the degrees of freedom available in an already limited model.

[108] Estimates not reported indicate that this result is invariant to the specific party that is in control.

[109] The share of gross state product generated from FIRE grew by 13 points between 1978 and 2001. The magnitude of the estimate could be retrieved from a regression including only the share of GSP from FIRE, and omitting all other GSP variables. I do not include this variable in the baseline results due to its high correlation with the median income variable and the share of schooling that occurs in the private sector. Therefore, it is difficult to assess what this variable represents.

Table 3.4
OLS Regressions for Share of State General Fund Budgets Allocated to Education (EDSHARE) - Supplemental Specifications

***Bold 95% significance**	(1)		(2)		(3)		(4)	
Assembly per Senate Seats (LEGSEAT)	0.19 (0.16)							
Voter Turnout (VOTE)	0.01 (0.01)							
State Government Uniparty (UNIPARTY)	**0.55** **(0.17)**	*****						
Governor Election Year (GOVELECT)	-0.28 (0.21)							
Governor Democrat (GOVDEM)	0.12 (0.17)							
GF Revenues: Corp. Income Taxes (REVCORP)			0.02 (0.06)					
GF Revenues: Fuels (REVFUEL)			**-0.43** **(0.08)**	*****				
GF Revenues: Indiv. Income Taxes (REVINC)			**0.07** **(0.03)**	*****				
GF Revenues: Lottery (REVLOT)			-0.03 (0.07)					
GF Revenues: Sales (REVSALE)			0.04 (0.03)					
Share GSP: Ag., Forest, Fishing, Mining (GSPAG)					**0.21** **(0.04)**	*****		
Share GSP: Const., Manu., Transp., Utilities (GSPCON)					**0.26** **(0.03)**	*****		
Share GSP: Government (GSPGOV)					**0.46** **(0.07)**	*****		
Share GSP: Wholesale and Retail Trade (GSPTRADE)					**0.49** **(0.11)**	*****		
Unemployment Rate - Nonwhites (UNEMPNON)							**-0.06** **(0.02)**	*****
Nonwhite Unemp / White Unemp (UNEMPRATIO)							-0.13 (0.13)	
Share Pop >25 with College degree (EDCOL)							-0.08 (0.05)	
Share Pop >25 with HS degree (EDHS)							-0.04 (0.03)	
R^2	0.332		0.330		0.351		n/a	
Observations	1300		1300		1300			

Notes: All regressions include year effects and dummy variables correcting for missing values that equal 1 when the relevant explanatory variable is missing and 0 otherwise. The missing values of the explanatory variables take a value of 0 when the missing dummy equals one. All within R2 represent proportion of within variation in outcome explained by changes in explanatory variables exclusive of the state effects. Specifications (4) was not run using all variables in each model, I have compressed them into one category for presenation purposes. All specifications include variables from Table 3.1.

Moving to table 3.5, the results in column (1) indicate that uniparty governments (UNIPARTY) prefer to fund K12 education, and this result does not depend on the specific party that is in control (not shown). The composition of political interests within state legislatures, represented by the number of assembly seats per senate seats (LEGSEAT), produces an interesting (albeit of small magnitude)

Table 3.5
OLS Regressions for Share of State Education Budgets Allocated to Public Higher Education (HESHARE) - Supplemental Specifications

***Bold 95% significance**	(1)		(2)	(3)	(4)		(5)	
Assembly per Senate Seats (LEGSEAT)	**-0.34 (0.13)**	*						
Voter Turnout (VOTE)	0.01 (0.01)							
State Government Uniparty (UNIPARTY)	**-0.37 (0.14)**	*	*this result does not vary by political party*					
Governor Election Year (GOVELECT)	0.08 (0.17)							
Governor Democrat (GOVDEM)	-0.13 (0.14)							
GF Revenues: Corp. Income Taxes (REVCORP)			**0.12 (0.05)**					
GF Revenues: Fuels (REVFUEL)			0.07 (0.07)					
GF Revenues: Indiv. Income Taxes (REVINC)			0.03 (0.02)					
GF Revenues: Lottery (REVLOT)			**-0.12 (0.06)**					
GF Revenues: Sales (REVSALE)			0.02 (0.02)					
Share GSP: Ag., Forest, Fishing, Mining (GSPAG)				0.00 (0.03)				
Share GSP: Const., Manu., Transp., Utilities (GSPCON)				-0.04 (0.03)				
Share GSP: Government (GSPGOV)				0.07 (0.06)				
Share GSP: Wholesale and Retail Trade (GSPTRADE)				0.03 (0.09)				
College Enrollment Rate (ENRATE)					**0.012 (0.006)**	*		
Weighted Average Nonresident Tuition in the Geographic Region in $1,000 (REGTUIT)					**-0.32 (0.13)**	*		
Number of PhD degrees awarded per Bachelors Degrees Awarded (PHDBA)					0.26 (0.16)			
Share of Public Higher Education Enrollments in Two-Year Colleges (TWOYEAR)					**0.03 (0.01)**	*		
Average SAT in 100s (SAT)					-0.24 (0.41)			
Research & Development Expend. Per Capita ($100) (RND)					-1.20 (0.66)			
Giving per Student ($1,000) (GIVE)					**-0.36 (0.10)**	*		
Endowment per Student ($1,000) (ENDOW)					0.00 (0.05)			
Share PhD Awarded in Science and Engin. (PHDSCI)					**3.78 (1.03)**	*		
Merit Aid State (MERIT)					**1.86 (0.38)**	*		
Capacity (CAPAC)					-0.65 (0.42)			
Unemployment Rate - Nonwhites (UNEMPNON)							**-0.04 (0.02)**	*
Nonwhite Unemp / White Unemp (UNEMPRATIO)							0.04 (0.11)	
Share Pop >25 with College degree (EDCOL)							0.45 (3.19)	
R^2	0.664		0.660	0.659	n/a		n/a	
Observations	1300		1300	1300				

Notes: All regressions include year effects and dummy variables correcting for missing values that equal 1 when the relevant explanatory variable is missing and 0 otherwise. The missing values of the explanatory variables take a value of 0 when the missing dummy equals one. All within R2 represent proportion of within variation in outcome explained by changes in explanatory variables exclusive of the state effects. Specifications (4) and (5) were not run using all variables, I have compressed them into two categories for presenation purposes. All specifications include variables from Table 3.1.

result. The estimate indicates that as local representation becomes more prevalent in statehouses relative to representation of larger geographic areas, higher education does more poorly.[110]

The estimates in column (4) also merit discussion, though the higher education specific variables may have some degree of endogeneity built into them. Working up from the bottom of this column, there is not strong evidence that HESHARES have been falling in response to increases in seating capacity (CAPAC) in public higher education institutions. The positive coefficient on the share of PhD degrees awarded in science and engineering (PHDSCI) indicates that states look favorably on higher education when it produces highly skilled professionals in emerging science and technology fields. Legislatures are also more supportive of higher education when a larger share of students attend two-year colleges (TWOYEAR), presumably due to the low cost of these colleges and because their accessibility allows for the subsidy to be received by a larger pool of residents. This may also reflect political factors however; as community colleges are more numerous and reside in more political districts than their four year counterparts.

The most dramatic, and concerning, result in table 3.5 is the negative and significant coefficient estimate on real private giving per student at public research universities within a state (GIVE). As state funding continues to lag behind, public universities have increasingly looked to private donations to supplement their revenue streams. However, some observers have worried that states would view these revenues as replacements for future state appropriations, and allow institutional

[110] While one might expect this variable to only vary in the cross-section, only 13 states did not change the number of assembly seats between 1972 and 2001 and only 10 experienced no changes in the number of assemblypersons per senator. Aside from capturing the impacts of self-interested assemblypersons, this variable may also reflect demographic factors, as changes in legislative representation and even in district lines are a function of changing population sizes and ethnic heterogeneity.

appropriations to lag in the future. Their fears are well founded. Despite the seemingly small point estimate (each additional $1,000 per student raised resulting in a 0.36 point loss in the HESHARE), the magnitude of this crowding out cannot be ignored, especially in the most recent decade. For example, public research universities in Maine have increased their annual private giving per student by $5,800 since 1990. The coefficient estimate indicates that their HESHARE should have dropped by 2.1 points as a result – which explains nearly all of Maine's 2.3 point drop over this period. In fact, for each of the five states that have seen their public universities increase per-student giving by over $3,000, the average fall in HESHARES has been 6.4 points while the five states that have not increased private fundraising efforts since 1990 have seen their shares fall by only 3.9 points.[111] This result also casts doubt on the ability of public universities to generate rainy-day funds or to stockpile appropriations in lush times (as their private counterparts can do), due to a fear that future appropriations would be smaller in response.

Turning to the INSHARE results in table 3.6, the estimates indicate that political factors (column 1) are contributing to the decline in institutions' share of higher education budgets. The estimates indicate that as a state's voters become more active (VOTE), and that as a state moves from a Republican governor to a Democratic governor (GOVDEM), student aid increases in attractiveness relative to institutional appropriations though the magnitude of these effects is small.[112]

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[111] I plan to examine this issue in greater detail in the future. There is an obvious concern about timing and/or endogeneity. With regard to timing, I estimated equations using a 1 period lag of giving and find even stronger results – with the coefficient rising to –0.420 (0.104). I plan to re-estimate this equation with an instrument for giving. See Ehrenberg and C. Smith (2001) for a description of the factors that should be included.

[112] These results hold when the equation is re-estimated excluding Georgia (Democratic governor Zell Miller was the driving force behind the introduction of the large and politically popular HOPE merit scholarship program in 1993).

Table 3.6
OLS Regressions for Share of State Public Higher Education Budgets Allocated to Public Institutions (INSHARE) - Supplemental Specifications

***Bold 95% significance**	(1)		(2)		(3)	(4)		(5)
Assembly per Senate Seats (LEGSEAT)	0.02 (0.10)							
Voter Turnout (VOTE)	**-0.03 (0.01)**	*						
State Government Uniparty (UNIPARTY)	0.04 (0.11)							
Governor Election Year (GOVELECT)	0.05 (0.13)							
Governor Democrat (GOVDEM)	**-0.27 (0.11)**	*						
GF Revenues: Corp. Income Taxes (REVCORP)			0.06 (0.04)					
GF Revenues: Fuels (REVFUEL)			**0.20 (0.05)**	*				
GF Revenues: Indiv. Income Taxes (REVINC)			**-0.035 (0.018)**	*				
GF Revenues: Lottery (REVLOT)			-0.06 (0.05)					
GF Revenues: Sales (REVSALE)			0.01 (0.02)					
Share GSP: Ag., Forest, Fishing, Mining (GSPAG)					0.01 (0.03)			
Share GSP: Const., Manu., Transp., Utilities (GSPCON)					0.01 (0.02)			
Share GSP: Government (GSPGOV)					-0.02 (0.05)			
Share GSP: Wholesale and Retail Trade (GSPTRADE)					0.09 (0.08)			
College Enrollment Rate (ENRATE)						**-0.027 (0.005)**	*	
Research & Development Expend. Per Capita ($100) (RND)						0.90 (0.52)		
Giving per Student ($1,000) (GIVE)						**-0.23 (0.07)**	*	
Endowment per Student ($1,000) (ENDOW)						-0.03 (0.04)		
Share PhD Awarded in Science and Engin. (PHDSCI)						**-3.63 (0.81)**	*	
Capacity (CAPAC)						0.44 (0.32)		
Unemployment Rate - Nonwhites (UNEMPNON)								-0.02 (0.01)
Nonwhite Unemp / White Unemp (UNEMPRATIO)								-0.14 (0.08)
Share Pop >25 with College degree (EDCOL)								-0.03 (0.03)
R^2	0.320		0.320		0.308	n/a		n/a
Observations	1250		1250		1250			

Notes: All regressions include year effects and dummy variables correcting for missing values that equal 1 when the relevant explanatory variable is missing and 0 otherwise. The missing values of the explanatory variables take a value of 0 when the missing dummy equals one. All within R2 represent proportion of within variation in outcome explained by changes in explanatory variables exclusive of the state effects. Specifications (4) and (5) were not run using all variables in each model, I have compressed them into two categories for presenation purposes. All specifications include variables from Table 3.2.

While the estimates of the industrial mix variables (column 3) and other demographic variables (column 5) yield no significant results, the variables representing a state's revenue sources (column 2) and higher education specific characteristics (column 4) do. The estimates in column 2 suggest that as states rely more on the individual income tax (REVINC), student aid programs grow in popularity. Since so many of the merit based aid programs are funded from lottery revenues, it is somewhat surprising that the share of a state's revenues coming from lottery sources (REVLOT) has no impact on INSHARES, though this may be due in part to its representing a small overall share of state general fund revenues.

Though there is a strong negative relationship between the share of PhDs awarded in the sciences (PHDSCI) and institutional aid shares, this may simply reflect the impacts of targeted student aid programs many years earlier. As with the HESHARE results in Table 3.5, institutional efforts to raise private monies (GIVE) seem to be met with retaliatory action by the states. The estimates in Table 3.6 indicate that every $1,000 increase in real private giving per student results in 0.23 points of the higher education budget leaving institutional coffers and going into the hands of the students.

Without any further discussion, it is worth citing the factors that do not seem to have an impact on any of the observed budget shares. These include: the education level of the population (EDCOL, EDHS), the level of public K12 and higher education enrollments (not shown), higher education seating capacity (CAPAC), the relative unemployment of nonwhites versus whites (UNDIF), relative prices (not shown) and endowment per student (ENDOW).

Econometric Estimates on Sub-Samples of Data

Table 3.7 depicts how the three budget share measures have changed from 1977-2001 in different sub-samples of the states. Though none of the reported changes within each category are statistically different from one another at the 95% level, several glaring patterns stand out. It appears that non-reform states, non-northeast states, low density states and single party states have cut their EDSHARES the most, while two-year budget cycle states, court reform states, limited governor power states, politically competitive and multiparty states have cut their HESHARES the most. Finally, it appears that students have benefited over institutions in single-year budget cycle states, in states where governors have substantial appropriative power, in dense states and in states controlled by multiple political parties.

When the baseline models are re-estimated on these different sub-samples of data, a number of interesting patterns emerge. Some of the patterns indicate that the baseline results were driven only by a particular sample of states, and some indicate that the lack of evidence of impacts in baseline regressions were due to confounding effects in different samples.[113] Five broad observations are worth highlighting; table 3.8 summarizes the significant findings.

[113] I only report differences that are statistically different with at least 90% confidence. A complete analysis is available upon request.

Table 3.7
Percentage Point Changes in Outcomes by State Institutional Characteristics

Institutional Characteristic		ΔEDSHARE	ΔHESHARE	ΔINSHARE
Autonomy of Higher Eduction Institutions	Yes (25 states)	-3.28	-5.77	-3.58
	No (25 states)	-3.85	-6.51	-3.51
Budget Cycle Length	2-Years (23 states)	-3.03	-7.27	-2.81
	1-Year (27 states)	-4.01	-5.17	-4.17
Court Reform State in 2001	Yes (24 states)	-2.42	-7.15	-3.02
	No (26 states)	-4.91	-5.22	-4.03
Funding Formula	Yes (29 states)	-4.23	-5.71	-3.78
	No (21 states)	-2.63	-6.74	-3.22
Governor Can Reduce Appropriations w/out Approval	Yes (37 states)	-3.66	-5.60	-4.26
	No (13 states)	-3.27	-7.68	-1.52
New England / Northeast	Yes (9 states)	-2.04	-5.69	-4.45
	No (41 states)	-3.89	-6.24	-3.35
Political Competition	Competitive (25 states)	-3.29	-6.77	-3.44
	Non-compet. (25 states)	-3.84	-5.51	-3.65
Population Density	Dense (25 states)	-2.96	-6.02	-4.77
	Less Dense (25 states)	-4.17	-6.26	-2.32
Uniparty Government	Yes (43% of state-years)	-5.25	-5.44	-2.62
	No (57% of state-years)	-2.10	-6.40	-3.92

Notes: Represent 1977-2001 changes.
No raw changes are statistically different across categories at 95% confidence level.
Uniparty states not constant over time, so changes are for inconsistent sample.

Table 3.8
Summary of Baseline Regression Changes on Data Sub-Samples

	Autonomy		*Budget Cycle*		*Court Reform*		*Funding Formula*		*Governor Power*		*Northeast*		*Political Comp.*		*Pop. Density*		*Uniparty Gov.*	
	Yes	No	2 Year	1 Year	Yes	No	Yes	No	Yes	No	In	Out	High	Low	High	Low	Yes	No
EDSHARE																		
Income				✓											✓			
Elderly				✓		✓							✓				✓	
Unemployment					⊗	✓				✓					✓	⊗	⊗	✓
Health				✓	⊗	✓			✓				⊗	✓	✓			✓
Crime				✓	✓	⊗												
Federal Transfers			✓			✓			✓									
HESHARE																		
Income	✓		✓		⊗	✓		✓		✓		✓	✓			✓		✓
Elderly	✓	⊗	✓								⊗	✓	✓					
Race		✓				✓		✓	✓			✓	✓	⊗				
Unemployment		✓							✓	⊗				✓			✓	
Out-migration						✓					⊗	✓						✓
INSHARE																		
Income		✓										✓					✓	
Elderly								✓	✓			✓		✓	✓			
College Population											⊗	✓	✓			✓		
Race				✓							✓		✓			✓	✓	
Out-migration	✓																	
SAT								✓					✓		✓			
PhD per BA								✓					✓			✓	✓	
Regional Tuition				✓			✓		✓		⊗	✓		✓		✓		

✓ = baseline results driven by this sub-sample, or if not significant in overall but significant in sub-sample
⊗ = produced significant estimates opposite those in baseline regressions
Note: Table presents only variables that were statistically different from other sub-sample with 90% confidence

First, from estimating each equation separately for the years 1972-1982, 1983-1992 and 1993-2001, it is apparent that changes in economic factors are increasing in importance on EDSHARES and HESHARES over time. The most concerning individual result was that while a one percentage point increase in the unemployment rate between 1972-1982 resulted in a fall in HESHARES by 0.1 points, today a similar increase results in nearly a half point fall in the HESHARE.[114]

Second, I find evidence that states with funding formulas respond more dramatically to changes in enrollment pressures than do non-formula states, as expected. Further, very few variables are significant in the HESHARE equation estimated on the formula states, indicating that funding formula states may do a better job at insulating higher education from the budget axe than non-formula states.

