Measuring Geographic Access to Higher Education: A County-Level Analysis

A THESIS SUBMITTED TO THE FACULTY OF THE GRADUATE SCHOOL
OF THE UNIVERSITY OF MINNESOTA
BY

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IN PARTIAL FULFILLMENT OF THE REQUIREMENTS
FOR THE DEGREE OF
MASTER OF SCIENCE

Elton Mykerezi

April 2012

ACKNOWLEDGEMENTS

Sincere thanks to Dr. Elton Mykerezi for providing me with much-needed advice and feedback during this process. My time in the University of Minnesota Applied Economics program was successful in great part due to my experience as your advisee. Thank you for all your help and encouragement.

Thanks to Dr. Rob King and Dr. Judy Temple for serving on my thesis committee. I appreciate your help and feedback during this process.

Special thanks to all of those people who helped me along the way, with encouragement, feedback, edits, and coffee! Michael, you took time out of your incredibly busy schedule and provided me with such helpful feedback (as only an English professor could). I truly appreciate it!

A very heartfelt thanks goes out to everyone in my Monday night study group – Danushka, Abby, Robynne, Allie, and Amanda. All of you gave me the motivation to keep working when that was just what I needed most. I couldn't have done it without you!

DEDICATION

I owe so much to my loving husband, Kevin Stanke. You have been so incredibly supportive during this long journey. From the little things (rides to and from campus, preparing dinner for me when I was late getting home) to the big things (financial, mental, and emotional support), you were there with me the whole time and I am so very grateful. Thank you and I love you.

ABSTRACT

This thesis defines college access measures that are dependent on county of residence, rather than individual student characteristics. Access to college was quantified by determining the physical availability (college seats, distance to nearest institution) and prices (minimum and average tuition) that students would face within driving distance from their county of residence. While geographic measures have been used in previous research, most have used state-wide measures, if at all, whereas this analysis uses weighted county-level measures, a technique that is more precise than any previously implemented. The results suggest that, of the access measures included in the analysis, lower minimum tuition levels do the most to improve educational attainment regionally. Proximity to public two-year institutions seem to provide the greatest benefit to associate-level degree attainment, particularly in areas with large Hispanic populations, whereas proximity to four-year public institutions provide the greatest benefit to bachelor's degree attainment. Finally, four-year minority serving institutions are more effective at serving their target populations, and also provide benefit to the entire region, regardless of race.

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CHAPTER 1 – INTRODUCTION

It has long been accepted that higher education is one of the most-important investments an individual can make to improve their well-being. Higher educational attainment is associated with lower unemployment and higher wages, higher family income, and better health for adults and their children (Council of Economic Advisers, September 1998). Additionally, education can provide a viable mechanism for closing gaps in well-being among racial and ethnic groups (Council of Economic Advisers, September 1998). Educational attainment has been shown to be one of the most important known mechanisms for the generational transmission of economic inequality in the United States, together with race and the transmission of wealth via inheritance (Bowles & Gintis, 2002).

In addition to private benefits, it is generally agreed upon that higher education provides public benefits over and above those earned by the individual; these are the "spillover effects" that occur in communities with a highly educated population. Wage spillover effects occur when a worker's social interactions with well-educated people increase his or her productivity. While researchers generally agree that the effect exists, it has been difficult to measure empirically, and estimates vary. In a 2004 study, Moretti found that a one percent increase in the proportion of college-educated workers raised the wages of high school dropouts, high school graduates, workers with some college, and college graduates by 1.9%, 1.6%, 1.2%, and 0.4%, respectively. Other studies (Moretti, 2004b; Lange, 2006) have found smaller effects (between 0.2% and 0.9%), but in general, findings support the existence of some wage spillover associated with higher educational attainment. In addition to the wage spillover effect, a number of empirical studies have found "non-income" spillovers such as increased voter participation (Dee, 2004), higher tax revenues for states, greater charitable donations, improved health and less dependence on criminal justice systems (Lochner, March 2004; Damon, 2011; College Board Advocacy & Policy Center, 2010).

Finally, there is research to suggest that colleges, particularly research universities, contribute to local and regional economic development by attracting talent to the area and partnering with local industry (Bramwell & Wolfe, 2008).

The existence of these positive externalities suggests that higher education may be a merit good – a good with special merit that should be available to everyone, regardless of their ability to pay. Because of the positive benefits associated with merit goods, there is a case for some form of government intervention to encourage their consumption. With regard to higher education, this means that the government has a role to improve access for all those interested in pursuing a college degree and to increase levels of educational attainment among its citizens.

Much research has been done to understand these two issues. This work is difficult, however, due to the lack of experimental evidence available to explain the relationship between college access and individual or community outcomes. Much of the difficulty lies in the fact that access to education (admission to college, financial aid, etc.) is usually closely tied to individual characteristics of the students. For example, better students typically gain access to more selective colleges and students from disadvantaged households tend to have greater access to Federal Financial Aid programs and other sources of financing. On the other hand, students from relatively well-off families may have greater access to private funds. Distinguishing the impact of the individual student characteristics from the impact of improved access is an almost impossible task at the individual level, and one that has caused researchers in this area much difficulty. In contrast, my thesis defines college access measures that are dependent on county of residence, rather than individual student characteristics. Access to college is quantified by determining the physical availability and prices that students would face within driving distance from their county of residence. Availability and price are examined for two- and four-year colleges, as well as colleges with distinct cultural identities (such as Historically Black Colleges and Hispanic

Serving Institutions). By taking individual characteristics "out of the equation" I am essentially isolating the impact of access on community outcomes, and expanding possibilities for future research in this area.

BACKGROUND

The Census Bureau has documented a consistent increase in the educational attainment of the U.S. population since the census first began asking individuals to report their highest degree earned in the 1940s. As of 2007, 84 percent of the population held a high school diploma and 27 percent held a bachelor's degree or higher (Crissey, January 2009). In 2010, the College Board established a goal of bringing the percentage of all Americans with associate degree or higher up to 55% by 2025. However, while Americans as a whole are becoming more educated, this trend is not evenly distributed among all populations. Educational attainment varies widely by race, ethnicity, age, and location, among other factors.

Part of the challenge in reaching the goal of 55% lies in erasing disparities in educational attainment for underrepresented minorities. Among adults ages 25-64, 62.9% of Asians and 46.0% of Whites have attained an associate degree or higher, but only 30.4% of Blacks and 20.2% of Hispanics have earned the same distinction (Lee & Rawls, 2010). What's more, only 61% of Hispanic adults have a high school diploma, reflecting both recent low-skilled immigration as well as below-average completion rates for native-born Hispanics (Berube, 2010).

Another potentially worrisome trend is being seen in attainment levels by age group. In recent years, a gap has emerged where younger adults are posting lower levels of attainment than some older groups. In 2000, 25-to-34 year-olds had slightly higher rates of bachelor's degree attainment than 35-to-44 year-olds. But in 2008, only 29 percent of the younger group reported having a bachelor's degree compared with 31 percent of the older population (Berube, 2010).

Distinct geographical differences in educational attainment exist throughout the United States as well. As of 2007, the Midwest region had the highest percentage of high school graduates, while the Northeast had the highest percentage of adults with a higher degree. Almost 40% of adults in that region hold a bachelor's degree or higher, a level that less than one third of Southern adults can claim. Educational attainment and enrollment levels vary widely on a state by state level. In 2001, approximately 26% of Black 18-25 year-olds in Arkansas were enrolled in 4-year public institutions, compared with 15% in Alabama (Baird, 2006). Attainment levels vary by metropolitan area as well. Highly-educated metropolitan areas ranked among the top gainers of college graduates during the 2000s, and residents of older suburbs are becoming more highly educated than those in primary cities, reflecting the suburbanization of the highly-educated (Berube, 2010).

All of these differences in educational attainment and enrollment levels can be attributed to differences in what is more broadly referred to as "access" to higher education. This one word, access, describes a slew of factors, from an individual's academic preparation to their family's financial situation, federal and state financial aid policies, to college tuition rates. At its most basic level, the concept of access is fairly straightforward. In order for an individual to have reasonable access to higher education, he or she must be able to apply, be admitted to, afford, and attend an institution. When examined individually, however, the complexity of college access begins to reveal itself. The college application process involves a basic level of academic preparation, which may be dependent on the student's high school or family background. The process should be inclusive and straightforward, but we wouldn't expect any school to admit students without some form of application. Admittance is dependent not only on the individual's background, but also on the policies of the college. The admission policies of an Ivy League school will be very different from a community college, for example, and many colleges place value on student characteristics not related to academic preparation, such as having a diverse

student body or a competitive athletic program. Whether an individual can afford to attend college is dependent on a wide range of factors, and is a subject that has been the focus of much research nationally and worldwide. Of course, a combination of an individual's personal finances and his or her willingness to take on student loan debt contribute to whether he or she will be able to afford to attend college, but so do a variety of external factors, such as tuition costs and financial aid availability. Once the other requirements (academic or financial) have been met, the difficulties associated with attending college are often overlooked. However, these difficulties can often be significant. Geography is a serious consideration, particularly for low income families and adult learners. The cost of school is drastically minimized when the student is able to live at home and maintain employment.

Understanding the complexity of college access is important. But this complexity is exactly what makes improving access so difficult. In the chapters to come I will discuss the problems with measuring access empirically, and suggest how we can improve these measures and help guide policy.

Problem Statement

In 2009, President Obama proclaimed, "by 2020, America will once again have the highest proportion of college graduates in the world (U.S. Department of Education)." Clearly, access to higher education is a national priority. So, it is no surprise that years of research have been devoted to the topic of access to higher education and ways to improve access for all students. But while empirical work on how to best increase educational attainment among adults is desirable, practical measures of access are difficult.