Third, there is evidence that changes in competing interests (HEALTH, CRIME) and federal transfers (FEDTRAN) have a substantial impact on EDSHARES depending on the sub-sample of states one looks within. For example, in states where governors have power to reduce appropriations without legislative approval, and in states that operate on a two-year budget cycle, increases in federal grants per capita result in sizable decreases in the education budget share. Further, I find evidence that the increasing cost of health care has crowded out education in states that operate on a single-year budget cycle, in states with multi-party governments, in states where governors have significant power, and especially in high density states.

Fourth, the impacts of racial heterogeneity on the HESHARE and INSHARE equations have been increasing over time. With respect to the HESHARE, increasing ethnic heterogeneity across age groups have led to the largest declines in states that

[114] It is also worth noting that the positive impact of SAT on INSHARES in table 3.2 is due to the positive effect this variable had on institutions in the 1970s. There is a statistically significant, and sizable, negative effect in the most recent decade – indicating that as high school student quality increases, states are increasingly turning to student aid programs, likely in an attempt to keep these students from leaving the state.

exercise more control over its public institutions, in non-formula states and in those where governors have significant power over appropriations cuts. Further, in the INSHARE equation, increasing ethnic heterogeneity has caused institutional shares to fall in states with annual budget reviews, in less densely populated states and in those with a high degree of political competition.

Fifth, though column (ii) of table 3.1 indicates that an aging state population looks favorably on higher education, it turns out that this result is driven by the impact the aging population had in the 1970s. Regression estimates indicate that in the 1990s, as the share of the population that is over 65 increased by one percentage point, the HESHARE fell by 0.56 points. This effect is statistically different than the effect in the 1970s with more than 99% confidence. Further, the impact (favorable) of aging in the HESHARE and INSHARE equations is driven by states outside of the Northeast. There is also evidence that the impact of an aging population has larger effects when political competition is greatest.

Tuition

Tuition rates at public higher education institutions are determined by the level of state support (Lowry 2001, Rizzo and Ehrenberg 2004), and are often times implicitly set by the legislatures or governors in a state. In just one of many examples, the state of Massachusetts and the University of Massachusetts agreed to keep tuition very low in the 1990s in return for strong support from the state, but are now considering changing this policy.[115] In any case, just as federal legislators are loathe to increase the maximum value of the Pell grant due to concerns about the "Bennett

[115] Jeffrey Selingo, *Chronicle of Higher Education*, 2/27/03. Under Governor Romney's plan, the state's flagship public campus, the University of Massachusetts at Amherst, would be spun off "to become a premier research university." Making it independent from the system, the governor said, would allow the institution to increase tuition rates to be more in line with other public flagships so it could "more successfully recruit out-of-state students and compete for top research faculty and grants."

Hypothesis", state legislators may respond to increasing tuition rates by cutting future appropriations, giving rise to a cycle of further tuition increases and budget cuts. Higher tuition rates may also cause future appropriations to be cut simply because they generate distaste for higher education. Since, tuition rates are also likely a function of a long history of state appropriations as well, it would be very difficult to estimate its impact on current budget shares.

The results of several papers uncover mixed evidence on the concurrent relationship between state appropriations and tuition in the cross-section. Lowry (2001) finds no evidence that tuition rates affect state appropriations at the institutional level; Koshal and Koshal (2000) find limited evidence of a relationship in a single year state level analysis; and Strathman (1994) finds that states that charge $1 more in tuition tend to have lower state appropriations by 93 cents. Though the authors each attempt to control for the endogeneity of tuition, these cross-section results are likely confounded by omitted variables, and cannot be used to conclusively say how within a state funding for higher education is expected to change as tuition rates increase.

I re-estimate the HESHARE regression including a one-period lag of the enrollment weighted average tuition at four-year public institutions in a state as an explanatory variable.[116] Coefficient estimates on the one-period lagged tuition suggest that when tuition increases by $1,000 one year prior to this budget cycle, legislatures respond by cutting the HESHARE by 3.4 points. Though the estimates of the other explanatory variables in the model are unaffected by this change, I also test a

[116] Durbin-Wu-Hausman tests indicate that *in changes* the one period lead, the current period level and one period lag are all endogenous in the HESHARE equation. Tests also indicate that the two-period lead and two-period lag are not endogenous. The test is executed by regressing the suspected endogenous variable on all other exogenous variables and computing the residuals from this regression. The test for endogeneity is simply a t-test on the coefficient of this residual when it is included in the original outcome equation along with the suspected endogenous variable.

specification in which the one-period lag of tuition is instrumented for by lagged values of variables that are expected to have an impact on tuition, but that might not be expected to directly impact HESHARES one year later.[117] The results are striking and indicate that when lagged tuition increases by $1,000 within a state, HESHARES are slashed by 6.3 points, with no resulting changes in the other estimated parameters.

Though these results should be viewed with caution, they are very suggestive.[118] Real average public tuition rates at four-year institutions have grown by approximately $1,500 since 1972. The coefficient estimate above indicates that HESHARES fell by almost 9.5 percentage points as a result of increasing tuition rates – explaining a majority of the missing 11 percentage point decline from above.

Sensitivity Analysis and Interpretations

That so little of the fall in HESHARES seems to be explained by changes in observable factors suggests that the functional forms of the baseline estimates are mis-specified. However, log-log, linear-log and log-linear specifications, among others, do not yield any addition insight into these causes.[119]

There are statistical and pragmatic concerns that will influence the way the results should be interpreted. Since the outcomes of interest in my estimating equations are proportions with restricted values between zero and one, one would suspect that my data are not normally distributed. However, scatter plots of both

[117] These variables include combinations of: enrollments, share of enrollments in two-year programs, share of enrollments in graduate programs, regional nonresident tuition rates, average faculty salaries (or a proxy for this), share of enrollments in private higher education, share of PhD awarded in sciences, research dollars per faculty in the state and some specifications with further lags of tuition.

[118] For instance, some schools will increase tuition in a year in anticipation of *future* appropriations cuts, making it difficult to disentangle the impacts of tuition and state support on each other.

[119] These estimates are available in the appendix to my dissertation. Log-log specifications indicate that the income elasticity in the EDSHARE equation is –5 and in the HESHARE equation is +5. These results simply suggest that the education budget is less income elastic than the overall general fund budget and that the higher education budget is more elastic than the overall education budget.

EDSHARE and HESHARE both within and across states indicate that this is not the case, while the distribution of INSHARE appears to be slightly skewed to the right. Regardless, estimates of regressions that "normalize" the data yield qualitatively identical results to the raw data, so I eschew their presentation here. A second concern is that OLS regression predictions are not restricted to fall between zero and one. Again, this is of little concern in this paper because all of the predicted values from my OLS regression estimates fall within this range, and also because regressions estimated using a logit-transformation of the budget shares produce similar results to the non-transformed regressions.[120]

While the previous concerns were largely cosmetic, the following two are more substantial because they have the potential to affect the parameter estimates in each of the regressions.[121] The first concern results from the long time-series contained in my panel. I have found evidence that the crucial orthogonality assumption required for OLS estimates to be unbiased is violated due to time series correlation in the regression residuals. I computed the residuals from all three baseline regression equations and estimated a variety of regressions of these residuals on their one and two period lags. The results indicate that approximately 2/3 of the variation in today's residuals can be explained by one-period lagged residuals. When the second lag is added, the same total amount of variation is explained, except with ½

[120] A logit transform of a variable Y is ln[Y / (1-Y)]. Also called the "log-odds" ratio, this transformation results in the regression predictions being constrained between 0 and 1.

[121] An issued analyzed more deeply in my dissertation is whether or not these three equations are determined simultaneously, and more specific, recursively. If one believes that changes in the EDSHARE affect changes in the HESHARE, and that changes in the HESHARE affect changes in the INSHARE, then finding that the higher branch budget allocations are endogenous in the lower branch equations would cast doubt on the validity of the separability assumption. Preliminary results indicate that OLS and IV estimates of the higher level budget shares in the lower level equations are vastly different, though the remaining exogenous variables are unaffected. In part, the results indicate that each percentage point increase in the EDSHARE results in a 0.6 point fall in the HESHARE while a one point increase in the HESHARE results in a 0.6 point fall in the INSHARE. However, I should caution that these estimates have not satisfactorily controlled for the spurious negative correlation introduced between the budget share measures.

due to the one-period lag and 1/6 due to the two-period lag.[122] If included explanatory variables are correlated with these lagged residuals, then the parameter estimates in my regressions will be biased. This bias may be exacerbated when lagged dependent variables are added to the model.[123]

The second concern is that the prices included in the EDSHARE and HESHARE equation are endogenous. Aside from the obvious fact that the earnings of public employees are a function of the level of state support for that particular budget item, in the case of education, higher earnings are highly correlated with educational quality – which might also be a choice variable for the legislature. To complicate the interpretation of the price variables, in some states it is the case that higher education is heavily subsidized by the federal government in ways which are not at all related to federal taxes, therefore the relationship between the true marginal cost of higher education and the price as seen by voters/legislatures is unstable (Alexander 2001, Bound et al 2001).[124]

Nonetheless, regression estimates in equations that attempted to control for the potential endogeneity of the price variables were very similar to those where the prices were dropped, or treated as exogenous. As a result, for expository purposes, the

[122] This is true both in states that operate on a single year budget and on a biennial budget, so another factor must be causing this correlation.

[123] Using methods derived in Baltagi and Wu (1999) I re-estimate the baseline models attempting to control for the autocorrelation in two ways. Both methods do a bit of violence to the reported baseline estimates in that there is a substantial loss of efficiency and the impacts of the elderly, unemployment rate and court reforms disappear in these models.

[124] A detailed discussion of the treatment of price variables can be found in an appendix to work in progress. To summarize, statistical tests of the price endogeneity in both the EDSHARE and HESHARE equations provided mixed results. The tests amount to including residual values from regressions of the suspected endogenous variables on all of the exogenous variables in the original outcome equations. Simple t-tests on the residual in these augmented regressions indicated that prices are exogenous in the EDSHARE equation and endogenous in the HESHARE equation.

relative price measures were included exogenously in the above baseline regressions.[125]

The results should be interpreted with caution because included variables may not only capture the demand for education spending, but also differences in technology or other supply factors within states with different demographic and other characteristics. For example, it may seem reasonable to exclude OUTMIG from the higher education production function, and so impacts on HESHARE from changes in migration likely result from demand side factors alone. However, changes in the size of the college-aged cohort are more difficult to interpret because economies of scale could make it possible to deliver the same education to larger cohorts with less than proportional increase in spending.

Policymakers should be concerned with the true functional form of legislative utility functions. This understanding is important to know whether certain marginal conditions require influence, or rather an expansion of the budget is necessary to improve the fortunes of public higher education. If the underlying utility function depicted by my utility-tree is *homothetic*, then the cost of reaching higher levels of utility must be proportional to the level of utility – budget shares are independent of utility levels and wealth levels. If this is the case, then simply increasing the size of the education budget will do nothing to alter the increasing substitution of K12 for higher education services. Consumer demand studies typically reject this functional form. In a rough attempt to understand this, I re-estimated the HESHARE and INSHARE equations by including a measure of the total size of the education budget in the HESHARE equation and the size of the higher education budget in the

[125] In the EDSHARE equation, one instrument for the relative price of education instructors to non-education employees was an estimate of the share of education employees that are unionized relative to the share of non-education public sector workers that are unionized. In the HESHARE equation, the instrument was an estimate of the share of public higher education instructors that were unionized to the share of all education instructors that were unionized.

INSHARE equation. The estimates on the budget levels indicate that increasing the size of the education budget will not affect the HESHARE, but increases in the size of the higher education budget, lead to a smaller share of resources going to institutions.[126]

The results presented above may be hard to interpret literally because there may be cross-variable utility effects associated with higher education spending. For example, spending on public higher education may reduce the incidence of crime and thereby raise the utility of everybody, not just the college aged population when additional dollars are allocated to higher education. Therefore, my estimates may overstate the direct importance of cohort sizes and other variables on budget share changes. This difficulty is related to the fact that it is nearly impossible to control for all factors that affect state legislative decisions. For example, I do not include information on state-wide programs involving property tax limits. Though their impact on budget shares is unclear, their use is increasing across the country, and varies by income and demographic conditions – which may explain some of the variation in the estimated coefficients on these variables above. The impact of these property tax exemptions on a variety of outcomes is something I will investigate more deeply in the future.

Finally, the aggregated data used in state-level analyses abstracts from a large degree of within state heterogeneity in the explanatory variables, which likely affects budget outcomes. If this heterogeneity is constant over time, then my within estimation techniques will control for it, however, there is reason to believe that variables such as the homogeneity of households with college aged children have changed over time. Future work should make greater efforts to incorporate this variation.

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[126] There is spurious negative correlation in these estimates which will be addressed in future work.

CHAPTER FOUR

POOLED ORDINARY LEAST SQUARES ECONOMETRIC ESTIMATES

This section presents empirical findings that seek to explain why public education budgetary equilibriums vary *across* states. For each of the three outcome measures, the following model is proposed:

$$Outcome_{it} = \sum_{k=1}^{K} B_k X_{itk} + \gamma_t + \varepsilon_{it} . \quad (4.1)$$

This is akin to restating the data as deviations from annual means and estimating the following equation:

$$Outcome_{it} - \overline{Outcome}_t = \sum_{k=1}^{K} B_k (X_{itk} - \overline{X}_{tk}) + (\varepsilon_{it} - \overline{\varepsilon}_t) . \quad (4.2)$$

The parameters of interest, β_k, answer the question, "holding all other factors constant, what is the expected difference in budget shares between two states if they differ in some observable factor by one unit?" Inclusion of the γ_t (i.e. "year effects") in equation 4.1 allows for the intercept term to vary by year and controls for unobserved aggregate time-specific effects that have the same influence on budget shares across all states. These factors might include: changes in federal laws and court rulings, cohort quality, immigration patterns, international conflicts and trade patterns, changes in the value of the Pell grant, changes in technology and the education production function, etc. – each presumed to change over time, but to impact all states in the same way. The cross-section estimator would be biased if year effects were excluded and if unobservable state-invariant, time-specific factors are correlated with

explanatory variables in the models.[127] For example, higher education institutions were given a 15 year grace period to comply with the federal mandatory retirement law passed in 1979 (it made mandatory retirement illegal). If this law resulted in an average increase in the "price" of higher education nationwide, then the estimated effect of HEPRICE on HESHARE would not only pick up cross-state budget share differences as a result of price differences, but also cross-state differences in the impact of the mandatory retirement law change on budget shares.[128]

I estimate equation 4.1 using pooled OLS, controlling for heteroscedasticity. The baseline estimates presented in this chapter are not corrected for serial correlation because tests of serial correlation do not reject the null hypothesis that no serial correlation exists in the data.[129] The test I ran was simply including lagged residuals from regressions of equation 4.1, $\hat{\varepsilon}_{it-1}$, into equation 4.1 and running a t-test on the coefficient of these lagged variables. I was unable to reject the null in any of the three outcome regressions. As acknowledged in chapter three, pooled OLS estimates of β_k, are not likely to be consistent if fixed state factors are unobservable and correlated with the explanatory variables in my model.[130] This inconsistency does not mean the

[127] A true cross-section estimator would be recovered from a separate regression for each of the 26 years of data and allowing the coefficients to vary each year. Due to a limited number of observations and a less than parsimonious specification, I pooled all of the data and included year effects to allow the intercept to vary by year. My use of the term "cross-section" refers to the latter of these specifications, which should more properly be referred to as a "pooled cross-section."

[128] For instance, if two states differed only in the average age and tenure of higher education faculty members, one might expect to observe a lower HESHARE in "older" state as a result of the mandatory retirement law change, not because this state responds differently to price changes than other states.

[129] Estimates from pooling the sample and running OLS and from running various specifications of feasible generalized least squares (FGLS) were nearly identical, so I present the OLS findings in this paper for simplicity.

[130] In order for pooled OLS estimates of β_k to be consistent for the true β_k two conditions must hold. First, there must be orthogonality between the regression residuals and the explanatory variables in each time period. Second, the matrix of explanatory variables must satisfy a rank condition that does not allow for any perfect linear dependencies on the right hand side. The presence of time-invariant state specific factors violates the first of these assumptions in most cases.

answer to the question of what explains cross-sectional differences is wrong, rather it indicates that what explains differences across states and changes within states may in fact be different. I will address this issue in the next chapter.

Baseline Estimates

Table 4.1 presents pooled OLS regression estimates for the education share (EDSHARE) and higher education share (HESHARE) equations while table 4.2 presents pooled OLS estimates for the institutional share (INSHARE) equation. The dependent variables are each defined in percentage point terms, so that an estimated coefficient of 2.5, for instance, indicates that if two states differ in the value of an independent variable by 1 unit, all else equal their budget shares can be expected to differ by 2.5 percentage points.[131] All of the results discussed below should be considered as taking place holding all other factors constant, including the impact of private schooling alternatives, migration patterns and the age distribution of the population in each state.

It is commonly believed that the observed declines in education spending, and higher education spending in particular, have occurred as a result of the increasing costs of health care (Medicaid) in states as well as explicit pressures to fund other budget items.[132] At best, my empirical findings provide tepid support for this view in the cross-section.

The results in column (i) of table 4.1 suggest that states with older populations (ELDERLY) do not spend less on education than their younger counterparts. Further,

[131] Models were also estimated using a variety of definitions for most of the independent variables and produced qualitatively similar results. For example, in models where the age distribution is entered continuously, I find that the EDSHARE is smaller in states where the median age is higher, ceteris paribus. These and other models are available upon request.

[132] Kane and Orszag for example.

Table 4.1: Pooled Cross-Section OLS Regressions for Education's Share of General Fund Budgets & Public Higher Education's Share of Education Budget

***Bold 95% significance**	*EDSHARE* (I)		*HESHARE* (II)	
Median Income in $1,000 (INC)	0.24 (0.44)		-0.23 (0.27)	
Squared Income (INC2)	**-0.012** **(0.004)**	*	0.002 (0.002)	
75-25 Income Ratio (INEQU)	**-5.81** **(2.73)**	*	-0.19 (1.73)	
Share of Population > 65 Years Old (ELDERLY)	0.32 (0.20)		**0.27** **(0.06)**	*
Share of Population Aged 5-24 (SCHOOLAGE)	**1.05** **(0.09)**	*		
Share Pop. 18-24 / Share Pop. 5-17 (COLRATIO)			0.02 (0.05)	
Relative Education Price (EDPRICE)	-1.79 (1.16)			
Relative Higher Education Price (HEPRICE)			-0.52 (0.41)	
Nonwhite schoolage / Nonwhite non-schoolage (SCHOOLRACERATIO)	**-6.51** **(1.37)**	*		
Nonwhite college pop / Nonwhite K12 pop (COLK12RACE)			**-1.41** **(0.32)**	*
(Nonwhite college pop / Nonwhite K12 pop) *Share Adult Population Nonwhite (RACEINTERACT)			**0.05** **(0.01)**	*
In-Migration (share population in state today that did not reside here 5 years ago) (INMIG)	**0.19** **(0.10)**	*	**-0.13** **(0.05)**	*
Out-Migration (share of population in state 5 years ago that does not reside here today) (OUTMIG)	**-0.31** **(0.13)**	*	0.08 (0.09)	
Share of K12 enrollments in private schools (K12PRV)	**-0.17** **(0.04)**	*	0.00 (0.04)	
Share of Higher Education enrollments in privates (COLPRV)	**-0.14** **(0.01)**	*	**-0.05** **(0.01)**	*
South	**2.27** **(0.42)**	*	**0.96** **(0.23)**	*
Federal Transfers per Capita ($1,000) (FEDTRAN)	**-6.44** **(2.14)**	*		
Unemployment Rate (UNEMP)	**-0.20** **(0.10)**	*	**-0.76** **(0.07)**	*
Health Costs (HEALTH)	0.06 (0.12)			
Crime Rate (CRIME)	**0.71** **(0.14)**	*		
Court Reform State (COURT)	**0.98** **(0.33)**	*	-0.03 (0.22)	
Adjusted R^2	0.544		0.508	
Observations	1300		1300	

Notes: All regressions include year effects and dummy variables correcting for missing values that equal 1 when the relevant explanatory variable is missing and 0 otherwise. All also include interactions between income level and distribution. In-migration and out-migration for EDSHARE equation are rates for entire population while for HESHARE and INSHARE are calculated for college aged population alone. The missing values of the explanatory variables take a value of 0 when the missing dummy equals one. All R2 are adjusted R2 and standard errors in (parentheses) are corrected for heteroscedasticity.

cross-state heterogeneity in health care costs (HEALTH) does not explain differences across states in education budget shares. After Medicaid expenditures, the second fastest growing item in state budgets has been corrections. Once I control for differing income distributions and employment conditions across states however, I find the counterintuitive result that states with higher crime rates spend larger shares of their budgets on education than states with lower crime rates.[133]

Including the unemployment rate (UNEMP) in this regression directly controls for the health of the labor market in a state (and therefore the demand for social program expenditures such as unemployment insurance) and indirectly for the demand for Medicaid services (caseloads expand as the economy stagnates under means-tested entitlement programs). While the estimated effect of unemployment on EDSHARES is significant at the 95% level, its magnitude is very small. The coefficient of -0.2 indicates that if one state differs from another (ceteris paribus) solely by having an unemployment rate that is one percentage point higher, that state will spend 0.2 points less on education. For 2001, the standard deviation in the unemployment rate across states was just about 0.9 percentage points, which suggests that 95% of the states (48 of them) would fall within 3.6 percentage points in their unemployment rates, and have an expected spread in their EDSHARES by less than ¾ percentage points. The actual spread in EDSHARES in 2001 for the middle 95% of states was 23 points, so differences in unemployment rates do not explain very much of this variation.

An important finding is that in the 24 states where courts have ruled K12 education finance systems unconstitutional (COURT), the share of the general fund

[133] This may either be a result of reverse causality (i.e. states that spend a larger share of their budgets on education must spend a smaller share on corrections, and therefore crime rates are higher), or the possibility that states spend a larger share of their budgets on education when crime rates are higher because of the belief that a more highly educated population will promote a more civil society. A third possibility is that more educated people become more sophisticated and more accomplished criminals. There is a large empirical literature devoted to this issue and I will eschew any meaningful discussion of it in this chapter.

budget allocated to education is approximately one percentage point higher. Therefore, *ceteris paribus*, states that have taken efforts to reform their K12 finance systems spend approximately $210 million more on education than their counterparts.

It appears that a substantial portion of the cross-sectional differences in preferences for funding education emanate from differences in cross-cohort ethnic heterogeneity across states (SCHOOLRACERATIO). I find that states where the school age population is more nonwhite than the adult non-school age population spend a considerably smaller portion of their budgets on education than do states with more homogenous cross-cohort populations. The point estimate suggests that if two states differ in this factor by one percentage point, their EDSHARES will differ by 6½ percentage points. The range of the SCHOOLRACERATIO variable for 2000 was one percentage point, and therefore is attributable to a $1.365 billion difference in educational spending between the most homogeneous and heterogeneous states if the size of the discretionary budgets in each state were equal to the national average.

Last, while differences in the *levels* of income across states do not appear to explain EDSHARE differences, heterogeneity in the *dispersion* of income does. States with more unequal distributions of income (INEQU), as measured by the ratio of household income for households at the 75^{th} percentile relative to those at the 25^{th} percentile, spend much less on education than do states with more equal distributions of income. To clarify the significance of the point estimate of -5.8, consider that the standard deviation of INEQU in 2001 was 0.3 and that all 50 states fell within three standard deviations of the mean of 3.3. The income distribution was much more unequal in states like New York and Mississippi (approximately 4.0) than in states such as Utah and Minnesota (approximately 2.8). The point estimate therefore suggests that if New York and Minnesota were equal along all other dimensions aside from INEQU, the difference in EDSHARES between them would be 7 percentage

points or about $1½ billion if the size of the discretionary budgets in each state were equal to the national average.

Turning to the HESHARE results in column (ii), the salient findings are those variables that do *not* appear to affect higher education's share of the education budget. Unlike the EDSHARE results above, neither differences in the levels and dispersion of income across states explain differences in HESHARES, nor do the 24 states that have mandated K12 court reforms behave differently than the 26 that have not. Differences across states in the relative cost of higher education to K12 education also do not explain any differences in higher education budget shares.

Two additional results deserve mention. If state legislatures follow the multi-stage choice process described earlier, the crowding out of higher education due to changing pressures from other budget items would only be realized through income effects via the impact of other budget items on the EDSHARE. If the states do not follow this procedure directly, or if the variables representing competing budget items also capture other factors affecting preferences between higher education and K12 education, then inclusion of these variables in the HESHARE equation may produce estimates that are statistically different than zero. While my inclusion of the unemployment rate in the HESHARE equation was intended to address the latter of these two issues, it is conceivable that the first holds as well. Nonetheless, the estimates in column (ii) suggests that states with higher unemployment rates, *ceteris paribus*, spend a larger share of their education dollars on K12 education.

Last, just as with education's share of the general fund budget, it appears that states systematically shift resources away from under-represented segments of the population. In states where the college aged population is relatively more non-white than the K12 aged population (COLK12RACE), a larger share of education dollars are spent in the K12 sector. Further, the magnitude of this impact is largest in the states

where the adult non-college aged population is more white (RACEINTERACT). Though the point estimate on COLK12RACE is rather large, the difference between the 95% most heterogeneous and most homogeneous states on this factor is only 0.4 percentage points – translating into a 0.56 expected difference in HESHARES based on this racial heterogeneity alone.

The estimated effects of the independent variables on INSHARES in Table 4.2 can be described briefly. The 10 states with substantial merit scholarship programs give 2.2 percentage points less to institutions than do states without merit programs. On average, this represents $160 per student less funding than for institutions in merit states than those in non-merit states. The small, but positive, coefficient on SAT scores provides some evidence for the notion that states with more talented pools of prospective college students will choose to invest more in public higher education institutions than in states with less talented high school students.[134]

Just as in both the EDSHARE and HESHARE equations, it appears that states use the INSHARE to shift resources away from underrepresented segments of the population. The negative estimate on COLRACERATIO suggests that states with more cross-cohort ethnic heterogeneity target more funding to students than do states with more homogenous populations. In other words, in states with substantial minority populations of college age residents (relative to adults), higher educational resources are less likely to be distributed in the form of generous across-the-board subsidies that all residents can benefit from and more likely to be targeted to specific students. Though the motivation for this distribution of funds cannot be ascertained from these regression estimates, looking at how cross-cohort ethnic heterogeneity

[134] In results not shown, it appears that the magnitude of this effect is much larger in states with smaller shares of students enrolled in private schools.

affects each of the three funding decisions is indicative that malevolent forces may be at play.

Table 4.2: OLS Regressions for Institutional Share of Public Higher Education Budgets - Cross-Section Estimates

***Bold 95% significance**		
Median Income, in $1,000 (INC)	-0.10 (0.36)	
Squared Income (INC2)	**0.007** **(0.003)**	*
75-25 Income Ratio (INEQU)	2.74 (2.45)	
Share of Population > 65 Years Old (ELDERLY)	**0.14** **(0.07)**	*
Share of Population Aged 18-24 (COLLAGE)	**0.66** **(0.23)**	*
Nonwhite college / Nonwhite non-college (COLRACERATIO)	**-0.05** **(0.01)**	*
In-Migration (share population in state today that did not reside here 5 years ago) (INMIG)	0.03 (0.06)	
Out-Migration (share of population in state 5 years ago that does not reside here today) (OUTMIG)	0.05 (0.10)	
South	**0.71** **(0.24)**	*
Unemployment Rate (UNEMP)	**-0.23** **(0.06)**	*
Share College Enroll Privates (COLPRV)	**-0.16** **(0.01)**	*
Share College Enroll Two-Years (TWOYEAR)	-0.009 (0.008)	
Proportion Below Pell (PELL)	0.07 (0.06)	
PELL x COLLAGE (PELLPOP)	0.002 (0.005)	
Regional Nonresident Tuition ($1,000) (REGTUIT)	0.00 (0.13)	
PhD Degrees Awarded per BA Degrees Awarded (PHDBA)	**-0.51** **(0.08)**	*
SAT (100 points) (SAT)	**0.57** **(0.20)**	*
Merit Aid State (MERIT)	**-2.17** **(0.63)**	*
Adjusted R^2	0.438	
Observations	1250	

Notes: All regressions include year effects and dummy variables correcting for missing values that equal 1 when the relevant explanatory variable is missing and 0 otherwise. All also include interactions between income level and distribution. In-migration and out-migration for INSHARE are calculated for college aged population alone. The missing values of the explanatory variables take a value of 0 when the missing dummy equals one. All R2 are adjusted R2 and standard errors i (parentheses) are corrected for heteroscedasticity.

Augmented Specifications

Tables 4.3 – 4.5 present results from models that are identical to those in tables 4.1 and 4.2, but added to each baseline specification are groups of variables that capture political and voting characteristics (column 1), the sources of state general fund revenues (column 2), the composition of gross state product by industry (column 3), and various combinations of higher education specific and other demographic variables (column 4). Since inclusion of any single group of variables had virtually no impact on the original baseline estimates from tables 4.1 and 4.2, I have suppressed their presentation.[135]

The augmented EDSHARE regressions in Table 4.3 indicate that differences in the political climates across states contribute significantly to differences in preferences for funding education. Most notably, states in which the governor is a democrat (GOVDEM) and in which the entire government is run by a single party (UNIPARTY) spend a larger share of their discretionary budgets on education than states with republican governors or with jointly controlled governments.[136] These results, coupled with the negative effects of voter turnout (VOTE) and local representation in state congress (LEGSEAT), suggest that education funding is not what gets people elected.

[135] I do not present models with all of the explanatory variables included due to the enormous multicollinearity in the data. Further, adding this many variables rapidly diminishes the degrees of freedom available in an already limited model.

[136] Estimates not reported indicate that the UNIPARTY result is invariant to the specific party that is in control.

Table 4.3: OLS Regressions for Share of State General Fund Budgets Allocated to Education (EDSHARE) - Supplemental Specifications

***Bold 95% significance**	(1)		(2)		(3)	(4)	
Assembly per Senate Seats (LEGSEAT)	**-0.45** **(0.08)**	*					
Voter Turnout (VOTE)	**-0.05** **(0.02)**	*					
State Government Uniparty (UNIPARTY) (interact is negative and significa	**1.88** **(0.43)**	*					
Governor Election Year (GOVELECT)	-0.31 (0.37)						
Governor Democrat (GOVDEM)	**0.63** **(0.28)**	*					
GF Revenues: Corp. Income Taxes (REVCORP)			**-0.27** **(0.06)**	*			
GF Revenues: Fuels (REVFUEL)			-0.05 (0.11)				
GF Revenues: Indiv. Income Taxes (REVINC)			**0.16** **(0.02)**	*			
GF Revenues: Lottery (REVLOT)			**-0.61** **(0.09)**	*			
GF Revenues: Sales (REVSALE)			**0.12** **(0.02)**	*			
Share GSP: Ag., Forest, Fishing, Mining (GSPAG)					0.07 (0.04)		
Share GSP: Const., Manu., Transp., Utilities (GSPCON)					**0.21** **(0.03)**		
Share GSP: Government (GSPGOV)					0.05 (0.06)		
Share GSP: Wholesale and Retail Trade (GSPTRADE)					**0.78** **(0.12)**		
College Enrollment Rate (ENRATE)						**0.02** **(0.01)**	*
Share Pop >25 with College degree (EDCOL)						**2.52** **(0.38)**	*
R^2	0.588		0.625		0.589	n/a	
Observations	1300		1300		1300	1300	

Notes: All regressions include year effects and dummy variables correcting for missing values that equal 1 when the relevant explanatory variable is missing and 0 otherwise. The missing values of the explanatory variables take a value of 0 when the missing dummy equals one. All R2 are adjusted R2 and standard errors in (parentheses) are corrected for heteroscedasticity. Specification (4) was not run using all variables in each model, I have compressed them into one category for presenation purposes. All specifications include variables from Table 4.1.

The results in columns (2) and (3) indicate that states that are dependent upon businesses to generate revenues, particularly those in financial services, prefer to fund non-education budget items. This can be inferred from the negative estimates on the share of general fund revenues coming from corporate income taxes (REVCORP) and the positive coefficients on the share of gross state product coming from sources other than finance, real estate and insurance businesses (the omitted GSP category). These regressions already control for income levels and private schooling alternatives in the states, so these results likely are capturing the impact of business interest groups on state spending or some other factors that affect preferences for education spending.

Moving to table 4.4, the results in columns (1) and (4) merit some discussion. The political variables in column (1) suggest that democratic governors prefer to fund K12 education over higher education and that states in which larger shares of the legislature are composed of local representatives (assemblypersons) as opposed to regional representatives (senators) prefer to fund K12 education. The latter result is not surprising given the likelihood that most assemblypersons have elementary and / or secondary schools in their voting district, but a far smaller number have a post-secondary institution in their district.

Though the higher education specific variables may have some degree of endogeneity built into them, the results in column (4) are notable nonetheless. Two surprising findings are that states do not seem to make higher education funding decisions conscious of nonresident university tuition rates in their region (REGTUIT) and that states in which the quality of public higher education is high spend a smaller share of their education dollars on higher education than states in which the quality of public higher education is not high (BARRONS). Rather, my findings suggest that those states that fund higher education more generously are taking a utilitarian approach to doing so. This can be seen by three results. First, states which graduate a larger percentage of PhDs relative to BAs spend more on higher education (PHDBA) presumably because PhDs are more highly skilled and whose services are not easily substitutable. Second, states in which undergraduate enrollments are more concentrated in two-year colleges as opposed to four-year colleges spend more on higher education (TWOYEAR). The community colleges typically offer a substantial number of vocational degree paths and serve their communities by providing job retraining programs and even job training programs for businesses located nearby. Finally, states with higher quality high school graduates (SAT) will spend a larger share of their education dollars on higher education.

Of concern to those in higher education should be two results that suggest that states view private dollars as replacements for public support of higher education. The results indicate that states whose public colleges generate more private giving (though this is not statistically significant) and those whose colleges have built substantial endowments spend a smaller share of their educational dollars on higher education than their counterparts. The magnitude of this endowment result is substantial. The difference in endowment per student from the "wealthiest" states to the "poorest" states (in terms of endowments) in 1996 was approximately $18,000 per full-time equivalent student. The point estimate suggests that if the wealthy states and poor states were identical along all other factors except endowment wealth and with education budgets at the national average level, their HESHARES would differ by 6½ points – or about $500 million (about $3,000 per student).

Table 4.4: OLS Regressions for Share of State Education Budgets Allocated to Public Higher Education (HESHARE) - Supplemental Specifications

***Bold 95% significance**	(1)		(2)		(3)		(4)
Assembly per Senate Seats (LEGSEAT)	**-0.18** **(0.04)**	*					
Voter Turnout (VOTE)	**0.07** **(0.01)**	*					
State Government Uniparty (UNIPARTY)	0.23 (0.24)						
Governor Election Year (GOVELECT)	-0.14 (0.25)						
Governor Democrat (GOVDEM)	**-0.48** **(0.18)**	*					
GF Revenues: Corp. Income Taxes (REVCORP)			**0.08** **(0.04)**	*			
GF Revenues: Fuels (REVFUEL)			**0.46** **(0.07)**	*			
GF Revenues: Indiv. Income Taxes (REVINC)			**0.03** **(0.01)**	*			
GF Revenues: Lottery (REVLOT)			**-0.18** **(0.07)**	*			
GF Revenues: Sales (REVSALE)			0.00 (0.01)				
Share GSP: Ag., Forest, Fishing, Mining (GSPAG)					**0.20** **(0.02)**	*	
Share GSP: Const., Manu., Transp., Utilities (GSPCON)					**0.13** **(0.02)**	*	
Share GSP: Government (GSPGOV)					**0.17** **(0.04)**	*	
Share GSP: Wholesale and Retail Trade (GSPTRADE)					**0.45** **(0.07)**	*	
Weighted Average Nonresident Tuition in the Geographic Region in $1,000 (REGTUIT)							0.00 (0.00)
Number of PhD degrees awarded per Bachelors Degrees Awarded (PHDBA)							**0.70** **(0.09)**
Share of Public Higher Education Enrollments in Two-Year Colleges (TWOYEAR)							**0.06** **(0.01)**
Average SAT in 100s (SAT)							**1.63** **(0.17)**
Research & Development Expend. Per Capita ($100) (RND)							-0.93 (0.53)
Giving per Student ($1,000) (GIVE)							-0.11 (0.10)
Endowment per Student ($1,000) (ENDOW)							**-0.36** **(0.04)**
Share PhD Awarded in Science and Engin. (PHDSCI)							**-3.42** **(1.08)**
Public Higher Education Quality (Barron's)							**-0.91** **(0.27)**
Capacity (CAPAC)							**-2.16** **(0.38)**
Share Pop >25 with College degree / Share Pop >25 HS Grads							**0.93** **(0.24)**
R^2	0.560		0.552		0.541		n/a
Observations	1300		1300		1300		1300

Notes: All regressions include year effects and dummy variables correcting for missing values that equal 1 when the relevant explanatory variable is missing and 0 otherwise. The missing values of the explanatory variables take a value of 0 when the missing dummy equals one. All R2 are adjusted R2 and standard errors in (parentheses) are corrected for heteroscedasticity. Specification (4) was not run using all variables in each model, I have compressed them into one category for presenation purposes. All specifications include variables from Table 4.1.