The problem that plagues current empirical work is that isolating any one access measure from another or from individual characteristics is difficult. Each measure is intertwined with many others. Consider some of the most commonly used access measures: Tuition (net of financial

assistance) is closely tied to individual characteristics such as college choice, making it difficult to empirically isolate the impact of policy tools (e.g. grants and scholarships). Federal student aid provides a very large proportion of the funding for college expenses, but all individuals are exposed to virtually identical federal rules, so differences in aid awarded are strictly due to variations in individual attributes rather than exposure to different policies. Lastly, state financial aid options are likely to be correlated with other state investments such as K-12 education; therefore states that offer higher levels of financial aid may also have students that are better prepared academically. Some researchers have used quasi-experimental methods (e.g. cross-state variation in public tuition rates, newly implemented state aid policies) in an attempt to examine the impact of financial access to education (Rizzo, 2004; Dynarski, The New Merit Aid, 2004). The idea behind this line of research is to isolate differences in individual outcomes that are attributable to differences or changes in access in the state in which they live rather than the individuals themselves. The idea behind my research is similar, but I will be isolating distance and price variations by county rather than state, potentially providing greater empirical variation in access.

PURPOSE

The complex relationships between access measures create problems for researchers, some of which I will discuss more in Chapter 2. The goal of my research is to create measures of access that are more precise geographically, therefore isolating some of the variability in these access measures across counties. While many studies have attempted to use geographic measures to determine access to education, there is much room for improvement in this area. The purpose of this study is to build upon previous methods used to measure geographic access to higher education, in an attempt to quantify both the supply of colleges in a region, their prices and a state's investment in education.

The main objectives of my research are as follows:

- Contribute to current literature with the design of more precise county-level measures of physical and financial access to education.
- Determine which regional investments in higher education (community colleges, minority-serving institutions, tuition levels, number of available college seats, among others) contribute most to educational attainment on a county level.

This information could be valuable to regional policymakers interested in determining the best allocation of resources for higher education. A better understanding of which investments have the greatest impact on educational attainment levels would be beneficial in helping to educate and maintain a highly educated workforce, and could eventually improve the economic well-being of the region.

SIGNIFICANCE

The findings of this study could be of significance to researchers who can use the geographic model as a tool for analysis. These results can also be useful to policymakers. By including a variety of geographic access measures such as tuition prices, number of seats, and distance to various types of schools, local policymakers will be able to better determine how best to allocate resources. Are local funds better spent lowering tuition, creating more seats at local/state schools, or allocating funds to minority serving institutions? Where is the biggest bang for the buck? The results of this study will help to answer some of these questions by creating the county-level access measures and examining their relationship with the growth in the share of educated adults at the county level.

Further, the measures proposed here can be used for future research with individual level data that provide information on the location of youth prior to college attendance (e.g. Geo-coded National Longitudinal Survey of Youth data).

CHAPTER 2 – LITERATURE REVIEW

INTRODUCTION

There are many factors that determine the likelihood that a person will pursue some form of higher education. Some of these factors are unique to the individual, such as the student's performance in high school, parental income, or their family background. Other factors, such as the labor market conditions or federal financial aid availability are susceptible to regional variations and beyond the direct control of the student and their family, but are still important to consider.[1] I have broken the literature into three parts: financial access, individual access, and geographic access or college supply. The first section examines all forms of financial access, including tuition costs, financial aid, and individual family income. The second section focuses specifically on measures that are unique to each individual, such as family background and academic preparation. Finally, the third section examines studies which have used some measure of geographic access to determine enrollment. In the following sections I will review the relevant literature available on these topics, and then discuss how my research will improve upon what currently exists.

MEASURES OF FINANCIAL ACCESS

FINANCIAL AID – FEDERAL

In 2005, the Educational Policy Institute compiled a systematic and rigorous ranking of the affordability and accessibility of higher education internationally. This study was the first to compare access on an international level, and it specified the following measures of affordability to benchmark: education costs, total costs (education plus living expenses), net costs, net costs after tax expenditure, out-of-pocket costs, and out-of pocket costs after tax expenditures. All cost measures were calculated as a percentage of ability to pay (ATP). The report then compared

[1] Families can indirectly control access to education if they chose their residence based on access to colleges and universities. However previous empirical work has found this is unlikely (Card, 1993).

sixteen countries on the six measures, which, when taken together provided a weighted overall affordability ranking. Their ranking placed the United States 13th out of the sixteen countries in the analysis. With ever-increasing pressure to improve America's educational competitiveness worldwide, this ranking is less than ideal.

The current administration, even as it tried to restrain other domestic spending in its 2011 budget request, has attempted to improve affordability for students – calling for the expansion of Pell Grants, the main source of federal aid for low-income families. The president's plan increased the top grant to $5,710 from its previous level of $5,550, and expanded the program to an additional one million students (NYT, 2010). This is the most recent effort on the part of the federal government to increase access to higher education through increased funding of federal aid programs. But while the Pell limit has increased during both the Obama and Bush administrations, it has not kept up with rising college costs. The maximum Pell grant now covers only about a third of the average cost of attending a public university, compared with three-quarters in the 1970s, when the program began (Herszenhorn & Lewin, 2010).

Much research has focused on the role of federal financial aid in determining college attendance. Most studies hypothesize that increased federal aid should reduce the financial burden on individuals, thereby increasing access. This does not always prove to be the case. Researchers Singell and Stone conclude that the expansion of federal aid has had a counterproductive effect on tuition prices – many colleges and universities simply absorb the benefits by increasing tuition costs while students see very little of the returns (Singell & Stone, September 2005). They find that while public college tuition for in-state students did not rise in tandem with Pell Grant levels, private college tuition, and public college out-of-state tuition increased by roughly $800 for every $1,000 increase in Pell recipients' average grants.

Other research has focused on the effects of federal financial aid on an individual's decision to pursue higher education. It is generally agreed upon that the benefits of federal aid are not distributed evenly to all individuals. A person's perceptions of the complexity of the loan process, as well as their willingness to take on student loan debt greatly influence who receives aid, and in what amount. Perna (2006) finds that many students and their families likely draw conclusions about the affordability of higher education based on published tuition and fees. Discerning the extent to which published prices will be reduced by some amount of financial aid is challenging for students and parents, at least in part because of the complexity of the financial aid determination process. Kane (2003) finds that complexity in the financial aid system suggests that perhaps only those who are committed to going to college expend the effort to find out how much grant aid they may receive. This research suggests that local "published prices" of a higher education may have a large impact on attendance decisions, especially for "marginal students", those who are somewhat undecided on if and when they are to pursue a higher education.

Economically disadvantaged students are typically less willing to take on loan debt, due to both practical and cultural reluctance. Over the years, while tuition prices have steadily increased, middle- and upper-class students have greatly increased their use of financial aid, while loans among low-income students remained relatively stable (Golden, 2010). This highlights the fact that increases in federal loans, which are intended to improve access for all individuals often have unintended effects and can impact populations in different ways, due to regional or cultural variation.

FINANCIAL AID – STATE

Until recently, few researchers had looked at the relationship between state need-based aid and college enrollment. Heller (1999) was one of the first to examine this relationship. He found that for all races, state need-based aid helped to explain public enrollment rates, especially at

community colleges. A more recent study by Kane (2003) examines California's Cal Grant scholarship program, and finds a large impact (3 to 4 percentage points) of grant eligibility on college enrollment among financial aid applicants. He hypothesizes that this could be due to clearer eligibility requirements for state aid, which would mean greater certainty as to how much support to expect. A study by Baird (2006) finds that state need-based aid plays an important role in explaining a state's public enrollment rates, while federal need-based grants have little to no measurable effect on enrollment. Of course, as noted, the impact of federal aid is more difficult to quantify as all U.S. individuals are subject to the same rules.

Clearly, the impact of state need-based aid on enrollment is one that merits further research. It seems as though state aid is a better predictor of access than federal aid, but the reason for this is not completely clear. I hope to explore the relationship between access and geography further by including county-level measures of access in my own research. Perhaps the relationship between enrollment and aid is due not only to the relative complexity or reliability of the aid, but also due to the fact that it affects prices in proximity to students. The results of my research will help to better explain this and many other access measures

TUITION COSTS

Studies analyzing factors influencing college attendance decisions have focused disproportionately on the price of college. In her 2006 study, Baird completed a comprehensive summary of the previous research on the role of tuition. The results were mixed. Leslie and Brinkman (1987) concluded that higher tuition costs did indeed decrease college enrollment. Kane (1994) found that enrollments among lower-income students were more sensitive to college costs than were those of higher income students. However, some researchers (Cameron & Heckman, 2001) find that controlling for other factors, the overall importance of tuition in enrollment decisions is minimal.

Previous research has varied in the way it measures overall tuition costs. Many studies use net tuition costs (total costs less financial aid) to more accurately determine the amount a student must pay to attend (Singell & Stone, September 2005). For example, a 2010 report submitted to Congress by the Advisory Committee on Student Financial Assistance reported the net price for attending a four-year public college: for a low-income student in 1992 it was $7,570 – 48% of family income. Since then, the cost has increased to $10,620 – still 48% of family income – in 2007. The increase has been greater for moderate-income students – from $8,790 in 1992 (22% of family income) to $14,650 in 2007 (26% of family income).

While net tuition costs may technically be the most accurate measurement of the financial burden on the individual, other research has shown that it is often difficult for a student to discern the amount by which published prices will be reduced by some amount of financial aid. Additionally, as noted, it may be difficult to disentangle the extent to which individual variation in the net price is due to "exogenous" policy factors as opposed to individual and family characteristics. For this reason, net tuition costs are not necessarily the best measure available. A better measure of cost, particularly for low-income students, might include not only tuition and books, but also foregone wages (Zhao, 2010). Many students cannot afford to stop working to attend college. For this group, lost wages is of particular importance, as is the student's distance to the nearest college.