The findings in table 4.5 can be described briefly. States which rely on lotteries to generate sizable portions of their revenues prefer to fund student aid over

institutional appropriations (REVLOT). This is not surprising given that many of the merit based aid programs in the United States are funded from dedicated lottery revenues. Just as in the HESHARE results above, supporters of public higher education institutions should be concerned that states in which public colleges generate more annual giving (GIVE) and accumulate larger endowments (ENDOW) than their counterparts will spend considerably less on institutions relative to students. The combined effects of these two estimates suggest that if two states were identical in all aspects aside from giving and endowment levels at their public colleges, and one state were at the top end of this private fundraising distribution and the other at the bottom, their INSHARES would be expected to differ by almost 3 percentage points. In other words, states in which public colleges take measures to ensure long-term fiscal health will provide institutional appropriations per student at approximately $225 below states whose colleges do not take such measures.

Table 4.5: OLS Regressions for Share of State Public Higher Education Budgets Allocated to Public Institutions (INSHARE) - Supplemental Specifications

***Bold 95% significance**	(1)		(2)		(3)		(4)	
Assembly per Senate Seats (LEGSEAT)	**0.54 (0.05)**	*						
Voter Turnout (VOTE)	**0.05 (0.01)**	*						
State Government Uniparty (UNIPARTY)	0.54 (0.29)							
Governor Election Year (GOVELECT)	-0.10 (0.28)							
Governor Democrat (GOVDEM)	0.03 (0.20)							
GF Revenues: Corp. Income Taxes (REVCORP)			**-0.08 (0.03)**	*				
GF Revenues: Fuels (REVFUEL)			**0.86 (0.07)**	*				
GF Revenues: Indiv. Income Taxes (REVINC)			**-0.087 (0.009)**	*				
GF Revenues: Lottery (REVLOT)			**-0.18 (0.07)**	*				
GF Revenues: Sales (REVSALE)			**-0.07 (0.01)**	*				
Share GSP: Ag., Forest, Fishing, Mining (GSPAG)					**0.12 (0.02)**	*		
Share GSP: Const., Manu., Transp., Utilities (GSPCON)					**0.07 (0.02)**	*		
Share GSP: Government (GSPGOV)					**0.23 (0.04)**	*		
Share GSP: Wholesale and Retail Trade (GSPTRADE)					**0.19 (0.09)**	*		
College Enrollment Rate (ENRATE)							**-0.014 (0.006)**	*
Research & Development Expend. Per Capita ($100) (RND)							0.33 (0.71)	
Giving per Student ($1,000) (GIVE)							**-0.34 (0.10)**	*
Endowment per Student ($1,000) (ENDOW)							**-0.11 (0.05)**	*
Share PhD Awarded in Science and Engin. (PHDSCI)							-2.12 (1.35)	
Capacity (CAPAC)							**2.25 (0.32)**	*
Regional Nonresident Tuition ($1,000) (REGTUIT)							0.02 (0.13)	
Share Pop >25 with College degree (EDCOL)							**-0.64 (0.27)**	*
R^2	0.492		0.549		0.456			
Observations	1250		1250		1250		1250	

Notes: All regressions include year effects and dummy variables correcting for missing values that equal 1 when the relevant explanatory variable is missing and 0 otherwise. The missing values of the explanatory variables take a value of 0 when the missing dummy equals one. All R2 are adjusted R2 and standard errors in (parentheses) are corrected for heteroscedasticity. Specification (4) was not run using all variables in each model, I have compressed them into one category for presenation purposes. All specifications include variables from Table 4.2.

Finally, states that have excess seating capacity (CAPAC) at their public colleges give a considerably larger share of higher education dollars to institutions than do states that have run up against capacity constraints. For example, the University of California and California State University Systems in the 2004-2005

academic year do not have enough room to accommodate all of the students that would normally be qualified to attend these institutions. As a result, the state of California has agreed to award scholarships (in the amount of the total tuition bill) to any of these students that choose to matriculate at a community college rather than a Cal State or UC school.[137]

Estimates on Sub-Samples of Data

Table 4.6 depicts how the three budget share measures varied in 2001 in different sub-samples of the states. Though none of the raw differences within each category are statistically different from one another at the 95% level, the magnitudes of several differences are substantial. There are four factors that seem to be correlated with favorable treatments toward higher education institutions. In states that have higher education funding formulae, in states outside of New England, in states where there is little political competition and in states with low population densities, the outcome measures are considerably larger. In addition, institutional support is favored over student support in states operating on biennial budget cycles, in states where colleges have little autonomy, where governors have limited power to reduce appropriations and where the governments are controlled by a single party.

[137] Peter Y. Hong. "Cuts Will Detour Some Students Bound for UC, Cal State." *Los Angeles Times,* 03/07/04.

Table 4.6: 2001 Outcome Levels by State Institutional Characteristics

Institutional Characteristic		EDSHARE	HESHARE	INSHARE
Autonomy of Higher Eduction Institutions	Yes (25 states)	36.20	16.49	91.91
	No (25 states)	35.88	16.32	96.34
Budget Cycle Length	2-Years (23 states)	36.75	16.47	95.47
	1-Year (27 states)	35.49	16.39	92.16
Court Reform State in 2001	Yes (24 states)	36.52	15.68	94.31
	No (26 states)	35.66	16.47	93.10
Funding Formula	Yes (29 states)	36.93	17.13	94.14
	No (21 states)	34.88	15.43	93.05
Governor Can Reduce Appropriations w/out Approval	Yes (37 states)	36.34	16.49	92.59
	No (13 states)	35.31	16.22	96.78
New England / Northeast	Yes (9 states)	29.99	13.54	88.57
	No (41 states)	37.40	17.05	94.80
Political Competition	Competitive (25 states)	35.25	15.93	92.26
	Non-compet. (25 states)	36.89	16.93	95.10
Population Density	Dense (25 states)	35.05	15.94	91.36
	Less Dense (25 states)	37.09	16.90	96.01
Uniparty Government	Yes (43% of state-years)	36.00	16.40	94.75
	No (57% of state-years)	36.11	16.16	93.06

Notes: No raw differences are statistically different across categories at 95% confidence level.

Despite these large raw differences, the conditional means are nearly identical for each sub-sample (not shown) and most of the baseline findings from tables 4.1 and 4.2 are maintained when the models are re-estimated in these different sub-samples. Several exceptions merit attention however and table 4.7 summarizes the statistical results.

Table 4.7: Summary of Cross-Section Regressions on Data Sub-Samples

	Autonomy		*Budget Cycle*		*Funding Formula*		*Governor Power*		*Northeast*		*Political Comp.*		*Pop. Density*		*Uniparty Gov.*	
	Yes	No	2 Year	1 Year	Yes	No	Yes	No	In	Out	High	Low	High	Low	Yes	No
EDSHARE																
Income										⊠	⊠		⊠	⊗		
Court	×	⊠		⊠				⊠		⊠	⊠		×	⊠		⊠
Elderly	⊠							⊗				×				
Prices (Relative)				⊠			⊠	⊗	⊗			⊠			⊠	
Race									×				×	⊠		
Unemployment			⊗	⊠												
Health								⊗					⊠	⊗		
Crime											⊠					
HESHARE																
Income		⊠		⊠	⊠					⊠		⊠				
Court		⊠			×	⊠					⊠	⊗	⊗			
Prices (Relative)						⊠										
Share HE in Privates		⊠		×						×			×		×	
Share K12 in Privates	⊠	⊗							⊗	×			×		×	
Race								⊗					⊠	×		
Unemployment									×							
Out-migration					×											
INSHARE																
Income	⊠		⊠								⊠			⊠		
Merit	×	⊠			⊠	⊗					⊗		⊠	×	×	
Pell	⊠											⊠				
Share Enroll 2-Years				⊠		⊠		⊠	⊠				⊗	⊠		⊠
Elderly					⊠			⊠		×		×			×	×
College Population								⊠	⊠							
Race		×			×		⊠	×				×	⊠			
Out-migration																
SAT		⊗	⊗	⊠			⊗	⊠		⊠				×		
PhD per BA		×														
Regional Tuition	⊗	⊠				⊠			⊗	⊠	⊗	⊠	⊠		⊗	⊠

× = statistical zeros in splits, but not in pooled sample
⊠ = produced estimates significantly larger (absolute value) than those in baseline regressions
⊗ = produced significant estimates opposite those in baseline regressions
Note: Table presents only variables that were statistically different from other sub-sample with 90% confidence

Re-estimating the baseline regressions after splitting the sample into the 25 most densely populated and the 25 least densely populated states provides useful insight into why different states exhibit different preferences for funding education rather than other budget items. Court mandated elementary and secondary school district spending equalization initiatives seem to lead to larger EDSHARES in rural states that have them (relative to rural states that do not have them), while leading to lower EDSHARES in more densely populated states that have them (relative to urban states that do not have them). The negative impact of cross-cohort ethnic heterogeneity in the baseline model is most dramatic in the less densely populated states. Further, I find evidence that the lack of importance in health care costs in explaining cross-sectional differences in education funding preferences may be due to the finding that health care costs lead to a crowding-out of education in the rural states while health care costs seem to be related to a crowding-in in the more urban states. At first glance, it is hard to understand why education budget shares would increase when health care costs increase, but this might be due to the fact that health care costs are capturing very large improvements in the quality of health care in these states, which is understood to have a synergistic relationship with worker productivity, and perhaps education investments.

Turning to the decision to fund higher education versus K12 education, it appears that factors affecting preferences for higher education funding are comparable in most sub-samples of states, with the exception of states with higher education funding formulas and in densely populated states. It is not very surprising that in funding formula states, those that have undergone court mandated elementary and secondary school equalization initiatives do not differ in their preferences for funding higher education from those that have not. This is not surprising because the cross-section estimates do not capture changes in the formulas over time (which might be

impacted by the court mandated equalization programs), only the fact that higher education spending in these states is a function of the composition of enrollments – which is not impacted by the court mandated reforms to K12 education.

The impact of cross-cohort ethnic heterogeneity is driven by the large effect in densely populated states. While the baseline estimate in table 4.1 suggests that if two states differ in COLK12RACE by one percentage point, their HESHARE will differ by 1.4 percentage points, within the sub-sample of densely populated states, a one percentage point difference in this cross-cohort ethnic heterogeneity variable would suggest that the more heterogeneous states give 3 percentage points less to higher education than their homogeneous counterparts.

Moving to the INSHARE results, I find that the lack of an impact of regional tuition rates explaining cross-state differences in INSHARES is likely due to the fact that states that within the group of states that grant their colleges and universities substantial governing autonomy, those in areas where regional tuition is high have significantly lower INSHARES than in those where regional tuition is low. By allowing INSHARES to fall, this is an implicit allowance by these states to have their public colleges and universities increase tuition rates in response to regional tuition pressures. On the other hand, within the states that exert a strong amount of influence in institutional governance matters, states in areas where regional tuition rates are high have larger INSHARES than in the states where regional tuition rates are low. The large difference in INSHARES explained by differences in the availability of merit aid programs is primarily seen in the states with little institutional autonomy.

Finally, the difference in the conditional expectation of INSHARES in politically non-competitive states versus the competitive states is much larger than the unconditioned difference from table 4.6. While the unconditioned difference is nearly three percentage points, I find that controlling for the explanatory variables in the

baseline models, states in which political competition is most intense have INSHARES nearly five percentage points lower than their less-competitive counterparts.[138] In plain English, states with intense political competition make greater use of student aid than do states without much competition. One need look no further than Zell Miller's successful campaign for governor in Georgia in the early 1990s as evidence that student aid programs ring a politically popular note with voters.

[138] A simple t-test indicates that this difference is statistically significant with 99% confidence assuming zero covariance between the conditional means in each sample.

CHAPTER FIVE

COMPARISON OF CROSS-STATE AND WITHIN-STATE ECONOMETRIC ESTIMATES

This chapter briefly describes how the cross-state results from this chapter diverge from the within-state estimates from chapter three and the implications of these differences. In this section, I present tests of whether estimates from the pooled OLS regressions in chapter four are statistically different than the estimates from the within-state regressions in chapter three. Any particular pooled OLS estimate may be biased for the true population impact of the explanatory variable on that particular budget share if unobserved state characteristics are correlated with some of the explanatory variables in the model. In most cases, I do not have an *a priori* expectation as to the sign of the bias, only that it is likely to exist.

Table 5.1: Omnibus Test of Difference between Pooled OLS Estimator of Chapter Four and Within Estimator of Chapter Three

Equation	χ^2 Statistic	Degrees of Freedom	p-value
EDSHARE	2,718	17	0.000
HESHARE	71	15	0.000
INSHARE	646	17	0.000

In the test depicted in Table 5.1, I find that collectively the estimates produced by the pooled OLS estimator are statistically different than the estimates produced by the within state estimator for each of the three baseline budget share equations. While interesting, this fact alone does not provide one with any insight as to which particular estimates are driving this finding.

Since regression estimates are simply weighted mean functions, in order to test whether the pooled OLS estimator (call it β_T) is statistically different than the within

state estimator in chapter three (call it β_W) one need merely to construct a t-statistic:

$$\frac{\beta_T - \beta_W}{\sigma_{\beta_T - \beta_W}}. \tag{5.1}$$

The dimension of this vector is equal to the number of parameters (***k***) estimated for each of the three outcome measures. Acquiring the standard deviation of the difference in the estimators requires getting one's hands dirty. Start with an expression for the variance of ($\beta_T - \beta_W$):

$$Var(\beta_T) + Var(\beta_W) - 2Cov(\beta_T, \beta_W). \tag{5.2}$$

This is a ***(k x k)*** symmetric matrix. In order to compute the covariance term it would be useful to take advantage of the fact that the pooled OLS estimator is a matrix weighted average of the within estimator and what is known as the between estimator (call it β_B).[139] Write this relationship as:

$$\beta_T = \theta\beta_W + (I - \theta)\beta_B. \tag{5.3}$$

Then, the covariance of β_T with β_W is:

$$Cov(\beta_T, \beta_W) = Cov[(\theta\beta_W + (1-\theta)\beta_B), \beta_W] \tag{5.4}$$

$$= Cov(\theta\beta_W, \beta_W) + Cov((1-\theta)\beta_B, \beta_W) \tag{5.5}$$

[139] The between estimator, β_b, for the sample of data I use in this dissertation would be retrieved from estimating the regression: $\overline{outcome}_i = \sum_{k=1}^{K} \beta_{kb} \overline{X}_{ki} + \overline{u}_i$.

$$= \theta\sigma^2_{\beta_W} + (1-\theta)Cov(\beta_B, \beta_W) \tag{5.6}$$

And plugging equation 5.6 into equation 5.2, the variance of the difference in the means is:

$$Var(\beta_T - \beta_W) = Var(\beta_T) + Var(\beta_W) - 2\{\theta\sigma^2_{\beta_W} + (1-\theta)Cov(\beta_B, \beta_W)\} \tag{5.7}$$

And since the between estimator and the within estimator are orthogonal, their covariance is zero and equation 5.7 can be rewritten as:[140]

$$Var(\beta_T - \beta_W) = \sigma^2_{\beta_T} + \sigma^2_{\beta_W} - 2\theta\sigma^2_{\beta_W} . \tag{5.8}$$

To test the similarity of one parameter at a time, the square root of the corresponding matrix coordinate in equation 5.8 will yield the appropriate denominator in the test statistic given in 5.1. In order to construct the test statistics given by equation 5.1 I need to calculate the weights θ in equation 5.3; all of the other necessary parameters have been estimated with the baseline regressions. The (***k x k***) matrix θ can be computed directly from my raw data since it is an algebraic combination of the within sum of squares of the explanatory variables (call this W_{xx}) and the between sum of squares (times the number of time periods) of the explanatory variables (call this B_{xx}).[141] Of course, a separate θ needs to be calculated for each outcome measure.[142]

[140] They are orthogonal because the mean is the quantity such that deviations from it are orthogonal to it. The orthogonality of the between and within estimators is simply the first order condition from minimizing the sum of the squared errors of the total deviations.

[141] Contact the author for a derivation. The theta is retrieved by computing the following matrix: $\theta = (W_{XX} + B_{XX})^{-1} W_{XX}$. This is a **K** x **K** matrix.

Tables 5.2 through 5.4 present the results from statistical tests that examine whether the pooled OLS estimates are statistically different than the within state estimates for a subset of variables in each of the three outcome equations. The tables present the estimated coefficient and standard error from the corresponding baseline models in the first two columns. The third and fourth columns present the standard deviation of the difference between the pooled OLS estimate and the within state estimate (pulled from the diagonal of the variance-covariance matrix calculated by solving equation 5.8 - the off diagonal covariance terms are used when testing multiple parameter estimates.) and the relevant p-value for each statistic. [143]

The results for the EDSHARE equations in Table 5.2 indicate that unobserved state-specific and time-invariant factors are positively correlated with median income (INC). This 1½ percentage point difference between the pooled OLS estimator and the within-state estimator is statistically significant with more than 99% confidence. For example, it might be the case that states with a "smarter" population have higher incomes, but that I haven't captured this measure well enough by my current vector of

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[142] The variance-covariance matrix of the difference in the estimators used to construct the test statistics is available from the author upon request.

[143] $Var(\beta_T - \beta_W)$ is a (***k x k***) matrix that has the variance of the difference of each of the ***k*** individual parameter estimates in the pooled sample versus the within sample along the diagonal and the covariance of the difference across different parameters off of the diagonal. The diagonal elements of this matrix are all I need to do the pair-wise tests I propose. The off-diagonal elements would only be needed to test cross-parameter differences, or more practically, the significance of multiple differences. The variance – covariance matrix will thus look like:

$$Var(\beta_T - \beta_W) = \begin{bmatrix} \sigma^2_{\beta_T^1 - \beta_W^1} & \sigma_{\beta_T^1 - \beta_W^1}\sigma_{\beta_T^2 - \beta_W^2} & \cdots & \cdots & \sigma_{\beta_T^1 - \beta_W^1}\sigma_{\beta_T^K - \beta_W^K} \\ \vdots & \sigma^2_{\beta_T^2 - \beta_W^2} & & & \vdots \\ \vdots & & \ddots & & \vdots \\ \vdots & & & \ddots & \vdots \\ \sigma_{\beta_T^K - \beta_W^K}\sigma_{\beta_T^1 - \beta_W^1} & \cdots & \cdots & \cdots & \sigma^2_{\beta_T^K - \beta_W^K} \end{bmatrix}$$

explanatory variables. Then in the cross-section, the impact of median income reflects the true negative relationship of income on EDSHARES, but also the positive contribution of a more educated population's relative preference for education spending. To reemphasize an earlier point, this statistical difference does not change the interpretation of the pooled OLS estimates on their face (in this case that observed differences across states in income levels do not explain observed differences across states in EDSHARES), but rather indicates that the within state estimates control for these unobservables better than the pooled OLS estimates do. In such a case, inferences about policy should be drawn from the within state estimators.[144]

[144] Assuming that the within state equations are properly specified and that systematic measurement error is not prominent in the data.

Table 5.2: Comparison of Selected Estimates from Table 4.1 and Table 3.1 Education's Share of State General Fund Budgets (EDSHARE)

(standard errors)	Pooled OLS Estimates (β_T)	Within State Estimates (β_W)	$\sigma_{\beta T-\beta W}$	p-value
INC	0.24 (0.44)	-1.27 (0.28)	0.000	**0.000 ****
INEQU	-5.81 (2.73)	-5.13 (1.81)	3.270	0.435
ELDERLY	0.32 (0.20)	-0.41 (0.18)	0.242	0.102
SCHOOLAGE	1.05 (0.09)	0.62 (0.12)	0.096	0.070
SCHOOLRACERATIO	-6.51 (1.37)	1.42 (1.10)	1.336	**0.050 ***
INMIG	0.19 (0.10)	0.02 (0.05)	0.087	0.147
OUTMIG	-0.31 (0.13)	0.06 (0.06)	0.117	0.098
COLPRV	-0.14 (0.01)	-0.05 (0.02)	0.021	0.071
FEDTRAN	-6.44 (2.14)	-0.56 (0.36)	0.002	**0.000 ****
UNEMP	-0.20 (0.10)	-0.05 (0.06)	0.096	0.177
HEALTH	0.06 (0.12)	-0.02 (0.06)	0.105	0.291
CRIME	0.71 (0.14)	0.03 (0.12)	0.150	0.069
COURT	0.98 (0.33)	1.18 (0.30)	0.364	0.339

**** statistically different with at least 99% confidence**
*** statistically different with at least 95% confidence**

Three additional results stand out from Table 5.2. The substantial negative impacts of both cross-cohort ethnic heterogeneity (SCHOOLRACERATIO) and federal government transfers to the states (FEDTRAN) in the cross-section are not likely due to differences in sampling variation across the two estimated equations, but more likely due to systematic negative correlations between fixed unobservables and SCHOOLRACERATIO and FEDTRAN. Third, this table provides even stronger evidence than the baseline estimates that competing interests in the state do not seem

to be crowding out education spending as the estimated differences of CRIME, HEALTH and UNEMP are not different that zero, nor are their individual impacts.

Turning to the tests in table 5.3 it is striking that though the point estimates of many of the explanatory variables pass the "eyeball test" that they are different across the two equations, statistically these differences are likely due to sampling variation rather than there being any important unobserved effects playing a role in HESHARES. However, the one near significant finding is that if one were to ignore the within state estimates, as many studies in political economy are forced to do, one would not be able to find any impact of court reforms on HESHARES. States with court reforms do not spend any less on higher education than states without them, but looking within a state, when a court reform is mandated, the HESHARE will fall substantially in response. There must be unobserved state-specific and time-invariant characteristics that are positively associated with whether a state has a court reform that are being captured by COURT in the cross-section causing the statistical zero estimate. Also, since the variance of COURT is not very large, the size of the bias is likely to be larger than for a variable that exhibits more dramatic random variation.

Table 5.3: Comparison of Selected Estimates from Table 4.1 and Table 3.1 Higher Education's Share of the Education Budget (HESHARE)

(standard errors)	Pooled OLS Estimates (β_T)	Within State Estimates (β_W)	$\sigma_{\beta T-\beta W}$	p-value
INC	-0.23 (0.27)	0.61 (0.23)	1.439	0.332
INEQU	-0.19 (1.73)	4.12 (1.52)	1.634	0.115
COLRATIO	0.02 (0.05)	0.13 (0.04)	0.034	0.091
COLK12RACE	-1.41 (0.32)	-0.15 (0.14)	0.385	0.095
RACEINTERACT	0.05 (0.01)	0.04 (0.01)	0.011	0.252
INMIG	-0.13 (0.05)	-0.02 (0.03)	0.043	0.119
OUTMIG	0.08 (0.09)	-0.13 (0.06)	0.345	0.329
UNEMP	-0.76 (0.07)	-0.22 (0.05)	0.784	0.306
COURT	-0.03 (0.22)	-1.19 (0.25)	0.244	0.066

**** statistically different with at least 99% confidence**
*** statistically different with at least 95% confidence**

As with the HESHARE results while many of the coefficients on the explanatory variables in the pooled OLS estimates in table 5.4 appear to be different than the coefficients derived from the within estimator, with few exceptions this is most likely due to sampling variation. The two notable exceptions are that the large differences across estimators in the impact of regional tuition rates (REGTUIT) and in the share of students enrolled in private higher education institutions (COLPRV) are statistically significant – suggesting that unobservables are responsible for the negative estimate of COLPRV and the zero estimate of REGTUIT in the cross-section regressions.

Table 5.4: Comparison of Selected Estimates from Table 4.2 and Table 3.2 Institutional Share of Higher Education Budgets (INSHARE)

(standard errors)	Pooled OLS Estimates (β_T)	Within State Estimates (β_W)	$\sigma_{\beta T-\beta W}$	p-value
INC	-0.10 (0.36)	0.23 (0.16)	0.062	0.060
ELDERLY	0.14 (0.07)	0.38 (0.10)	0.065	0.084
COLLAGE	0.66 (0.23)	0.28 (0.12)	0.263	0.192
OUTMIG	0.05 (0.10)	-0.09 (0.05)	0.042	0.095
UNEMP	-0.23 (0.06)	0.03 (0.04)	0.057	0.070
COLPRV	-0.16 (0.01)	0.02 (0.01)	0.016	**0.029 ***
PELL	0.07 (0.06)	-0.06 (0.03)	0.077	0.166
REGTUIT	0.00 (0.13)	-0.21 (0.09)	0.000	**0.000 ****
PHDBA	-0.51 (0.08)	-0.15 (0.12)	1.153	0.404
SAT	0.57 (0.20)	0.29 (0.18)	0.002	**0.002 ****
MERIT	-2.17 (0.63)	-2.86 (0.27)	0.194	0.087

**** statistically different with at least 99% confidence**
*** statistically different with at least 95% confidence**

CHAPTER SIX

CONCLUSION

The race to the bottom in state funding for public higher education has serious implications for academic quality at our public colleges and universities and for the productivity and security of our nation in the future. No institution is immune from the resource squeeze. The University of Michigan is being forced to make tradeoffs just like Wichita State University and Tompkins-Cortland Community College. While the decisions each face are different (e.g. Michigan might decide between increasing the size of its introductory classes or hiring more part-time faculty while Wichita State might decide between keeping faculty salaries constant while accommodating increased enrollments or increasing faculty salaries but turning deserving students away), the causes are the same. In nearly all 50 states, the share of state tax dollars ultimately finding its way to public higher education institutions has fallen by well over 25% in the past 30 years and schools and states are rapidly spiraling toward the private high-tuition equilibrium.

With the higher education act up for reauthorization this year a lot of attention will be paid to the high sticker prices of colleges and universities or the unpleasant outcomes of institutional decisions forced by the aforementioned tradeoffs. What will largely be ignored are the questions of how we got here and who ultimately bears the burden of the withdrawal of state funding. Like a fish tank that leaks a drop of water per week, it will go largely unnoticed until after several years someone complains that their fish are near death because there's so little room to swim. There's only so many roofs that higher education institutions can delay maintaining – they can't continue to seek temporary financial equilibrium by marginalizing the future. Before I summarize the empirical results of this dissertation, allow me to answer several questions.

Why Might the Private High-Tuition Equilibrium be Undesirable?

If one were to write down an economic model of higher education finance, the most efficient outcome would be for all universities to charge a price equal to marginal cost *for each student.* Given the ability of most colleges and universities to generate revenues from outside sources, they could then discount tuition prices for those least able to pay. Theoretically this is a great idea, but it has some difficulties in its application.

Under a high-tuition high-aid strategy (HTHAS) there is no guarantee that the aid dollars will go to those students that need it the most. The most transparent reason for this is the difficulty in ascertaining what true ability to pay is. A family of four with a combined income of $100,000 and renting a home is not necessarily more able to pay for college for one of its children than a family of four with a combined income of $40,000, but which owns a home worth $1,500,000. An HTHAS poses a substantial moral hazard problem.

If it is true that there are substantial spillover effects and other positive externalities from individual investments in higher education, under a HTHAS the classic under-provision problem for public goods may well be exacerbated due to an inability for high paying students to internalize all of the benefits.

Dramatic tuition increases that would accompany a HTHAS may disproportionately hurt the middle-class (and likely the median voters) whose family incomes would be too high to receive financial aid, but have not increased fast enough to keep pace with the rate of tuition increases. A recent study by Hill, Winston and Boyd (2004) indicates that at twenty-eight of the most highly selective (and most costly) private colleges and universities (COFHE schools) low income students actually pay very little to attend these institutions (at one school an average student from the bottom income quintile paid less than $800 per year to attend). The study

also found that while average sticker prices at the COFHE schools are 66% of median U.S. family income, the average student coming from a family with that level of income pays only 23% of her family income to attend. These results do not likely have external validity as the resource base at the COFHE schools dwarfs that of the average public institution.

Movement to a HTHAS may lead to an increase in competition for those students that are able to pay the full sticker price. The larger the share of a student body that pays full price, the more generous institutional financial aid packages can be to those students that cannot afford to pay. Such a strategy would likely decrease the number of low-income students that attend higher quality institutions and will result in even more institutional stratification in quality than that which exists today and at the extreme case an unraveling as envisioned in a pure adverse selection model. The movement away from having a continuum of student financial aid packages and toward a two-peaked discrete distribution might diminish the collegiality within an institution as inevitably the students (and their families) that are paying full cost are receiving the same education as students that are paying substantially less. Finally, the gap between the institutional haves and have-nots may continue to widen as the schools that are able to enroll a wealthier student body would have a larger base from which to draw annual alumni contributions and to build endowments.

A conversion to an entirely need-based aid system may cost states more in the long run than a system of broad appropriations. While institutions of higher education currently have some incentive to keep tuition low (to ensure that they will receive state money the following year), under a HTHAS there would be no such controls as institutions will increase tuition as much as possible to maximize revenues from both students and state-aid. This concern is real. The College Board reports that the institutions that have been increasing tuition rates the fastest over the last decade are

the for-profit private universities. One effect of these increases is to transfer a substantial pool of public money into the private for-profit sector and likely leads to a larger amount of federal money being spent on student aid than otherwise would prevail.

States that move to a HTHAS will necessarily grant a large degree of autonomy to their state institutions. While in many cases this would lead to better institutional outcomes, one area that would be threatened by this move would be the public service mission of state colleges and universities. Extension programs are very expensive to maintain, if for the only reason of the overhead cost of maintaining numerous satellite outposts throughout each state, and would likely be the first target for elimination as universities are granted more autonomy. One might also begin to notice a change in the program offerings of colleges and universities toward more profitable enterprises.

As states continue to allow their public colleges and universities to pursue HTHAS, it would not be surprising to see the public institutions behave more like their private counterparts as far as fundraising is concerned. This might cause concern for two reasons. First, most of the public colleges and universities are starting from such a low base of tuition, private giving and endowment levels relative to their private counterparts that it would take an extremely long time for them to catch up. Second, there are governance and conflict of interest questions that may be more important. For example, the University of Georgia has had to turn to foundation trustees to pay half of the President's salary. A recent dispute involving the athletic program there has caused these trustees to call for his ouster, while the public regents that pay the other half of his salary want him to remain. Additional conflicts may result from a deterioration of the "Chinese Wall" between the sources of research funding and the independence of the research being undertaken. The debate over the

sanctity of the privately funded biomedical and agricultural research undertaken at many national public universities has already begun to rage.

Finally if states move to a HTHAS the question remains of whether enough students will be able to receive the benefits of a higher education. If the "average" state spent its entire higher education budget on student aid in 2001, 71,000 students would have received a full tuition scholarship at those relatively low tuition levels. There would be an additional 89,000 students that would be forced to pay the full cost of a public education (about $17,000 per student per year). One-sixth of the students that attend my institution (Cornell University) receive a Pell grant and nationwide over 50% of all students in higher education receive some form of financial aid. Given the conservative estimates above, 56% of the public school students in the average state would require substantial financial assistance.

Isn't Elementary and Secondary Education More Important?

To make any reasonable assessment here the near impossible task of computing the marginal benefits and costs needs to be done. Even assuming that both the K12 and higher education sectors are in equilibrium, it wouldn't be hard to imagine why the marginal dollars should be distributed to both sectors. K12's synergy with higher education is irrefutable. The production and quality of the next generation of K12 teachers depends vitally on the health of the public higher education sector. Also, in allocating marginal dollars, the spillover effects of larger investments in higher education are likely to be at least as large as those invested in the K12 sector.

Are our Priorities in Order?

In 2002, residents of the United States spent a combined $50 billion consuming alcohol products and legal pornographic products. In total, the 50 states spent $60 billion on public higher education.[145]

Summary of Empirical Results

Though no universally accepted structural (theoretical) model of political economic equilibrium exists, empirical specifications describing preferences for public spending on public education yield valuable insights into why public higher education is facing an alarming fiscal crisis. The empirical evidence in this dissertation suggests that all of the observed four percentage point fall in education's share of state general fund budgets has been attributable to changes in the income distribution within states. Though measures of competing interest groups seem to not have crowded out education spending, their effects are confounded by them having differential impacts in different sub-samples of states.

While collectively, observable within state changes are unable to explain the six percentage point drop in the share of the education budget allocated to public higher education since 1977, there is substantial evidence that the discretionary nature of higher education spending and its ability to independently raise revenues have caused its decline. Dynamic panel estimates indicate that states do not practice strictly incremental budgeting, and exercise the most discretion over the determination of the higher education – K12 split than among other budget decisions. Further, estimates on a sample split by three different time periods indicate that the sensitivity of higher education budget shares to declining labor market conditions has increased over time.

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[145] In total, expenditures on public higher education were just over $120 billion. *Source*: 2004 Economic Report of the President.

Attempts by public institutions to respond to lagging state appropriations by increasing tuition or private fundraising efforts have been met with substantial chagrin by state legislatures and calls into question exactly what institutions are expected to do in the face of budget difficulties as they rapidly spiral toward the private equilibrium.

The 3.9 percentage point decline in the share of higher education budgets allocated to public institutions, as opposed to students, can be fully explained by changes in the relative size of the college aged cohort, increases in nonresident tuition rates in the geographic region and by a movement to merit aid programs in 10 states over the past decade. Investigation of the merit aid result reveals that the increasing popularity of non-means tested aid has not been altruistically motivated. I find evidence that these targeted programs are used to redistribute income to well-off families and to avoid providing broad based institutional support that would benefit economically disadvantaged members of the populace. A hypothesis advanced by current president of Murray State University, King Alexander (2001), that federal aid programs provide perverse incentives for higher education funding in that low tax effort states are rewarded with more federal aid than high tax effort states, is supported by these results as well. I find that as more households in a state become eligible to receive a federal Pell grant that states respond by moving aid away from institutions and toward students. In fact, these perverse incentives may account for some of the unexplained fall in the HESHARE from above. The more support a state provides for its public institutions, and hence the lower the tuition rates are, the less federal aid its students will be eligible to receive. This is consistent with the result in Rizzo and Ehrenberg (2004) that increases in federal Pell grant generosity and state need-based grant aid awards result in increases in in-state tuition levels at flagship public universities.

Several additional results deserve attention. Similar to other studies, I find that court mandated K12 equalization schemes have resulted in substantial increases in K12 spending within states. However, unlike these studies I find that 36% of the total spending increase has come at the expense of public higher education – representing $280 per full-time public college student in an average sized state. My results also indicate that ethnic heterogeneity across age cohorts results in state funding being allocated to the schooling cohorts that look most similar to the non-school age population in a state.

Figure 6.1 summarizes the results from both the EDSHARE and HESHARE regressions in a single table by indicating exactly which states look with favor and disfavor on education spending. The raw data used to create this figure are presented both graphically and in tabular form in appendix figures two and three and in appendix table two. The points along the horizontal axis are retrieved by estimating the state effect (the c_i) from equation 3.1 (for the EDSHARE outcome) and then ranking the states according to the size of the unobserved effect. Broadly speaking this estimated c_i represents a state's fixed preference for funding education relative to other budget items. States with a positive unobserved effect give a higher priority to educational expenditures than the "average" state.[146] In this figure, states that exhibit the strongest priority for education funding are assigned a rank in ascending order.

The points along the vertical axis are retrieved by estimating the state effect (the c_i) from equation 3.1 (for the HESHARE outcome) and then ranking the states according to the size of the unobserved effect. Broadly speaking this estimated c_i

[146] Not too much should be drawn from the magnitude of the unobserved effects. Their ordinality is of larger interest than their cardinality since the estimation method I use restricts $\sum_{i=1}^{50} c_i = 0$. In other words, the estimated fixed effects represent a state's deviation from the average state when the average state effect has been normalized to equal zero.

represents a state's fixed preference for funding higher education relative to K12 education. States with a positive unobserved effect give a higher priority to higher educational expenditures than the "average" state. In this figure, states that exhibit the strongest priority for higher education funding are assigned a rank in ascending order. These state effects can be considered to represent states' true tastes for higher education spending because they are computed while controlling for all of the observable factors that are expected to systematically influence budget shares (i.e. the explanatory variables in equation 3.1).