By using a combination of geographic and financial measures, my research will minimize some of the issues associated with available tuition and access measures. In most current research, tuition is measured as either net or total, but typically without any regard to location. Students who cannot afford to stop working to attend college or who can mediate living expenses by attending college near their home may not be concerned with the lowest cost college in their state, but rather with the lowest cost tuition within driving distance.

FAMILY INCOME LEVELS

Disparities in family income largely account for differentials in measured schooling attainment. Yet the interpretation of this statistical relationship is ambiguous (Cameron & Heckman, 2001). Earlier, I mentioned the relationship between Pell Grants and tuition prices. Singell and Stone (2005) find that many colleges and universities simply absorb the benefits by increasing tuition costs while students see very little of the returns. Specifically, private college tuition, and public college out-of-state tuition increased by roughly $800 for every $1,000 increase in Pell recipients' average grants. However, the impact of this relationship is felt differently at different income levels. Much of the added burden of increases in tuition is felt by middle- and upper-income families, as the benefits of Pell Grants go primarily to low-income students. Similarly, a student's use of student loans differs depending on their family income levels. Research shows that loans are often less attractive to low-income families for practical or cultural hesitations related to taking on debt (Golden, 2010). Low-income students tend to take out loans less often and for lower amounts than middle and upper-class students.

Cameron and Heckman (2001) criticize previous research, saying that these studies focus too much on a student's current financial situation at the time they are deciding whether to attend college. They propose an alternative model, which includes long-term levels of family income. They find that family income matters, but has its greatest influence on forming the ability and college readiness of children and not in financing college education. It is long-term factors that mainly account for this relationship, not short-term cash constraints that can easily be fixed by Pell grants or other transfer programs offered to children late in their life cycle of adolescent development.

Lastly, Newman-Ford (2009) identified the role of finance as a key motivator for remaining at home, with low-income students being less likely to move away from home to attend college, due

to the added burden of living expenses. As mentioned previously, an economically-disadvantaged student bears the added cost of potentially foregone wages in attending college (Golden, 2010).

These findings support the need for greater research on the relationship between student location and college access. We know that students from low-income families are less likely to take on student loan debt, and also less likely to move away from home to attend college. If we want to improve access for all students, we must consider the location of the student in relation to affordable higher education, rather than simply focusing on tuition levels or financial aid.

Measures of Individual Access

Measures of individual access such as race/ethnicity, academic preparation, or parental education are often looked at to help explain some of the variation in access to higher education. We know that college attendance rates differ greatly by race and ethnicity. In 2008, 70.7% of Asian Americans ages 25-34 held an associate degree or higher compared with 49.0% of Whites, 30.3% of African Americans and 19.8% of Hispanics. Yet Black/White differences in test scores can be largely attributed to differences in the quality of high schools attended. Perna (2006) found that differences in test scores and curriculum also helped explain differences in college enrollment patterns among Hispanic and White youth. Cameron and Heckman (2001) find that at each schooling level minority schooling generally rises above white levels when endowments are equalized.

Most research has shown that the effects of poor academic preparation have a much greater impact on a student's access to higher education than financial considerations such as Pell Grants or financial aid levels. For example, Pell Grant recipients on average are less likely to graduate within six years from college – despite generous financial aid – than others, in large part because of prior educational deficiencies (The Editors, 2010). In Baird's review of prior research, high

school achievement was found to be the single most important factor explaining college attendance. Preparation is of such overriding importance that tuition and financial aid policies have at best a marginal impact on enrollment decisions. Several studies in her review also show that parental education is a stronger predictor of college enrollment than is parental income. Increases in parental education have played a significant role in increasing college enrollment, particularly for Black families (Baird, 2006).

Geographic Access/College Supply

Clearly, there is a wealth of research on the ways in which various external and internal measures influence a student's access to higher education. Financial aid policies, family income, academic preparation, race, and tuition prices all influence a student's decision of whether to attend college and which school they ultimately attend. However, the amount by which each of these factors varies by region, state, or even county can often be large. In the following section, I will describe how each access measure varies geographically, to highlight the importance of including geographic measures in an analysis of college access.

Financial aid policies differ widely from state to state. A 2010 report by the College Board Advocacy and Policy Center describes their "College Completion Agenda" – a list of ten policy recommendations – and describes how educational policies differ across the country. They find that during the past ten years, states have been investing more money in merit-based financial aid. But each state has its own unique policy. Georgia's HOPE (Helping Outstanding Pupils Educationally) Scholarship program began in 1993. Financed by the state lottery, the scholarship rewards academic achievement (maintenance of 3.0 GPA) and in return covers tuition, fees and books at in-state public colleges or universities. Other states such as Florida, Tennessee, New Mexico, and Louisiana have similar large merit-based programs. Other unique state policies include Virginia's Two-Year College Transfer grant which provides an additional $1,000 annual

incentive for students who have received an associate degree and will enroll in a four-year institution the following year in a shortage field (e.g. science, technology, engineering, mathematics, or nursing). Oklahoma's Promise Scholarship targets low-income students in middle school – the students agree to take a rigorous high school curriculum, maintain a 2.5 GPA, practice good behavior and complete the FAFSA. In return, the state provides $54 million in funding. Some states have targeted adult learners – Michigan provides up to $5,000 for adults to attend two years at a community college. This type of variation in state financial aid policy provides a strong argument for including some measurement of geography in any analysis of college access.

The College Board's report also examines the variety of state policies currently in place to improve academic preparation. Some states have implemented standards for teachers and principals, while others have aligned K-12 education with international standards and college admission expectations, or improved high school and career counseling. Although each state has some structure in place to articulate their own standards, there is little agreement between states when it comes to common measures, definitions of progress, how to deal with students who transfer across state lines, and teacher training standards. These discrepancies create wide variation in the level of student preparation by state. In their 2003 study, Mykerezi and colleagues found that in counties where local spending on K-12 education is low, the percentage of adults without a high school degree is high. It follows that these same regions will have a hard time attracting a skilled workforce. Large differences in resources devoted to primary and secondary school education of White and Black southern youth had a significant impact on academic preparation and eventual earnings.

One of the critical measures of college access is family income, and it is not surprising that this measure varies significantly across the country. According to the 2009 American Community

Survey, poverty rates varied from a low of 8.5% in New Hampshire to a high of 21.9% in Mississippi. Similarly, tuition prices range from $6,428 in the South to $9,857 in New England for public four year colleges and from $1,594 in the West and $4,221 in New England for two-year colleges (College Board Advocacy & Policy Center, 2010). Finally, the racial and ethnic makeup of the United States has been changing rapidly in recent years, and those changes vary widely by region. Between 1990 and 2000, for example, twelve states saw their non-Hispanic white populations decline. During the same period, Black populations declined in only two states, and Hispanic and Asian populations grew in every state. This growth is even more pronounced in the South and West, where most states saw double-digit percent increases in the non-White and Hispanic populations (Crouch, 2007).

While it may seem obvious that a student's location impacts their level of college access, few studies have included a geographic measure in their research. However, a small number of studies that have included some form of geographic access measure. In her 2006 study, Baird attempts to improve upon the previous research by considering factors that influence differences in state enrollment rates such as the supply of colleges available in the state and the amount the state spends on higher education, while simultaneously examining a wider array of policy variables that may influence enrollment decisions, such as student preparation, financial aid, family background, labor market conditions, and tuition costs, disaggregating the entire analysis by race. She finds that state need-based aid and a state's investment in capacity are the most powerful predictors of state-level enrollment rates in some form of higher education. These findings are significant for a number of reasons. Geographic access is something that has been overlooked in previous research. It has been typically assumed that the barriers to education are due to finances or ability, not geographic access. However, Baird's research shows that the supply of colleges in a region is one of the most significant predictors of whether a student decides to attend college.

Baird's review highlights a common weakness among the current available research. Measuring exogenous variability in access to education can be quite complicated. Kane describes the concern perfectly:

"The main sourcse of variation in price are long-standing differences in states' tuition policy, which are likely to be correlated with other state policies, such as the number of community colleges in a state. Within states, student-level variation in financial aid packages partially reflect differences in academic talent or financial need, which may be only imperfectly measured in observational analyses. For instance, low-tuition states such as California may simply encourage college enrollment more than high-tuition states such as Pennsylvania and Delaware in ways other than in their tuition levels: by building more schools close to people, by recruiting more in high school, and so forth (Kane, 1994)."

I have shown that there is large variation in states' investments in higher education. These investments may come in the form of lower tuition, increased financial aid, more available seats at state schools, or more community colleges. But many of these measures may be correlated with other individual characteristics such as academic preparation, family income, or even demographics. When combined with the usual factors of tuition, financial aid information, and family backgrounds, geographic information can be particularly useful in helping determine college enrollment. Many of the studies Baird examined used geographical measures to try to capture this variability, but most looked at these measures on a state level, if at all. Within states, student-level variation in financial aid packages partially reflects differences in academic talent or financial need, which may be only imperfectly measured in observational analyses.

Particularly for low income families, geography is a substantial consideration. The cost of school is minimized when the student is able to live at home and maintain employment. Newman-Ford (2009) identified the role of finance as a key motivator for remaining at home, with students from low-income backgrounds being most likely to remain at home in order to reduce the financial burden of being a student. State financial aid may be a critical determinant for students

considering whether or not to attend college, but even when using individual level data it is very difficult to get an accurate measure of how much financial support each student would receive if they applied for college. For this reason, a variety of methods for calculating the supply of colleges in a given region, or the physical access to college, have been attempted in the hopes of capturing some of this exogeneity.