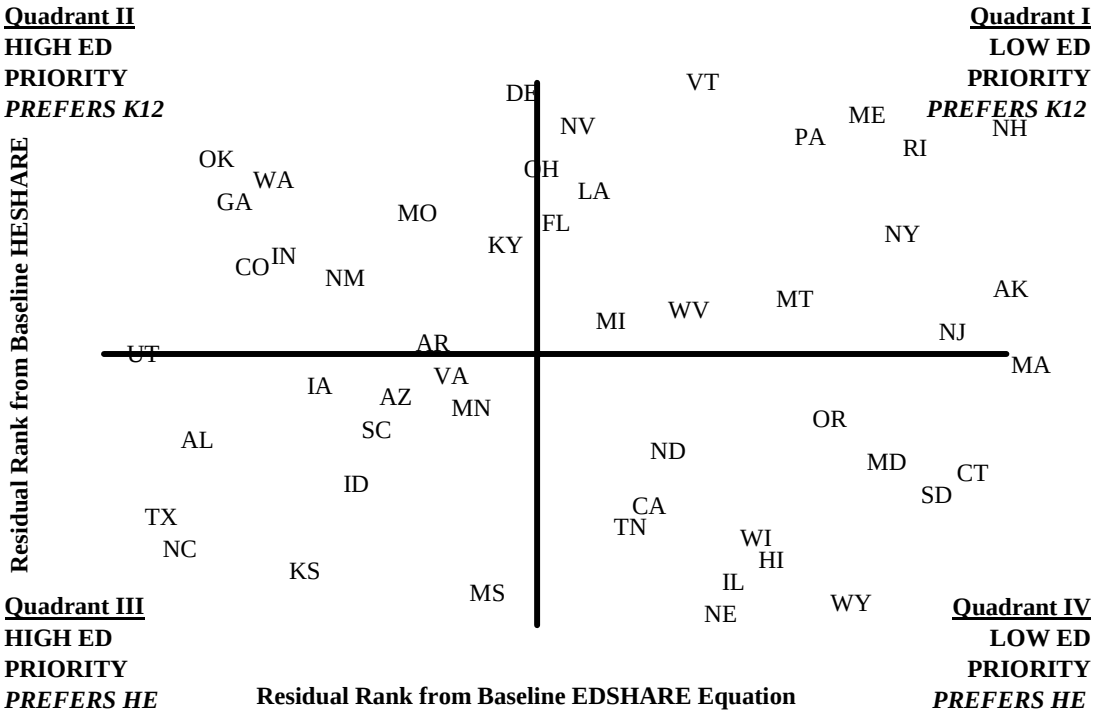

Figure 6.1
State Preferences for Funding Public Education

The 25 states that are located in the two western quadrants (II and III) are those that generally prefer to fund education over other budget items. The 25 states in the eastern quadrants (I and IV) are those that prefer to spend state tax dollars on non-educational items. The 25 states that are located in the two northern quadrants (I and

II) are those that prefer to fund K12 education over higher education, while the 25 states in the two southern quadrants (III and IV) prefer to fund higher education over K12 education. Therefore those states that look least favorably upon public higher education are those located in the first quadrant while those states that look most favorably upon higher education are located in the third.

What immediately stands out from this figure is that quadrant I is dominated by the states in the Northeastern U.S. With the slight exception of Connecticut every single northeastern state has a relative distaste for all forms of education spending. There is a more random group of states that are strong supporters of public higher education that includes North Carolina, Texas, Kansas, Alabama and Idaho. No clear regional distinctions emerge in the other two quadrants. Delaware, Oklahoma and Washington, while each preferring to spend a large share of their budgets on education, prefer to direct these education dollars to the K12 sector. While Nebraska, Wyoming, Illinois and Hawaii each do not prefer to devote a substantial share of state funds to education, prefer to allocate these scarce dollars to the higher education sector.

A somewhat surprising (to me) finding is that the rank order correlation between the EDSHARE state fixed effects and the HESHARE state fixed effects is 0.02. It does not appear that a state's (conditional) preference for higher education spending is related to its preference for funding education generally.[147] The way that I have constructed this figure is that states with a low numerical ranking are those that look more favorably upon an education budget share. Therefore the 0.31 rank order correlation between the HESHARE state fixed effects and the INSHARE state fixed effects indicates that those states that look less favorably on higher education tend to

[147] The rank order correlation between the fixed effect in the EDSHARE equation and the INSHARE equation is also low, 0.15.

use the limited higher education dollars to fund student aid programs as opposed to funding bloc grants to its public colleges and universities. This correlation may be capturing the fact that those states that do not have an enormous amount of money tied up in public higher education do not want to build costly public infrastructure when the private infrastructure is already there (or when a large share of their college-aged population leaves the state). Hence these states turn to student scholarship programs to provide its residents with access to an affordable education or to entice its residents to remain in the state.

Directions for Future Research

This dissertation's broad scope has opened the door to a number of interesting research questions. The strong relationship observed between tuition rates and budget shares in chapter three suggests that a focused dynamic analysis of the tuition – state appropriations relationship would be a fruitful endeavor. Among the strategies I envision pursuing are constructing a test of Granger causality using a vector autoregression (VAR) technique and applying the tools of macroeconomics to understand the tuition – appropriation equilibrium using a dynamic programming approach.

I could very well have estimated a fourth equation in this dissertation. The share of student aid dollars in the form of need-based aid has shrunk from 92% to 75% in the past decade alone. Since the INSHARE has been increasing substantially over this same period, whether the growth in merit-based aid programs has crowded out need-based aid spending is an empirical question that has yet to be answered.

The large and robust finding that court reforms have led to a partial crowding out of higher education spending naturally leads a researcher to ask what other K12 funding initiatives have an adverse affect on higher education appropriations. Many

states have instituted school property-tax relief programs which provide tax relief to certain state residents but these tax savings are reimbursed to the local school districts from the state budget (New York State's STAR program is an example). In fact, in November 2003 the voters in Maine rejected a statewide ballot initiative for a school property tax relief program due to the belief that the state would use funds from higher education to pay for the program.[148]

Examining the impacts of the budget share declines on a number of student and institutional outcomes is a fertile ground for future research (in terms of the specific impact on student outcomes and institutional quality). Eric Bettinger of Case Western Reserve University and Bridget Long of Harvard University are just beginning work analyzing the impact felt by first year students in the Ohio public school system from having taken a class from an adjunct faculty member. They are currently looking at student outcomes while still in college such as the probability of passing future courses in that field of study and the number of additional credit hours taken in that field of study. Ron Ehrenberg and Liang Zhang at the Cornell Higher Education Research Institute are in the process of using institutional level data across the United States to determine the impacts of non-tenure track faculty members have on various institutional outcomes such as graduation rates. Given the appropriate data, an enormously helpful study would be to determine the long-term labor market effects of various institutional quality characteristics on its graduates as well as other impacts of the characteristics on the universities themselves.

A study that I am in the beginning stages of will analyze whether fiscal illusion exists in the student matriculation decision. Since public colleges and universities are quickly moving to the private high-tuition high-aid strategy, it would be useful to understand how different students will respond to different financial aid packages.

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[148] Paul Carrier for www.Mainetoday.com, November 8, 2003.

One concern is that a student may react differently to two otherwise similarly valued financial aid scenarios if they are packaged differently. For example, for a net price of $10,000 a student today may be asked to pay tuition of $12,000 but receive a $2,000 merit scholarship award from the state. Would this same student be more or less likely to matriculate at the same institution of the tuition were raised to $35,000 per year with a corresponding $25,000 scholarship? Expected utility theory says that she ought to. Prospect theory and my own observations suggest otherwise.

Finally, it would be useful for someone to estimate how rates of return to investments in higher education vary across states and over time within states. In addition, these studies should do their best to do a detailed analysis of the correlation between public higher education investments and economic growth in those states.

Policy Implications

Many of the likely reasons for public higher education's decline are difficult to quantify, but may shed light on policy recommendations and a roadmap for future research. Perception surely represents a challenge for our public institutions. When laypeople think of college, an image of the ivory clad walls and expansive quadrangles of Harvard spring to mind and it is hard for them to disentangle this vision with the reality at many public institutions. For example, a common perception in Texas is that the public system is egregiously wealthy because the Permanent (endowment) Fund is triple the size of the endowment at Rice. Never mind that the payout on this fund supports the operations of seventeen branch campuses and constitute no more than $1/10^{th}$ of the revenues per student than the Rice endowment generates. Many taxpayers, politicians, and philanthropic organizations have the belief that their dollars will go further if allocated to more "needy" causes. Further, as the private rate of return to education continues to increase it is incumbent upon the public higher

education community to reemphasize the importance of broad based access, their public service mission, that it is a provider of jobs and essential for economic development.[149]

Legislators and taxpayers alike need to be educated about how the system of higher education finance works. Too much attention is paid to sticker prices and to rates of tuition increase and not enough attention to the fact that public university tuition increases are largest when state support is smallest and that only a small fraction of students actually pay the full sticker price to attend an institution of higher education. Further, more attention needs to be paid to actual dollars of tuition changes as opposed to percentage changes. For example, take two hypothetical institutions, Jeffrey College (JC) and Ephraim College (EC) which both depend on their states for funding. Tuition at JC is $2,000 in 2003-2004 while it is $20,000 at EC. Due to budget cuts in each of their states, both JC and EC increase tuition in 2004-2005 by $1,000. The way the news media and many politicians currently interpret this increase, JC would be vilified for increasing tuition by 50% while EC would be lauded for increasing tuition by only 5%!

The "race to the bottom" in state higher education spending suggests we ought to think more seriously about the optimal way to organize the higher education sector throughout the United States. The dramatic differences in costs across all of the states and in different states having varying degrees of preference for higher education suggest that fiscal federalism and higher tier governance may be a better way to finance higher education in order to ensure that all Americans have access to a quality higher education.[150] As it stands our system of financing higher education is wrought

[149] The ratio of income of adult male college graduates to high school graduates has increased steadily from 1.25 in 1980 to 1.65 in 2000 with a slight dip in the mid-90s. In future work, I will attempt to recover measures of the rate of return to higher education by state to see how funding priority has changed as these returns have changed.

with inefficiencies which will only increase, not decrease, if we pursue a high-tuition high-aid strategy. The federal student aid programs are an administrative morass for students and their families to wade through. Over 14 million students participate in the Pell grant program, the Special Education Opportunity Grant, Federal Work Study, Perkins Program, Education Tax Credits, Stafford Subsidized Loans, Stafford Unsubsidized Loans, PLUS loans and SLS loans – one can only imagine the administrative cost of these programs and the opportunity costs to families planning for college.[151]

As part of this organizational thinking states should also reconsider how they organize higher education within their own borders. Some may wish to create a streamlined system of community colleges, undergraduate colleges and research universities like in California. Some may wish to devise an integrated K-16 school system. Some may wish to divest themselves of public higher education entirely while others may want to substantially increase the scope of operations. As with most public programs, there is no "one size fits all" solution; the systematic withdrawal of state support for the previous three decades indicates that the current equilibrium is unstable and states and their taxpayers would be well served to change it.

Closing Thoughts

Higher education is increasingly becoming a political issue. Politicians and interest groups are most guilty of committing the cardinal sin in economics – confusing absolute measures with marginal decisions. It is unlikely that the median person (measuring preferences for state spending) in the United States thinks spending

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[150] The federal government already spends $70 billion on higher education as compared to $60 billion by the states.

[151] The College Board. *Trends in Student Aid 2003.*

more money on K12 education is a bad thing. However, the relevant question is not whether K12 expenditures are good or bad; it is instead how much education spending we want – which can ONLY be answered by looking at the marginal benefits of education spending compared to the marginal costs. While there is no concrete evidence that the net marginal benefits to higher education investments are positive, there is also no evidence for the contrary. Interest groups and politicians are increasingly acting as demagogues, appealing to a fervent but small group of supporters that believe more spending on their pet project is the only good thing, completely abstracting from the important economic questions that need to be considered.

Clearly the rise of merit aid programs has been politically motivated, but so too are initiatives to institute performance and accountability standards (which are notoriously difficult to measure and implement). Some of the budget share declines may have occurred in response to the growing use by the flagship public universities of nonresident enrollments. They might also be emblematic of implicit agreements between public universities and legislatures to trade-off less political oversight in exchange for less state funding.

Recent work by Bound, et al (2001) provides additional insight. They find that states may not have an incentive to invest in higher education because the flows of college educated labor produced in a state have little impact on the stock of college graduates that work in a state. If this is the case, then it might make sense for a state to devote its resources to areas where it has a comparative advantage over other states. Finally, it might also be the case that statewide property tax initiatives in many of the states have contributed to the declining higher education share. In work just underway, I am looking at the question of whether the increased state burden for K12

expenditures as a result of local property tax exemptions for particular demographic groups has come at the expense of higher education expenditures.[152]

A continued decline in state support for public institutions will result in innumerable negative consequences for the students that attend, or hope to attend them in the future. Among the consequences are: continued tuition increases[153]; movement away from full-time tenure tracked faculty toward part-time faculty and graduate student instructors; increases in student-faculty ratios; an erosion of liberal arts and humanities programs in favor of more practical and professional programs; increases in time to degree and dropout rates; fall in public service expenditures; increased loan burden on students attending college; a limitation of program offerings; and a multitude of additional factors. Further, future budget cutbacks are likely to have a disproportionate negative impact on community colleges, which rely on a larger share of their operating budget from state sources and where a larger share of minority and first time college attendees are enrolled. While these changes may not be dramatic in any single year, over a period of time, the resource gap and faculty quality gap between the publics and privates will be so large as to render a private education and a public education two entirely different products.[154]

A recent issue of the *Chronicle of Higher Education* asked a variety of higher education experts how they would deal with the tuition crisis facing our institutions,

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[152] This work is primarily focused on more fundamental questions relating to school district expenditures, particularly due to New York State's STAR program.

[153] Although high tuition, high need-based aid strategies are actually quite progressive, the sticker shock created by the high sticker prices, especially at two-year colleges, may scare those away who are at the margin of college attendance. The College Board estimates that the largest public high school class on record will graduate in 2008, and that a majority of these students will come from minority populations and those that would be the first generation to attend college – so the sticker shock is of considerable concern.

[154] As Ehrenberg and Brewer (1996) have shown that there is already a distinct advantage to attending an elite private college.

particularly at the publics.[155] While laudable, one can't help but feel uneasy with the topic's implicit acceptance that policies of broad state support and low tuition are historical relics. However, there are steps that states and institutions can take to ensure that this doesn't happen. It would be comforting to see comparative rates of return analyses on different state spending items to justify why higher education is falling out of favor, though those are notoriously difficult to calculate. Among the other steps include an increased participation in tuition reciprocity programs and cross-institutional cooperation.[156] Institutions can attempt to secure multi-year budget appropriations from legislatures in order to stop the destructive pattern of mid-year budget cuts. State tax codes can be revised and our public institutions can do a better job of marketing the "local public good" aspect of their product. While programs like funding formulas may be popular ways to secure financing for institutions, the determination of the formulas themselves are subject to political debate, and may also result in a sub-optimal distribution of student types within institutions due to institutional attempts to take advantage of these formulas.

Funding for education is a (less-than) zero sum game played out in statehouses across the nation. States decide how much to spend on education, then decide how much to allocate to each sector - and for years have acted as if K12 funding is more sacred than higher educational institutional spending. For instance, each state maintains a "rainy day fund" that is supposed to smooth the effects of budget shocks. In 2001, New York met the needs for a 5% K12 budget increase and maintained the current levels of its student aid program (Tuition Assistance Program) out of this fund, but none of it was tapped for SUNY and CUNY institutional needs. In the 2003-2004

[155] September 19, 2003 (Volume 50 Issue 4).

[156] See www.ilr.cornell.edu/CHERI and click on "surveys" for a description of these reciprocity programs.

fiscal year, 24 of 44 states surveyed by the State Higher Education Executive Officers indicated that they expected to receive decreases in the level of state spending for public higher education and in the 18 states that expected increases, in real per student terms funding is expected to remain flat. Demographic changes and the higher profile of K12 education do not bode well for public higher education's future as well. A dramatic shift in public and legislative priority is required to ensure that future generations of students have access to public higher education that is of comparable quality to what is available today. An even larger commitment will be required to make this endeavor affordable and to keep our public institutions from falling further behind their private counterparts.

Paul Simon (not the musician, but former United States Senator from Illinois and founder of the Public Policy Institute of Southern Illinois) felt that we as economists and faculty members need to act as custodians of the American Higher Education System. He put it best when he said, "Robert Frost once challenged each of us to become a one-person revolution… … if you are in a position of responsibility in education be willing to do that little extra that ultimately can be meaningful. It may require risking a little, and most of us are risk-averse. But without that small risk, you won't change things… … get together with some of your friends and think about little steps that you can take to change things. We don't simply need to lobby state governments for more money, we need to raise the consciousness of the American people, especially those that are down and out, about how important higher education is to our society.