In her 2006 study, Baird summarizes much of the previous research focused on geographic access to higher education. According to her summary, one of the first researchers to incorporate geographic measures as a means to explain some of the exogenous variation in college attendance was Card, in 1993. He used the presence of an accredited four-year college in the local labor market as an indicator for access, and found a strong relationship between proximity and enrollment, particularly for those students with the lowest propensities to continue their education. Rouse (1994) included the state-level number of two year schools and four year schools per capita as well as the distance from the students' high school to the nearest two-year and four-year colleges to control for geographic access. Cameron and Heckman (2001) used the presence of a public two or four year school in the county as a geographic access measure. Mykerezi Mills and Gomes (2003) used a straight-line distance from each county center to the nearest college as a measurement instrument. Jepsen and Montgomery (2009) improved upon the straight line measurement by calculating the travel distance from an individual's home to the nearest university to measure the effects of proximity on enrollment, but their study was limited to the greater Baltimore area and focused solely on adult students' decisions to attend community college. Their findings, however, showed a strong relationship between proximity and enrollment: for adult learners, each additional mile of travel distance to the nearest community college reduces enrollment by 3 to 5%. Finally, a study by Rosenbaum (1995) examined a residential integration program – the Gautreaux program – in which low-income families were randomly given the opportunity to move to suburban neighborhoods surrounding Chicago. The

study looked at the eventual success of the "urban movers" compared with the "suburban movers" and found that the suburban mover youth did better on several education measures and were more likely to have jobs with good pay and benefits.

The use of geographical measures is not limited to academic research. Huang and Mills (1999) used commuting distance as a way to measure the benefits of commuting to large metropolitan areas for higher wages.

These studies highlight the need for improvements in geographic measures in academic research. Researchers who ignore geographic measures completely are also ignoring a critical piece of the college access puzzle. Examining geographic access on a state-level assumes homogeneity of access within each state, which as we have seen may not be justified. Even county-level measures can be lacking when we consider large counties with disparate populations, or counties that contain both urban and rural areas. My study will improve upon previous methods used to measure geographic access to higher education. By creating measures of access that are more precise geographically, I will isolate some of the variability in these access measures across counties. In the next section I will describe my methodology and discuss how these methods can be used in future research, whether related to higher education or simply with regard to regional economics.

CHAPTER 3 – RESEARCH METHODOLOGY

OVERVIEW

While a number of studies have attempted to use geographic measures to determine access to education, I have shown that there is much room for improvement in this area. The purpose of my study is to build upon previous methods used to measure geographic access to higher

education, in an attempt to quantify both the supply of colleges in a region and a state's investment in education.

I hope to contribute to the current literature by improving upon the measures previously used and provide more precise measures of college access and regional supply. My improved access measures will help explain even more of the exogenous variation in enrollment decisions and should provide a greater understanding of the regional factors that contribute to higher education enrollment and educational attainment levels.

INSTITUTIONS

The first step in calculating the geographic measure was determining the sample of colleges and universities to target in the study. Using the Integrated Post-Secondary Education Data System (IPEDS) for the years 1990 and 2000, I compiled an initial list of colleges and universities that contained over 9000 institutions and included everything from theological seminaries to beauty schools. Keeping in mind the target of increased access for first time students and the ultimate goal of degree attainment, it seemed wise to eliminate some schools from the list. Theological seminaries, schools not offering at least a two-year degree, schools without an undergraduate offering, administrative units, and schools classified as "non-degree offering" were all eliminated as they do not lead to formal post-secondary degrees. Medical schools, health professional schools, law schools, and other specialized professional schools are also not considered as they are typically post baccalaureate institutions with a narrow focus and do not contribute significantly to access to a college education. The total number of colleges and universities considered is 2,764. For each remaining school, information was collected on enrollment, tuition prices[2], number of seats available for first-time full-time freshmen, the highest degree offered,

[2] Tuition was calculated by totaling 'tuition2' (in-state, first time, full time undergraduate tuition) with 'fees2' (in state undergraduate fees).

and whether the institution was minority serving (a Hispanic-serving institution or Historically Black College and University). Any schools reporting no tuition or no available seats were deleted. The final list contained 2,648 institutions. To ensure accuracy in the final list of schools, I cross-checked the list using the same characteristics from 1990. 197 new schools were started between 1990 and 2000, and 124 schools closed during that time. Further, I used a general web search to verify the start and closure dates of some of these colleges.

After finalizing the list of institutions in 2000, eight categories of schools were created: public two-year and four-year institutions, private two-year and four-year institutions, two-year Hispanic-serving institutions, four-year public and private Hispanic-serving institutions, and Historically Black Colleges and Universities. In the sections following, the categories are explained in greater detail, along with some unique characteristics and rationale for inclusion in the study.

Table 1 contains descriptive statistics for the entire population of institutions included in my analysis. In the sections that follow, I will include similar descriptive statistics for each of the eight categories of schools included in the final analysis, to give context and allow for comparisons between institution types. The minimum value for the full-time first-time enrollment shown below warranted further research – what kind of institution would only enroll one student? To investigate, I selected all those institutions from the population that had a full-time first-time enrollment of less than 15 (n=33), and searched for the school online. All of the institutions I researched are operational. Most are very specialized schools with only one or two programs; others are primarily master's degree granting, but offer one bachelor's degree. While these are not what most people would have in mind when they think of access to higher education, it is only fair to leave these schools in the analysis, as they do offer students access to a college degree.

Table 1 – Descriptive Statistics: All Institutions included in Analysis

		Observations	Mean	Std Dev	Min	Max
All Institutions	Percent Hispanic Enrollment	2648	7.3	15.2	0	99
	Percent Asian Enrollment	2648	3.7	7.9	0	99
	Percent American Indian Enrollment	2648	1.5	8.0	0	99
	Percent Black Enrollment	2648	12.1	18.5	0	99
	Tuition and Fees	2648	7292	6954	11	32765
	Full-Time First-Time Enrollment	2648	6598	830	1	7560

FOUR-YEAR INSTITUTIONS

Compared with other countries, higher education in the United States is highly egalitarian. Americans traditionally feel that everyone should receive a "common", unified academic education (Goldin, 1999). Historically, however, higher education has focused primarily on a small minority of students – mostly upper-income, white males. Between 1638 and 1819 only 49 higher education institutions were established, 40 of them private, and all of them four-year. In fact, until the early part of the twentieth century (and the growth of the junior college), four-year institutions were the only options for students wanting to pursue higher education.

During the 19th century a greater need for specialized education developed, due in part to increasing applications in science and industry, and along with it the expansion of the higher education system. During that time over 650 colleges and universities were established, more than 80 percent of which were private (Goldin & Katz, 1999). Then, in the late 19th century, the Morrill Land Grant Act gave scrip in the form of federal land to each state for the endowment, support and maintenance of at least one college. This Act, along with changing demographics in the college-age population led to a burst of activity in the public sector. Prior to 1910, only about 10% of all young Americans graduated from high school, but by the mid-1930s that number was about half in most states. More students were prepared to attend college, but fewer of them were prepared to pay the higher tuition prices at private institutions. Consequently, the percentage of students at public institutions increased from about 22% to about 50% during this time, while the

total number of public institutions changed very little (Goldin & Katz, 1999). This trend continues today. In 2004 there were only 630 public four-year institutions in the United States, but these institutions enrolled 6.2 million students, 5 million undergraduates and slightly more than 1 million graduate students (Eckel & King, 2004).

The past fifty years have seen an ever-increasing diversity of students attending college. The civil rights movement of the late 1960s granted racial and ethnic minorities – particularly African- and Hispanic- Americans – access to institutions from which they had previously been excluded (Gumport, Iannozzi, Shaman, & Zemsky, 2009). Today, 49% of Blacks and 45% of Hispanics are enrolled in college compared with 61 percent of non-Hispanic Whites (Davis & Bauman, August 2008). Much of this discrepancy is due to the differences in four-year attendance. 42% of all non-Hispanic White students attended a four-year institution full-time in 2006, while only 31% of Black students and 24% of Hispanic students earned the same honor. One of the great successes in higher education in the United States has been the expansion of education for women. Since the 1980s women have enrolled in college in greater numbers than men, and have received bachelor's and graduate degrees in greater numbers than men.

Table 2 provides descriptive statistics for all of the public and private four-year institutions included in my analysis. Average tuition and fees, enrollment, and minority enrollment are included. While the two institution types are fairly similar in their demographic makeups, they vary greatly in average tuition and enrollment. The public four-year institutions have nearly four times the average enrollments of the private institutions, while the average tuition of the private institutions is more than four times that of the public. The other notable difference between the two groups of schools is in their prevalence. There are almost twice as many private four-year institutions than there are public. This is consistent with what we have seen from the literature – private institutions are more common, but public colleges educate more students through higher

enrollments and lower tuition. Later, in the analysis, we will see whether the presence of these institutions has a positive impact on the educational attainment of a region, and if there is a greater positive impact for one institution type over the other.

Table 2 – Descriptive Statistics: Four Year Institutions included in Analysis

		Observations	Mean	Std Dev	Min	Max
Public	Percent Hispanic Enrollment	462	3.5	4.2	0	22
	Percent Asian Enrollment	462	4.1	8.0	0	91
	Percent American Indian Enrollment	462	1.3	5.1	0	91
	Percent Black Enrollment	462	7.7	9.5	0	87
	Tuition and Fees	462	3585	1339	750	11069
	Full-Time First-Time Enrollment	462	1556	1364	6	7560
Private	Percent Hispanic Enrollment	929	3.6	3.7	0	23
	Percent Asian Enrollment	929	3.3	5.2	0	88
	Percent American Indian Enrollment	929	0.6	3.4	0	85
	Percent Black Enrollment	929	7.5	9.4	0	98
	Tuition and Fees	929	15244	5296	150	32765
	Full-Time First-Time Enrollment	929	412	457	1	4257

TWO YEAR INSTITUTIONS

Over the past 50 years, the number of two year institutions in the United States has grown substantially. During this same period, the role that these schools play in higher education has changed. Community colleges, also referred to as junior or technical colleges, were originally created during the early twentieth century as an alternative to the traditional four-year higher education model. Between 1960 and 1980, the number of two year institutions grew from 332 to 869, in response to the college-age baby-boomers. At the time, the existing education system couldn't handle the sudden increase in enrollment. Community colleges could allow states to preserve the quality of the four year college while not having to exclude individuals from higher education. Since then, their role has expanded to include five facets of educations: transfer education (preparing students for a four-year institution), career education (preparing students for

the workforce), developmental (remedial education for high school graduates), continuing (non-credit courses for the community), and industry training (training for regional employees). In recent years, their numbers have grown again, this time due mostly to for-profit two year institutions[3].

Originally, community colleges strived for very low or free tuition. This was abandoned in the 1990s as the costs of higher education skyrocketed. Even with their increased costs, however, community colleges are still the most affordable form of higher education. The average cost of one year at a community college is $2,544, compared to $7,020 for a four-year public institution (College Board Advocacy & Policy Center, 2010).

In 2006, three-quarters of all four-year college freshmen attended an in-state college (U.S. Department of Education, 2008). This statistic is certainly much higher for students at community colleges. The function that community colleges will play in educating underserved populations will depend greatly on their location. Hispanics currently have the highest two-year entry rates, which can be greatly attributed to the regional concentration of Hispanics in states such as California and Texas, which have extensive community college networks. 92% of Hispanics live in a county in which either a two- or four- year college is located, compared with only 82% of whites (Cameron & Heckman, 2001). This issue has led many to wonder how much community college diverts students from four year colleges (diversion) and how much it provides a place for students who might not otherwise attend college (democratization). Including two year institutions in my analysis will help us understand whether these institutions have a positive effect on the educational attainment of the regions they serve, if their effect is strengthened or diminished depending on the demographic characteristics of the region, and whether the democratization or diversion effect dominates.

[3] For-profit institutions were not included in this analysis.

Table 3 contains descriptive statistics for all two-year institutions included in my analysis. It is interesting to note the differences between two-year and four-year institutions. There are almost twice as many two-year public (n=881) than four-year public institutions (n=462). Conversely, private four-year institutions are more common than private two-year institutions (only 80 private two-year institutions were selected for this analysis). Tuition and fees are significantly lower at the public institutions, regardless of type (two-year or four-year). For example, average annual tuition and fees were approximately $1920 at two-year public institutions, and approximately $3585 at four-year public institutions in 2000, compared with more than $8000 at two-year private institutions and more than $15,000 at four-year private institutions. Finally, two-year institutions attract the largest shares of minority students, while private four-year institutions have the smallest percentages of minority enrollment. Later, we will see what impact the presence of a two-year institution has on the overall educational attainment of a region, and how that effect compares to four-year institutions.

Table 3 – Descriptive Statistics: Two Year Institutions included in Analysis

		Observations	Mean	Std Dev	Min	Max
Public	Percent Hispanic Enrollment	881	4.5	5.7	0	29
	Percent Asian Enrollment	881	3.6	9.7	0	99
	Percent American Indian Enrollment	881	1.3	4.3	0	77
	Percent Black Enrollment	881	13.4	16.4	0	99
	Tuition and Fees	881	1920	1251	116	8024
	Full-Time First-Time Enrollment	881	512	470	10	4012
Private	Percent Hispanic Enrollment	80	5.0	6.1	0	20
	Percent Asian Enrollment	80	5.8	13.6	0	86
	Percent American Indian Enrollment	80	0.4	1.0	0	6
	Percent Black Enrollment	80	16.8	19.9	0	99
	Tuition and Fees	80	8084	3855	2250	30500
	Full-Time First-Time Enrollment	80	173	238	1	1653

HISTORICALLY BLACK COLLEGES AND UNIVERSITIES

Historically Black Colleges and Universities (HBCUs) are institutions of higher education that were established before 1964 with the intention of serving the Black community. In 1863, the Morrill Act provided for land grant colleges in each state. However, many southern states excluded Blacks from their land grant colleges. In response, the second Morrill Act of 1890 was passed to require states to establish a separate land grant college for Blacks if they were being excluded from the then existing land grant college. Many of the HBCUs were founded in response to the Second Morrill Act (Goldin, A Brief History of Education in the United States, August 1999). Today, there are 105 HBCUs located throughout the country. These institutions are primarily four-year institutions, but the list does include some two-year schools. Though mostly still clustered in the Southeast region, their range has grown over time. From 1976 to 2001, total HBCU enrollment grew from 180,059 to 222,453 (U.S. Department of Education, 2010).

As HBCUs work harder to maintain enrollment levels and low tuition costs, the percentage of non-Black students enrolled at these institutions has begun to climb. HBCUs do not discriminate in admissions. They are open to all students who meet admissions criteria, and therefore most public HBCUs have significant non-black populations. A small number of HBCUs have a majority of non-black students. For example, during the 1999-200 school year, only 10% of the total enrollment at Bluefield State College in West Virginia was African American (U.S. Department of Education, National Center for Education Statistics, 2002).

In their 2003 study, Mykerezi, Mills, and Gomes examined the effect of HBCUs on racially diverse rural counties throughout the United States. They found that the presence of an HBCU improved social, financial, and physical access to postsecondary education among rural Blacks (Mykerezi, Mills, & Gomes, 2003). For racially diverse students, pursuing education in an

environment surrounded by individuals with similar backgrounds makes higher education more accessible socially. HBCUs make postsecondary education more financially accessible by providing relatively low-cost college to students. On average, HBCUs charge about $6,600 less in tuition than comparable institutions (Clark, 2009). Finally, HBCUs minimize the physical distance an individual residing in the rural South must travel to enroll in a college or university.

My study will improve upon the research of Mykerezi and colleagues by including a more precise geographic distance measure in the analysis, as well as local tuition prices and available seats. The inclusion of HBCUs in the analysis[4] will allow us to see if improved access to postsecondary education has the same effect on young people in predominantly Black counties as in other counties throughout the U.S. Table 4 shows the descriptive statistics for the HBCUs included in the analysis. All the HBCUs in this analysis are four-year institutions, but they can be either private or public, so it is not surprising that the average enrollment for this category of institution is less than the typical public school, but greater than the typical private. Similarly, the average tuition and fees is slightly more than what would be at a public institution, but less than a private. HBCUs' most notable characteristic, of course, is their very high percentage of black enrollment – 83.6 percent on average. Including this group of schools in my analysis will allow me to determine the amount by which the presence of an Historically Black College and University contributes to the educational attainment of Blacks in the region.

[4] When determining the categories of institutions, a small number of two-year HBCU institutions were discovered. To avoid duplication these institutions were coded as a two-year public institution rather than HBCUs.

Table 4 – Descriptive Statistics: Historically Black Colleges and Universities (HBCUs) included in Analysis

		Observations	Mean	Std Dev	Min	Max
HBCUs	Percent Hispanic Enrollment	82	0.7	1.4	0	9
	Percent Asian Enrollment	82	0.4	0.8	0	3
	Percent American Indian Enrollment	82	0.0	0.4	0	3
	Percent Black Enrollment	82	83.6	23.0	0	99
	Tuition and Fees	82	5597	3173	1620	12132
	Full-Time First-Time Enrollment	82	551	422	32	2185

HISPANIC SERVING INSTITUTIONS

The Hispanic Serving Institution (HSI) designation was established in 1992 in response to shifting demographics. As more Hispanic students began attending college many schools began to see their student population change to include a large Hispanic population. This prompted an initiative to create a classification for these schools, similar to those for HBCUs and Tribal Colleges. Unlike HBCUs and Tribal Colleges, the definition of what constitutes an HSI is not predetermined by legislation, but rather criteria outlined by the U.S. Department of Education. According to the Department of Education, Hispanic serving institutions must be degree-granting institutions where at least 25 percent of full-time-equivalent undergraduates are Hispanic (U.S. Department of Education, National Center for Education Statistics, 2002). In order for a school to be eligible for federal funding under the Title V Developing Hispanic-Serving Institutions Program, however, they must meet additional criteria. The institution must be non-profit, must offer at least a two-year degree, must be accredited, and must have a high proportion of economically needy students (25 percent of the overall student population and 50 percent of the Hispanic student population must be low-income). Institutions that meet the HSI criteria above are eligible to apply for Title V federal funds. The assumption here is that Latino postsecondary education can be improved by improving the quality of the institutions they attend.

Very little research has looked at whether HSI institutions increase educational attainment for Latino students. One major obstacle associated with analysis of HSIs is the lack of consistent datasets that identify HSIs and more specifically whether these schools have received Title V funding. IPEDS first began recognizing the HSI designation in 2000 and they still have no indicator for whether the schools received Title V funding. Including the HSI designation in my analysis will allow us to see the relationship between the location of a Hispanic Serving Institution and its impact on educational attainment of Latinos (as well as non-Latinos) in the region. Table 5 shows the descriptive statistics for all types of Hispanic Serving Institutions included in my analysis. Two year institutions are the most common, with 105 throughout the country. Of course, all three types of institution have high percentages of Hispanic enrollment.