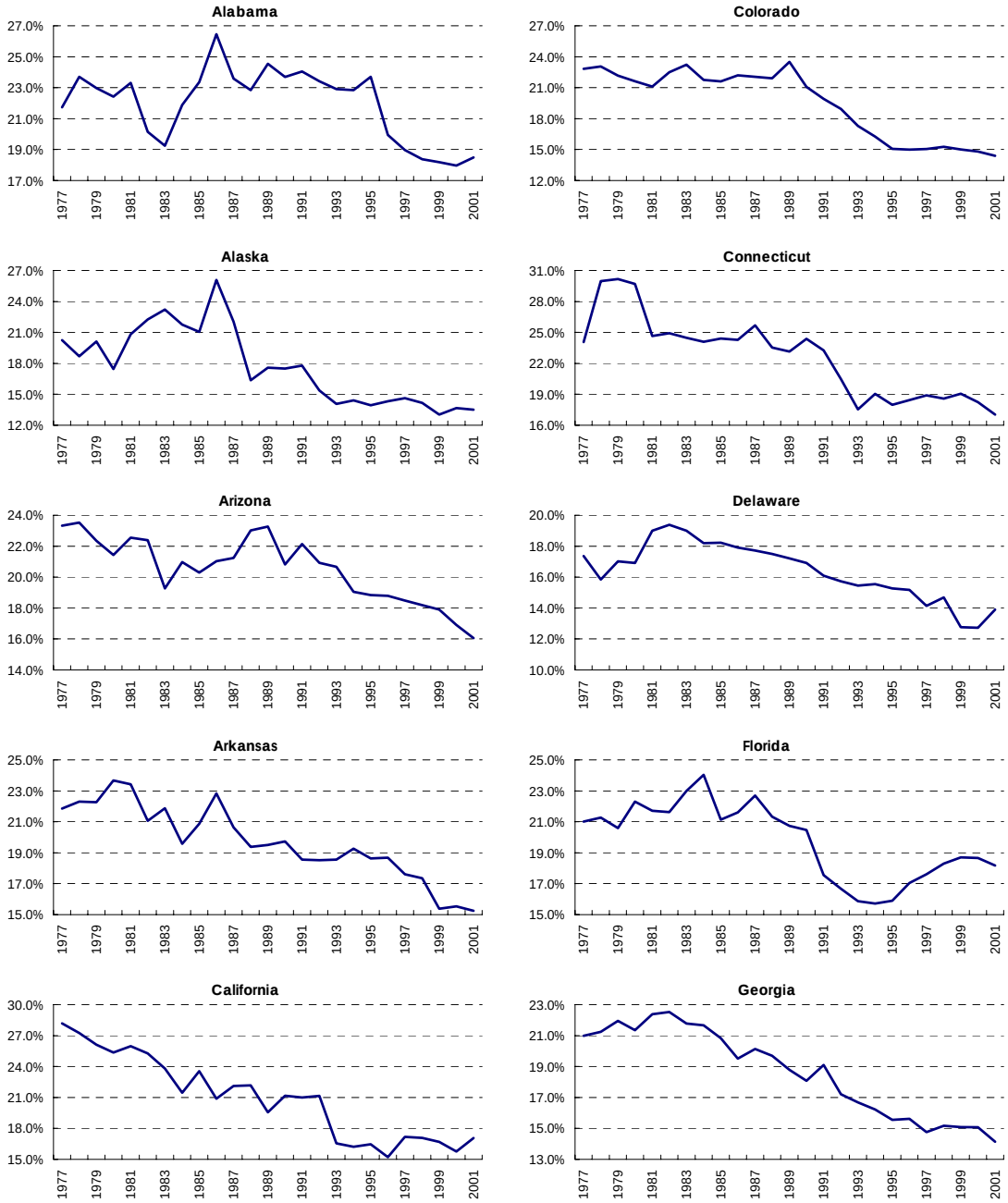


Figure A.1
Share of State General Fund Budgets Spent on Public Higher Education
1977-2001

Figure A.1 (Continued)

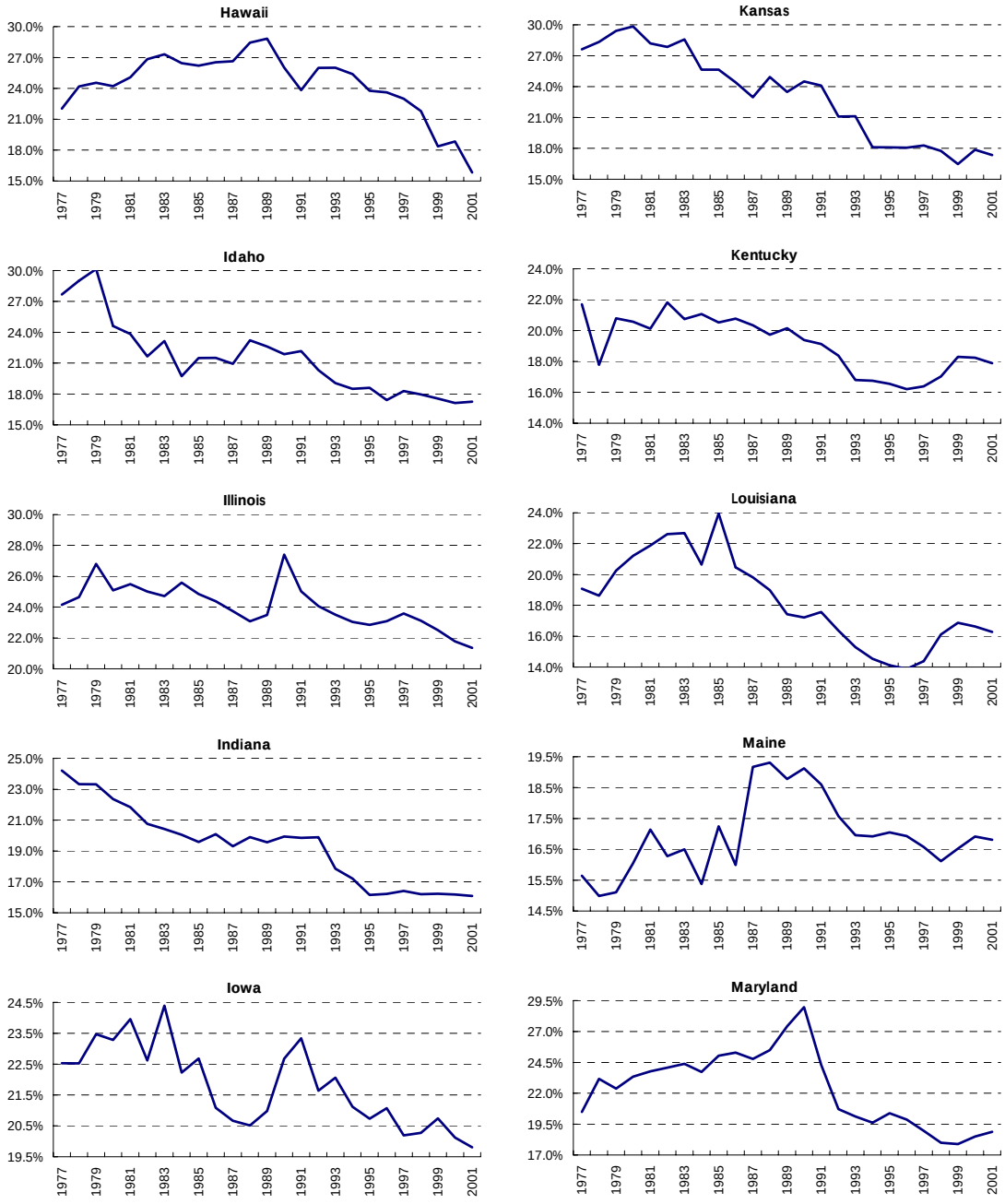
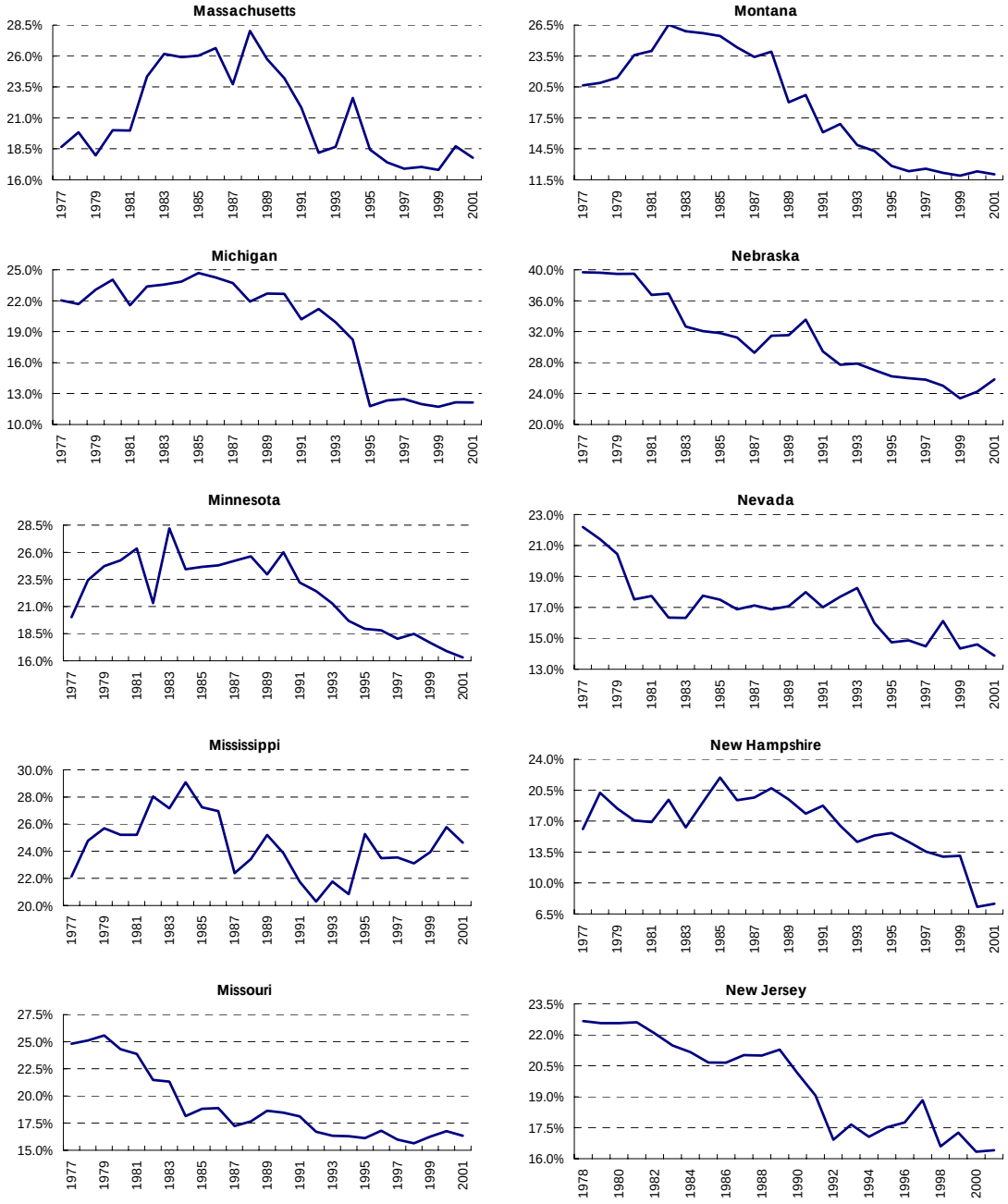


Figure A.1 (Continued)



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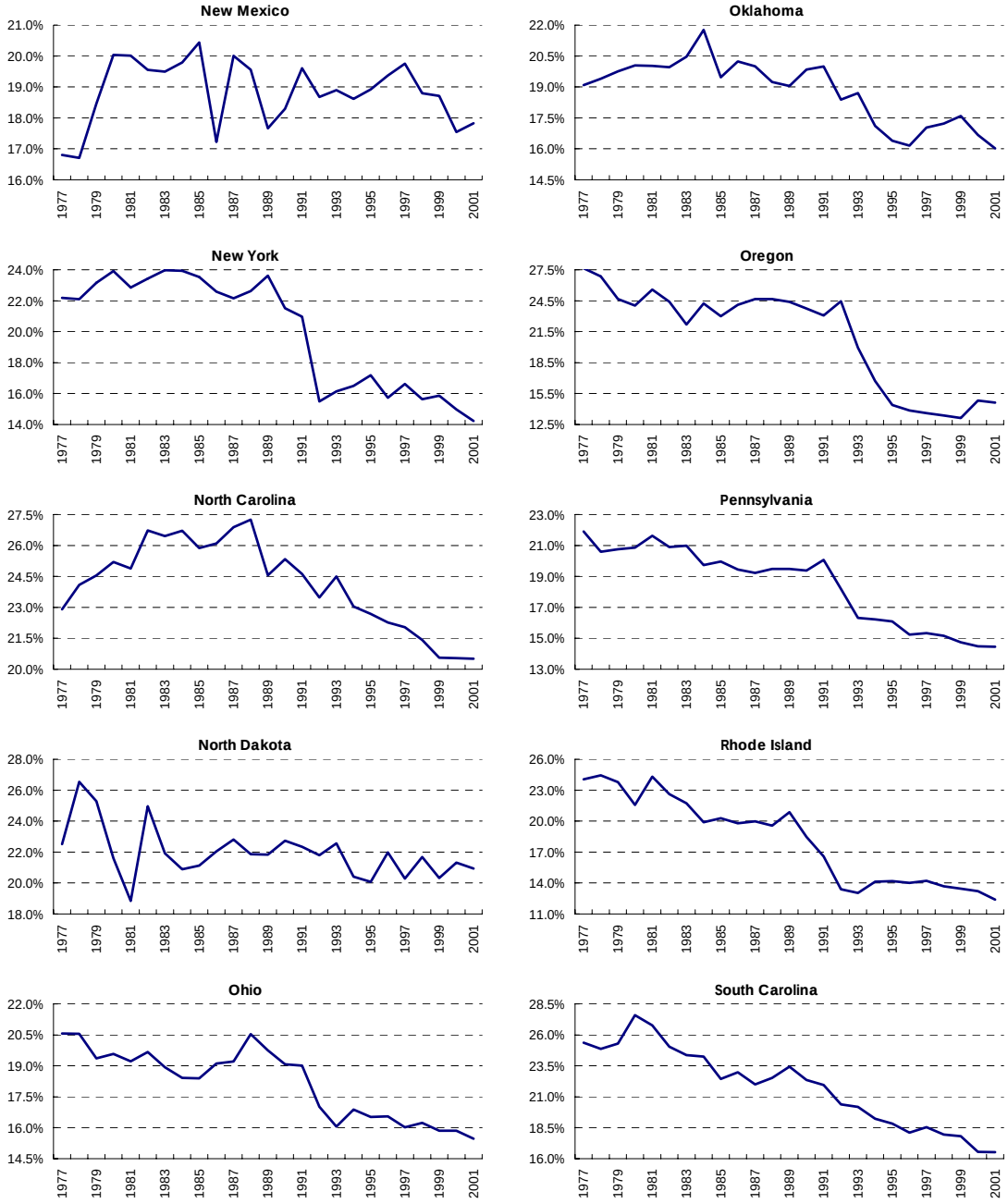

Figure A.1 (Continued)

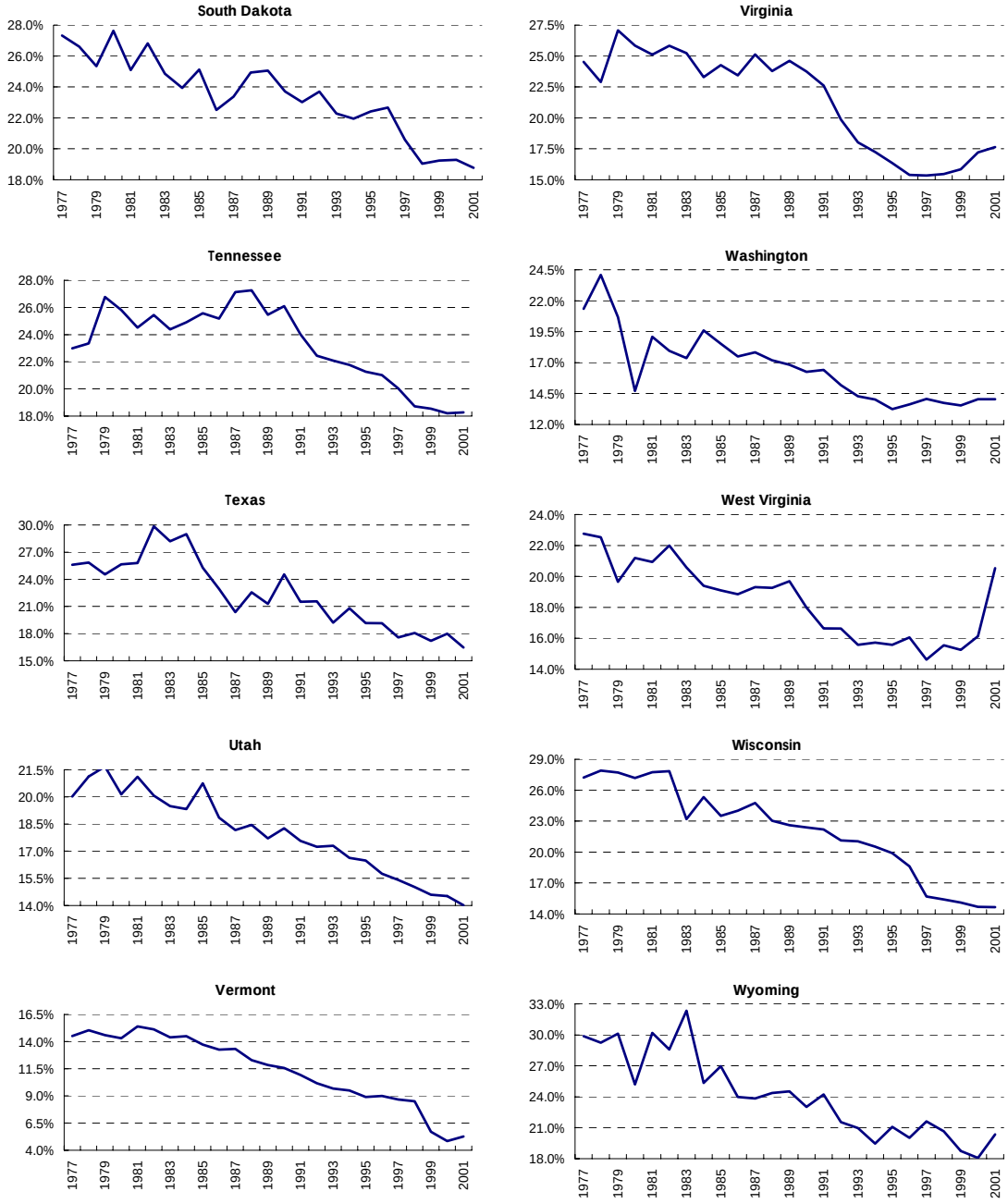

Table A.1
Variable Definitions and Data Sources

Variable Name	Definition / Explanation*	Source(s)
Outcomes		
EDSHARE	Total Educational Expenditures / General Fund Expenditures	2
HESHARE	Public Higher Education Expenditures (incl. all grant aid) / Total Educational Expenditures	2, 11, 12, 13, 18
INSHARE	Appropriations to Public Institutions / Public Higher Education Expenditures	2, 11, 12, 13, 14, 18
Income Distribution, Prices & Budget Factors		
INC	Median Household Income	6
INC2	Median Household Income Squared	6
INEQU	Income of Household at 75th percentile / Income of Household at 25th percentile	6
INCINEQU	7525 x WEALTH	6
EDPRICE	Employment Weighted Average of K12 and Higher Education Instructor Earnings / Employment Weighted Average of Non-Education Public Employee Earnings	3
HEPRICE	Earnings of Public Higher Education Instructors / Earnings of Public K12 instructors	3
FEDTRAN	Per Capita Total Federal Government Transfers	1
Demographics		
ELDERLY	Share of Population Aged 65 and Older	4, 5