Table 5 -- Hispanic Serving Institutions (HSIs) included in Analysis

		Observations	Mean	Std Dev	Min	Max
Four Year Public	Percent Hispanic Enrollment	44	55.9	31.7	12	99
	Percent Asian Enrollment	44	3.8	4.8	0	19
	Percent American Indian Enrollment	44	0.8	1.5	0	7
	Percent Black Enrollment	44	7.5	11.6	0	48
	Tuition and Fees	44	2248	739	820	4761
	Full-Time First-Time Enrollment	44	1030	758	44	3135
Four Year Private	Percent Hispanic Enrollment	45	65.0	34.9	6	99
	Percent Asian Enrollment	45	3.0	4.7	0	17
	Percent American Indian Enrollment	45	0.3	1.5	0	10
	Percent Black Enrollment	45	6.5	8.9	0	41
	Tuition and Fees	45	8278	5814	295	23427
	Full-Time First-Time Enrollment	45	527	481	3	1965
Two Year	Percent Hispanic Enrollment	105	44.1	18.7	24	99
	Percent Asian Enrollment	105	7.0	8.5	0	41
	Percent American Indian Enrollment	105	1.5	3.7	0	35
	Percent Black Enrollment	105	8.5	10.1	0	55
	Tuition and Fees	105	1743	2127	11	9475
	Full-Time First-Time Enrollment	105	615	645	41	4072

GEOGRAPHIC DATA

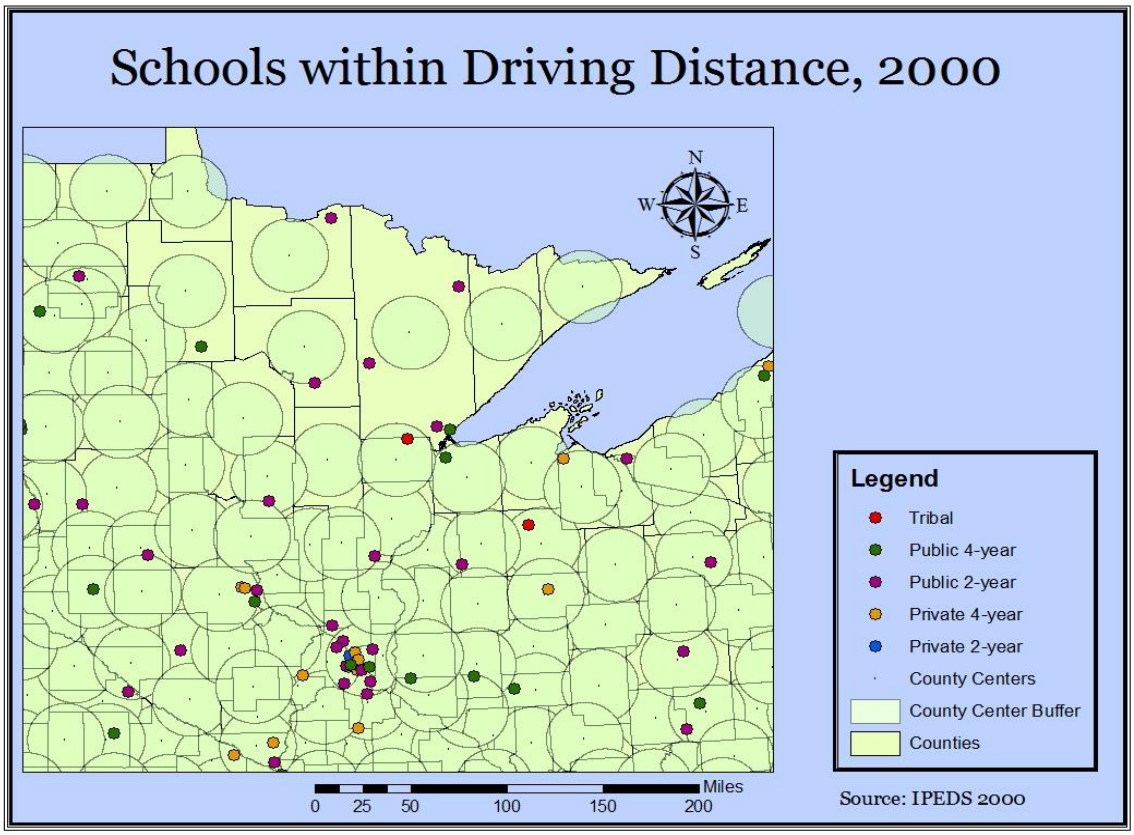
In addition to the institutional data, geographic data was required to calculate physical access for students in a given region to the nearest institution. In this section I describe how the available geographic data was used to develop this new measure. A census tract is a geographic region defined for the purpose of taking a census. Census tracts represent the smallest territorial unit for which population data are available in many counties. For the purpose of my analysis, I used Arc-GIS software to calculate the geographical relationship between each census tract and the colleges and universities in the surrounding area.

One benefit of using census tracts rather than counties as the geographic unit can be seen by looking at Figure 1. Here, we can see that a number of different types of colleges have been identified, along with a 20 mile buffer around each *county* center. This is the unit of measurement that was used in the Mykerezi, Mills and Gomes study of HBCUs. Looking closely, we can see there is a large cluster of schools near the bottom of the map. This cluster represents the Minneapolis-St. Paul metro area in Minnesota. Because of the size of the counties in that region, the buffers surrounding the county centers in this area overlap and the attributes of many of these metro schools are being included in multiple county buffers. Directly northeast of the Minneapolis-St. Paul region, there is a smaller cluster of schools (one Tribal College, one Public 2-year college, and two Public 4-year colleges). These schools are located in the Duluth area. Due to the size of the county in which Duluth is located, however, these schools are not being included in the buffer surrounding the county center. Using census tract rather than county centers in the analysis would capture schools like these, which are located in large counties with pockets of densely populated regions. For each county, the following calculation was used to determine the weighted distance to the nearest institution type:

$$\frac{\sum(P_t D_t)}{P_c}$$

where P_t is the population of sixteen to nineteen year olds in each census tract, D_t is the distance to the nearest institution type from the center of the census tract, and P_c is the population of sixteen to nineteen year olds in the county.

Figure 1 -- County center buffers and regional schools



Using Arc-GIS software and the IPEDS zip code variable, I mapped (or "geocoded") each college and university from the list described earlier. Once each category of schools was geocoded, I calculated the distance from the center of each census tract in the United States to the nearest school in each category[5]. By using the distance from each census tract center to the nearest

[5] Because the eight categories of schools are mutually exclusive, the actual categories are as follows: Four-Year Historically Black Colleges and Universities; Hispanic Serving Institutions (2-year); Hispanic Serving Institutions (Private 4-year) Hispanic Serving Institutions (Public 4-year); Private 2-year institutions (excluding all Tribal Colleges and HSIs); Public 2-year institutions (excluding all Tribal Colleges and HSIs);

college or university, I was able to create a weighted average distance for each county, giving more weight to tracts with a larger population of 16-19 year olds. This measurement is more precise than any of those previously used, because weighting the distances by the potential student population in each tract gives more weight to distances from heavily populated tracts (such as metropolitan areas) and less weight to sparsely-populated tracts. Thereby creating a more accurate measure of how far the average person living in each county would actually have to travel to attend college. Figure 2 shows all census tract centers, shaded to represent their distance from the nearest 2-year college (shown in red). Here, again, we see a cluster of census tracts in the Minneapolis-St. Paul metro area, all shaded in dark brown indicating that they are located less than 10 miles from the nearest 2-year school. Now, we also see a tighter cluster of census tracts in the Duluth area.

In addition to the distance measure, I created a 20-mile radius around the center of each census tract, again weighted by the population of 16-19 year olds in the tract. The buffer represents a reasonable estimate of driving distance. While some studies have used county-level or state-level measurements of access, it is reasonable to assume that students would be more influenced by the distance they actually have to travel to attend school, rather than the number of schools within their county or state, which could vary widely depending on where the student lives. Within each buffer, I calculated the lowest cost college, the average cost of all colleges, and the total number of college seats available to first-year, full-time students, using the weighted census tract values to calculate the average for the entire county[6]. So, for the average person in the county, these

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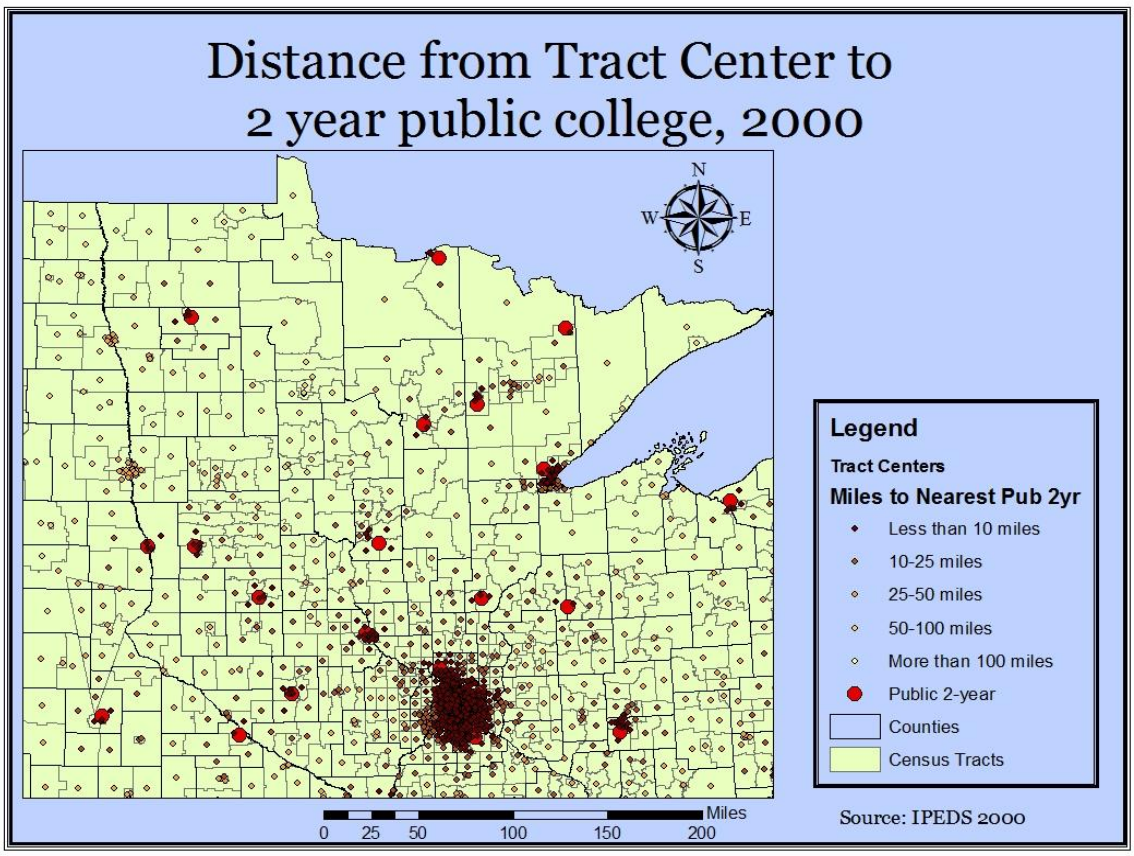
Private 4-year institutions (excluding all HSIs and HBCUs); Public 4-year institutions (excluding all HSIs and HBCUs).

[6] Counties without a college in driving distance were given values of 0 for the average tuition and minimum tuition measures. A dummy variable called 'No College within Driving Dist' was then given a value of 1 for these counties. The inclusion of this variable represents the marginal effect of not having a college within a reasonable driving distance.

measures will represent the minimum they would have to pay to go to college within 20 miles of where they live, and the average cost to attend college near where they live. The number of

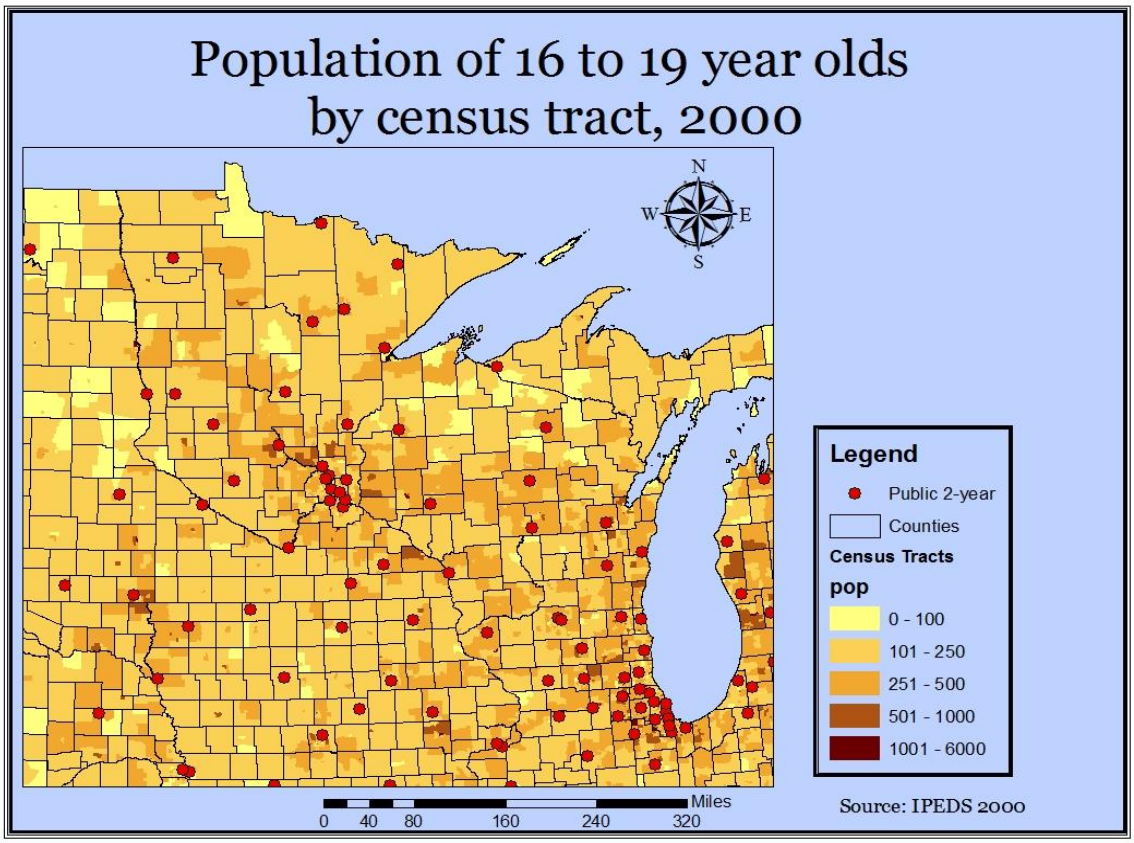
Figure 2 -- Tract center distance measures



college seats per capita available in the 20 miles radius from where they live will also be computed. These measures are new and they represent a major improvement on those currently available. Consider, for example, a student who lives in a county with 2 or more colleges or universities. According to previous measures, this student would likely have good access to higher education. If, however, the schools are quite expensive, or have few seats available, or are outside the range of a reasonable driving distance, this may not be the case. With my improved measures, it will be possible to better determine how proximity, supply, and price interact with other county-level measures of well-being to determine the total share of the population 25 years and older with a college degree or higher. The decision to use the 16-19 year old population in

each census tract as a weight for each distance measure was made with the assumption that this would be the target population for the colleges and universities in the region. While not every individual in this population is likely to pursue a college degree, they are the population a college would be most concerned with serving, therefore were selected for that reason. Figure 3 shows the same region again, with each census tract shaded to represent the total population of 16-19 year olds in the tract. Heavily shaded tracts will have the effect of "pulling" the center of the county toward them.

Figure 3 -- Census tract population



SOCIOECONOMIC DATA

In addition to the geographic data, county-level census data was collected on a variety of socioeconomic demographic measures to be used as controls in my analysis. Data on the educational attainment of the adult population (as measured by the percentage of the population with an associate degree or higher or a bachelor's degree or higher) will serve as the dependent variable in my analysis. Control variables include a lagged measure of educational attainment (1990 county measures of attainment), per capita income, and lagged per capita income. Counties with a large Black or Hispanic population (greater than10 percent) were selected for separate analyses, in order to examine the effect of HSIs and HBCUs on these populations and determine whether the schools are fulfilling their missions of increasing educational opportunities for these populations. For the purpose of these analyses, Black and Hispanic educational attainment and per capita income for 1990 and 2000 were selected as well.

VARIABLES

Table 6 contains descriptive statistics for each of the variables to be included in the analysis, for every county in the United States. Some things to remember when examining the table: all educational attainment variables represent the percentage of individuals in the county that have earned a given education level *or higher*, meaning the percentage of the population with a bachelor's degree includes all of those individuals (25 and older) who have earned a bachelor's degree or higher and the percentage of the population with an associate degree includes all those with an associate degree or higher.

In addition to analysis on the entire country, I will be performing additional analyses on counties with a significant Black and Hispanic population (10% of the county's total population or higher). Tables 7 and 8 show the descriptive statistics for these counties, along with the variables selected for each analysis.

Table 6 -- Descriptive Statistics for all variables included in Analysis

Variable Name	Description	Obs	Mean	Std. Dev.	Min	Max
% BA or BS in 2000	Percent of county with bachelor's degree in 2000	3141	16.5	7.8	4.9	63.7
% BA or BS in 1990	Percent of county with bachelor's degree in 1990	3137	13.5	6.6	3.7	53.4
% AA or AS in 2000	Percent of county with an associate's degree in 2000	3141	22.2	8.7	7.3	67.6
% AA or AS in 1990	Percent of county with an associate's degree in 1990	3137	18.9	7.6	5.3	58.9
% Black with BA 2000	Percent of county's Black population with a bachelor's degree in 2000	3141	10.8	15.2	0.0	100
% Black with BA 1990	Percent of county's Black population with a bachelor's degree in 1990	3137	9.2	16.0	0.0	100
% Black with AA 2000	Percent of county's Black population with an associate's degree in 2000	3141	15.6	18.3	0.0	100
% Black with AA 1990	Percent of county's Black population with an associate's degree in 1990	3137	13.0	18.2	0.0	100
% Hisp with BA 2000	Percent of county's Hispanic population with a bachelor's degree in 2000	3141	10.9	11.5	0.0	100
% Hisp with BA 1990	Percent of county's Hispanic population with a bachelor's degree in 1990	3137	11.3	14.9	0.0	100
% Hisp with AA 2000	Percent of county's Hispanic population with an associate's degree in 2000	3141	15.0	13.2	0.0	100
% Hisp with AA 1990	Percent of county's Hispanic population with an associate's degree in 1990	3137	16.4	17.5	0.0	100
% White with BA 2000	Percent of county's White population with a bachelor's degree in 2000	3141	17.8	8.6	0.0	77.3
% White with BA 1990	Percent of county's White population with a bachelor's degree in 1990	3137	14.5	7.2	3.7	71.1
% White with AA 2000	Percent of county's White population with an associate's degree in 2000	3141	23.7	9.3	0.0	79.6
% White with AA 1990	Percent of county's White population with an associate's degree in 1990	3137	20.0	8.2	5.3	74.8
Hisp Per Capita Income 1999	Per capita income in 1999, Hispanic population	3121	11365	6835	100	222392