Table A.1 (Continued)

SCHOOLAGE	Share of Population Between Ages 5 and 24	4, 5
COLLAGE	Share of Population Between Ages 18 and 24	4, 5
COLRATIO	Share of Schoolage Population Between Ages 18 and 24	4, 5
SCHOOLRACERATIO	Share of Schoolage Population that is Nonwhite (5-24) / Share of Non-schoolage Adult Population that is Nonwhite	4, 5
COLRACERATIO	Share of College Age Population that is Nonwhite (18-24) / Share of Non-College Age Adult Population that is Nonwhite	4, 5
COLK12RACE	Share of College Aged Population that is Nonwhite / Share of K12 Aged Population (5-17) that is Nonwhite	4, 5
RACEINTERACT	COLK12RACE times Share of Adult Population (25 and over) that is Nonwhite	4, 5
INMIGALL	Share of Overall Population Residing in State Today that Did Not Reside in State 5 Years Ago	4, 5
OUTMIGALL	Share of Overall Population that Resided in State 5 Years Ago that No Longer Resides In State Today	4, 5
NETMIGALL	INMIGALL - OUTMIGALL	4, 5
INMIGCOL	Share of 18-24 Year Old Population Residing in State Today that Did Not Reside in State 5 Years Ago	4, 5

Table A.1 (Continued)

OUTMIGCOL	Share of 13-19 Year Old Population that Resided in State 5 Years Ago that No Longer Resides In State Today	4, 5
NETMIGCOL	INMIGCOL - OUTMIGCOL	4, 5
Enrollment Pressure / Competition		
COLPRV	Share of Full-Time Equivalent Enrollments in Higher Education Institutions that Attend Privates (FTE = 40% for graduates, 35% for undergraduates and 33% for two-year students)	8, 11, 12, 13
K12PRV	Share of Elementary and Secondary School Enrollments in Private Schools	8
HE_ENROLL	FTE Graduate, Undergraduate and Two-Year Students at All Public Two- and Four-Year Institutions	11, 12, 13
K12_ENROLL	Total Elementary and Secondary School Enrollments in Public Schools	8
TWOYEAR	Share of Public Higher Education (FTE) Enrollments in Two-Year Colleges	11, 12, 13
CAPAC	Predicted Public Higher Education FTE Enrollments / Actual Public Higher Education FTE Enrollments	1, 4, 8 ,11, 12, 13
EDCOL(HS)	Either Share of Population Aged 25 and Older with High School Degree or with College Degree	1, 4, 7
SAT	Average SAT Score of High School Graduates that Plan to Attend College	8, 23
ENRATE	HE_ENROLL / Number of Public High School Graduates	8, 11, 12, 13

Table A.1 (Continued)

Competing Interests, Economic Conditions		
HEALTH	Health Care CPI x Share of Adult Population Aged 65 or Older	4, 22
CRIME	Murders, Rapes, Robberies, Assaults, Burglary, Larceny and MV Theft per 100,000 Population	24
UNEMP	Unemployment Rate - Entire Population	10
UNEMPNON	Unemployment Rate - Nonwhite Population	10
UNEMPRATIO	UNEMPNON / UNEMP	10
COURT	=1 in State-Year After Court Decision Mandated K12 Finance Reform	28
GSPAG	Share of State GSP Generated by Agriculture, Forest, Fishing and Mining Activity	9
GSPCON	Share of State GSP Generated by Construction, Manufacturing, Transportation and Utilities	9
GSPFIRE	Share of State GSP Generated by Finance, Insurance, Real Estate and Services	9
GSPGOV	Share of State GSP Generated by Government	9
GSPTRADE	Share of State GSP Generated by Retail and Wholesale Trade	9
REVCORP	Share of State General Fund Revenues Generated by Corporate Income Taxes	2
REVFUEL	Share of State General Fund Revenues Generated by Motor Fules Sales Taxes	2

Table A.1 (Continued)

REVINC	Share of State General Fund Revenues Generated by Individual Income Taxes	2
REVOTH	Share of State General Fund Revenues Generated by License Taxes and Fees and Other Sources	2
REVLOT	Share of State General Fund Revenues Generated by Lottery Revenues	2
REVSALE	Share of State General Fund Revenues Generated by State Sales Taxes	2
Political Factors		
GOVDEM	=1 in State-Year When Governor is a Democrat	1
UNIPARTY	=1 in State-Year When Both Houses of State Legislature are Controlled by the Same Party	1
GOVELECT	=1 in Years When Governor Seat is Up for Election	1
ASSEMBLY	Number of Assembly Seats per Capita	1
SENATE	Number of State Senate Seats per Capita	1
VOTE	Share of Voting Age Population Casting Votes in Congressional Election	1
Other Higher Education Variables		
ENDOW	Endowment Generated by Public Four-Year Institutions per FTE Public Enrollment in the State	11, 12, 13, 25, 27
GIVE	Total Giving per FTE Student from All Sources at Public Research Universities in the State	11, 12, 13, 27

Table A.1 (Continued)

MERIT	=1 in the State-Year Where there are Substantial Merit Aid Scholarship Programs	30
PELL	Proportion of Households with Annual Incomes Below the Maximum to be Eligible to Receive a Federal Pell Grant	6, 34
PHDPERBA	Ph.D degrees Awarded in Public Institutions / Bachelors Degrees Awarded by These Institutions	11, 12, 13
REGTUIT	Enrollment Weighted Average Nonresident Tuition at 4-Year Public Institutions in the Geographic Region (exclduing own state) in $1,000	11, 12, 13
RND	Total Research and Development Expenditures at Public Universities per Capita	1, 3, 11, 13, 32
SCIPHD	Share of Ph.D degrees Awarded at Public Institutions in Science and Engineering Fields	11, 13, 32
Institutional Characteristics		
Autonomy	Split Sample in Half According to Institutional Autonomy	31
Biennial Budget Cycle	23 States Operate on a Biennial Budget	16
Decades	Sample Split by 1972-1982, 1983-1992 and 1993-2001	
Funding Formula	29 States Have Higher Education Funding Formulas	33
Governor Power	37 States Have Governors that Can Reduce Appropriations Without Legislative Approval	16

Table A.1 (Continued)

Political Competition	Split Sample in Half According to Competitiveness of Political Processes in the States	29
Population Density	Split Sample in Half According to Population per Square Mile of Land Area	1
Region	Split for 11 Southern States and for 9 Northeastern States	1
Uniparty Government	Sample Split by State-Year where Legislature and Governorship Controlled by 1 Party (on average 21 states per year)	1

* *All shares / percentages represented times 100 = e.g. budget share of 25% is represented as 25.*
All dollar values are actual (e.g. median income is 30,000)
All dollar values are deflated to 1998 dollars using Fiscal Year GDP implicit price deflator as of Feb 2002

Table A.2
Data Sources

1. U.S. Bureau of the Census, *Statistical Abstract of the United States: 1976-2001*
2. U.S. Bureau of the Census, State Government Finance Files, 1972-2001
3. U.S. Bureau of the Census, State Government Employment and Payroll, 1972-2001 http://www.census.gov/govs/www/apesst.html
4. U.S. Bureau of the Census, Population Estimates Program, http://eire.census.gov/popest/archives/state/st_sasrh.php
5. U.S. Bureau of the Census, Decennial Census Microdata Files: via IPUMS http://www.ipums.org
6. U.S. Bureau of the Census, Current Population Survey (unpublished data), *Estimates of Income of Households by State 1979-2001*
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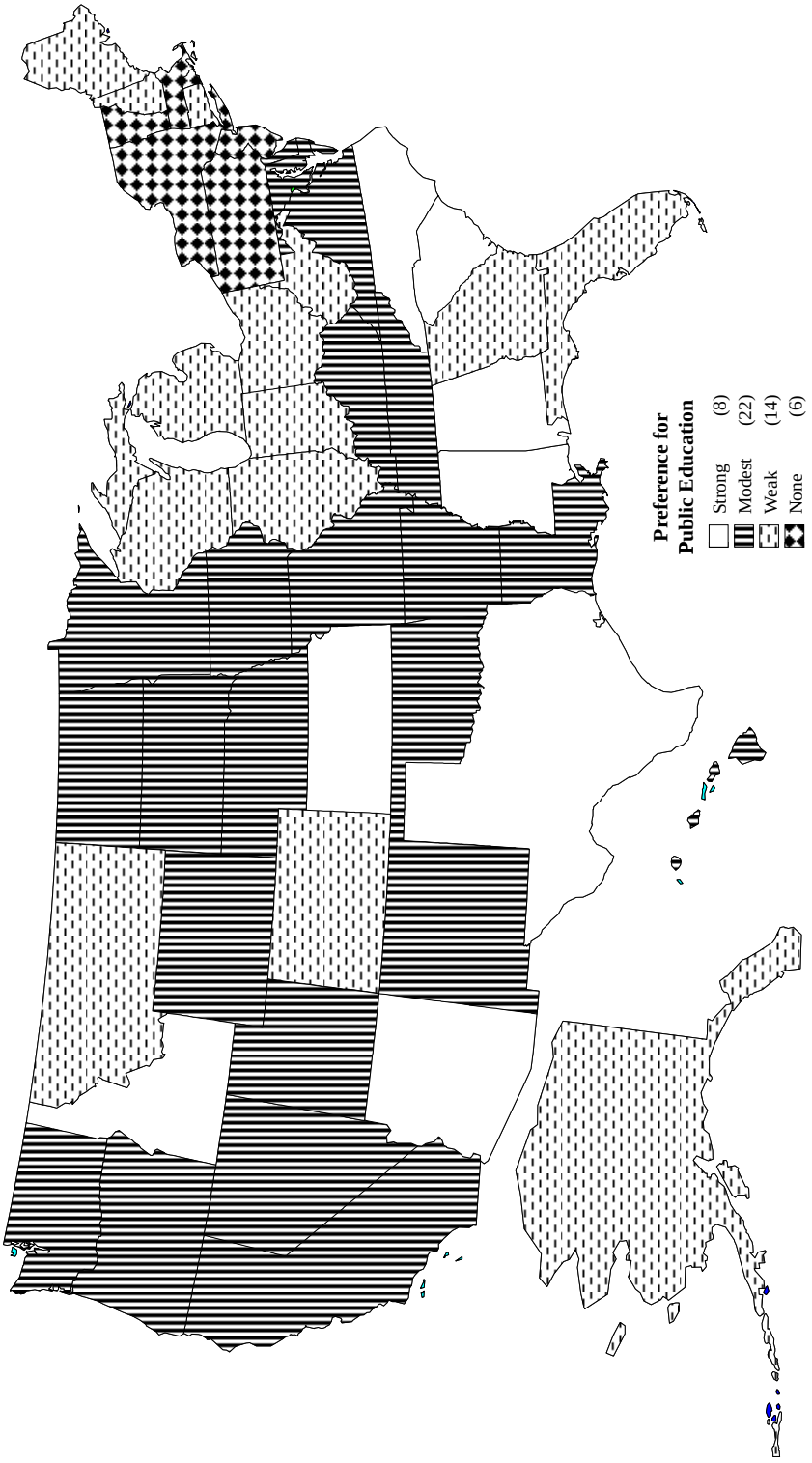

Figure A.2
State Preferences for Funding Public Education

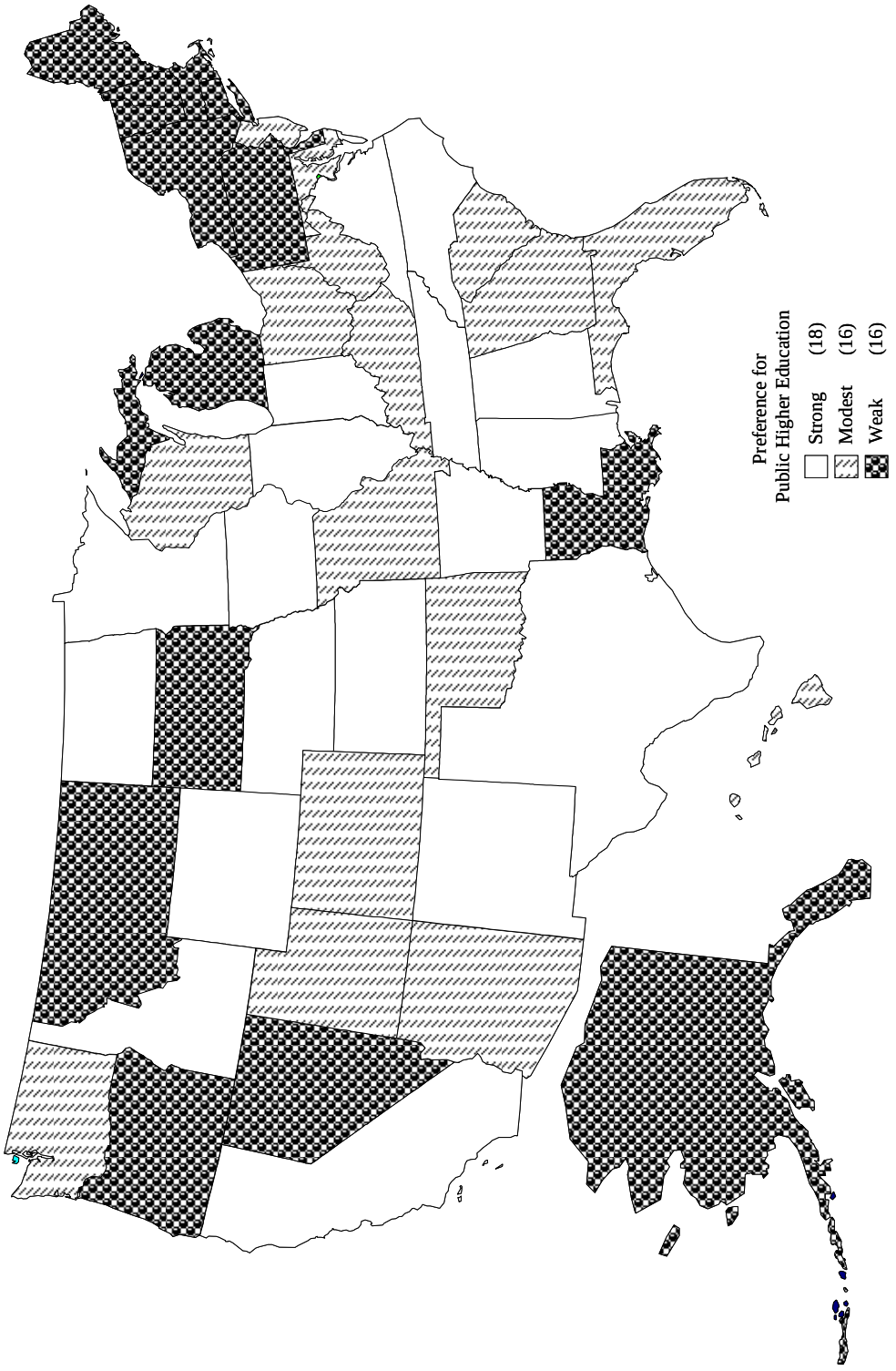

Figure A.3
State Preferences for Funding Public Higher Education

Table A.3
Predicted "State Effects" from Baseline Estimating Equations

	EDSHARE		*HESHARE*		*INSHARE*	
Rank*	State	c_i	State	c_i	State	c_i
50	MA	-12.2	VT	-9.3	NY	-16.4
49	AK	-12.0	DE	-4.5	VT	-14.9
48	NH	-11.9	NH	-4.3	PA	-9.1
47	CT	-10.9	ME	-3.8	IL	-7.6
46	NJ	-7.5	NV	-3.4	NJ	-6.4
45	SD	-7.2	PA	-3.3	MA	-3.9
44	RI	-7.0	RI	-3.0	MN	-3.8
43	NY	-6.9	OK	-2.5	RI	-3.1
42	MD	-5.7	OH	-2.4	IN	-2.2
41	ME	-5.4	WA	-2.3	OH	-1.9
40	WY	-5.1	LA	-2.2	IA	-1.6
39	OR	-4.6	GA	-2.1	CO	-1.0
38	PA	-3.8	MO	-1.9	GA	-0.9
37	MT	-3.6	FL	-1.7	WI	-0.8
36	HI	-3.0	NY	-1.7	CT	-0.7
35	WI	-2.6	KY	-1.3	MI	-0.6
34	IL	-2.5	IN	-1.2	FL	-0.2
33	NE	-2.4	CO	-1.1	VA	-0.1
32	VT	-1.6	NM	-1.1	MO	0.1
31	WV	-1.4	AK	-1.0	OK	0.4
30	ND	-0.6	MT	-0.8	KY	0.5
29	CA	-0.3	WV	-0.7	CA	0.7
28	TN	-0.3	MI	-0.6	WV	0.7
27	MI	0.1	NJ	-0.4	SC	0.8
26	LA	0.2	AR	-0.4	MD	1.0
25	NV	0.2	UT	-0.3	TN	1.1
24	FL	0.9	MA	-0.1	NC	1.2
23	OH	1.0	VA	0.2	ME	1.3
22	DE	1.1	IA	0.5	OR	1.6
21	KY	1.5	AZ	0.8	WA	1.8
20	MS	2.1	MN	0.8	ND	1.8
19	MN	2.3	OR	0.9	NH	1.9
18	VA	2.6	SC	1.2	LA	2.0

Table A.3 (Continued)

17	AR	2.6	AL	1.4	KS	2.2
16	MO	3.2	ND	1.5	AR	2.4
15	AZ	3.7	MD	1.9	NM	2.5
14	SC	4.6	CT	2.0	AL	2.6
13	ID	4.8	ID	2.1	TX	2.8
12	NM	5.0	SD	2.1	MT	2.8
11	IA	5.2	CA	2.2	SD	2.9
10	KS	5.7	TX	2.4	DE	3.0
9	IN	6.2	TN	2.6	NE	3.3
8	WA	6.3	WI	2.7	NV	3.5
7	CO	6.4	NC	3.0	ID	3.8
6	GA	6.8	HI	3.3	AK	4.0
5	OK	6.9	KS	3.4	AZ	4.2
4	AL	7.1	IL	3.4	MS	4.3
3	NC	8.6	MS	4.2	HI	4.4
2	TX	10.1	WY	5.0	WY	4.8
1	UT	13.1	NE	9.7	UT	4.8

** A more highly numbered rank indicates lower preferences for the corresponding budget item*

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