Variable Name	Description	Obs	Mean	Std. Dev.	Min	Max
Black Per Capita Income 1999	Per capita income in 1999, Black population	2898	12820	8352	10.0	133613
White Per Capita Income 1999	Per capita income in 1999, White population	3141	19282	4820	9914	72287
Per Capita Income 1999	Per capita income in 1999, Total population	3141	17513	3943	5213	44962
Hisp Per Capita Income 1989	Per capita income in 1989, Hispanic population	3086	7450	4803	0.0	93810
Black Per Capita Income 1989	Per capita income in 1989, Black population	3136	6650	655	-7153	212120
White Per Capita Income 1989	Per capita income in 1989, White population	3137	11967	3039	4696	40380
Per Capita Income 1989	Per capita income in 1989, Total population	3137	11162	2723	3417	28381
Minimum Tuition	Minimum tuition for institutions within driving distance of county	3141	1992	2731	0.0	24028
Average Tuition	Average tuition for institutions within driving distance of county	3141	3639	4149	0.0	27859
Number of Seats	Number of first-time full-time seats within driving distance of county	3140	1460	4104	0.0	67632
Dist to Nearest Private 2-Year	Distance to nearest private two-year institution from county	3140	136	166	2.1	2140
Dist to Nearest Private 4-Year	Distance to nearest private four-year institution from county	3140	48.7	52.8	0.8	953
Dist to Nearest Public 2-Year	Distance to nearest public two-year institution from county	3140	34.2	47.2	1.9	1033
Dist to Nearest Public 4-Year	Distance to nearest public four-year institution from county	3140	41.3	41.1	0.9	953
Dist to Nearest HBCU	Distance to nearest HBCU from county	3140	294	435	2.2	3911
Dist to Nearest 2-Year HSI	Distance to nearest two-year Hispanic serving institution from county (weighted)	3140	318	240	1.7	2541
Dist to Nearest 4-Yr Priv HSI	Distance to nearest four-year private Hispanic serving institution from county (weighted)	3140	354	216	2.6	2706
Dist to Nearest 4-Yr Pub HSI	Distance to nearest four-year public Hispanic serving institution from county (weighted)	3140	343	243	1.5	2611
No College within Driving Dist	Dummy variable indicating county has no institutions within driving distance	3141	0.3	0.4	0.0	1.0

Table 7 -- Descriptive Statistics for Counties with a Significant Black Population

Variable	Obs	Mean	Std. Dev.	Min	Max
% Black with BA 2000	732	8.4	5.5	0.0	42.9
% Black with BA 1990	731	6.8	4.5	0.0	40.2
% Black with AA 2000	732	12.2	6.9	0.4	49.3
% Black with AA 1990	731	10.0	5.8	0.0	46.4
% White with BA 2000	732	18.9	9.7	5.1	77.3
% White with BA 1990	731	15.6	8.1	4.2	69.0
% White with AA 2000	732	24.3	10.1	6.6	79.6
% White with AA 1990	731	20.6	8.8	5.8	71.9
Black Per Capita Income 1999	732	11442	3127	2701	25947
Black Per Capita Income 1989	731	6532	2108	0.0	18125
White Per Capita Income 1999	732	20410	5268	10276	72287
White Per Capita Income 1989	731	12964	3205	7197	40380
Minimum Tuition	732	1569	1895	0.0	17725
Average Tuition	732	3557	3568	0.0	20040
Number of Seats	732	2408	6782	0.0	67632
Dist to Nearest HBCU	732	53.4	90.6	2.3	1366
Dist to Nearest Private 2-Year	732	92.2	56.9	2.1	325
Dist to Nearest Private 4-Year	732	37.0	24.3	0.8	123
Dist to Nearest Public 2-Year	732	18.3	12.5	1.9	118
Dist to Nearest Public 4-Year	732	29.6	18.0	1.1	103
No College within Driving Dist	732	0.1	0.3	0.0	1.0

Table 8 -- Descriptive Statistics for Counties with a Significant Hispanic Population

Variable	Obs	Mean	Std. Dev.	Min	Max
% Hisp with BA 2000	365	5.7	4.2	0.0	24.4
% Hisp with BA 1990	364	4.8	4.0	0.0	23.0
% Hisp with AA 2000	365	8.7	5.3	0.3	31.0
% Hisp with AA 1990	364	8.0	5.4	0.0	32.3
% White with BA 2000	365	3.0	1.8	0.0	10.4
% White with BA 1990	364	13.3	6.9	0.0	37.5
% White with AA 2000	365	44.8	13.1	11.0	82.0
% White with AA 1990	364	39.2	14.1	0.0	74.3
Hisp Per Capita Income 1999	365	10196	2363	4792	18584
Hisp Per Capita Income 1989	364	6458	2096	2386	16120
White Per Capita Income 1999	365	21976	6977	13262	72287
White Per Capita Income 1989	364	12614	4056	4696	40380
Minimum Tuition	365	868	1458	0.0	9977
Average Tuition	365	2226	3369	0.0	14444
Number of Seats	365	2871	9214	0.0	67632
Dist to Nearest 2-Year HSI	365	123	217	1.7	2535
Dist to Nearest 4-Yr Priv HSI	365	210	200	2.6	2265
Dist to Nearest 4-Yr Pub HSI	365	150	222	1.5	2611
Dist to Nearest Private 2-Year	365	225	195	2.1	2140
Dist to Nearest Private 4-Year	365	78.8	79.7	0.8	953
Dist to Nearest Public 2-Year	365	61.0	77.3	2.2	1033
Dist to Nearest Public 4-Year	365	70.9	74.0	2.1	953
No College within Driving Dist	365	0.4	0.5	0.0	1.0

CHAPTER 4 – DATA ANALYSIS AND RESULTS

INTRODUCTION

My analysis is focused on how college supply increases the percentage of college graduates in a given county, and how it affects each county's economic growth and development. Are counties with a healthy supply of higher education opportunities (such as a greater number of community colleges, more four-year public institutions, low-cost tuition, a large number of available seats for undergrads, etc…) more able to attract and keep college graduates? If so, how does that affect the economic well-being of the region, as measured by the educational attainment of the county's adult population? A better measure of college supply will be particularly useful in understanding the effects of higher education on a region's economic development and prosperity.

ORDINARY LEAST SQUARES REGRESSION

My hypothesis is that counties with better measures of access (more available seats for first-year full-time students, lower tuition within a reasonable driving distance, shorter distance between population center and nearest institution, etc.) should have a higher percentage of educational attainment among their adult population. To test this hypothesis, I will regress the educational attainment of each county in the United States on the eleven geographic access measures I developed.

The basic empirical model to be estimated is

$$y_{ijt} = X_{ijt}\beta + Z_i\gamma + \delta y_{ijt-1} + \varepsilon_{ijt}$$

where y_{ijt} is a measure of the percentage of adults 25 years of age or older in educational category j (some college, or no college) in county i at time t (2000); X_{ijt} is a vector of the county-level control variables (per capita income in 1990 and 2000); Z_i is a vector of access variables (distance to the nearest college or university, number of seats within driving distance, lowest cost

college within driving distance, and average cost of all colleges within driving distance); y_{ijt-1} is the lagged county-level dependent variable. I'm controlling for the county's per capita income in 2000 and 1990 and education levels in 1990 in order to show a causal relationship between the distance measures and the dependent variable. Controlling for the temporally lagged dependent variable is known as the "value added specification."

Educational attainment at the county level will be measured using two variables – the share of adults with an associate degree or higher and the share of adults with a bachelor's degree or higher (as opposed to no college at all). To measure the effects of supply on the total share of the population 25 years and older with a college degree or higher, I will use an OLS regression model with robust standard errors. Robust statistics are not unduly affected by outliers or other small departures from model assumptions. Failure to meet assumptions can lead to biased estimates of standard errors and invalid inference, but using a regression model with robust standard errors protects against minor problems such as normality, heteroscadasticity, or observations with large residuals, leverage or influence (UCLA Academic Technology Services).

In addition to performing these regressions on all counties in the United States, I will also analyze the effectiveness of minority-serving institutions – Historically Black Colleges and Universities and Hispanic Serving Institutions – by performing the same basic regression with two notable differences: the sample population includes only those counties with high Black or Hispanic populations, respectively, and the educational attainment of the Black or Hispanic adult population is used as the dependent variable. Comparing the results of these regressions to an identical regression run with the educational attainment of White adults as the dependent variable can help determine if the minority serving institutions are helping those populations they are created to serve.

Interpretation of Results

Table 9 shows the results of two related regressions. The first regresses the percentage of adults with a bachelor's degree or higher on the access measures created for the analysis as well as the control variables (previous educational attainment and per capita income). The second regresses the percentage of adults in each county with an associate degree or higher on the same independent variables and controls. Results indicate that minimum tuition in the twenty-mile radius of the county population center is negatively associated with educational attainment, which is what we would expect – as the minimum tuition within driving distance increases, the percentage of the county with a degree decreases. The partial association of average tuition costs within a 20-mile radius is just the opposite; as average tuition increases, the share of the population with a degree increases as well. Here, we are likely seeing the effect of "latent demand" for education. It helps to think of the population in a region as composed of three distinct groups: definite attendees, definite non-attendees, and undecided (or marginal students). Attendees are more likely to make college attendance a priority regardless of access. For these students, access will have a greater impact on their choice of college rather than their decision to attend at all. Alternatively, non-attendees have little intention of attending college and improvements in local access are unlikely to impact their decision. Rather, it's the undecided (or marginal) students who are most likely influenced by local access measures of minimum cost and distance. Therefore, after controlling for minimum tuition and distance, average price likely represents latent demand of non-marginal attendees. Many researchers have suggested that there is a large latent demand for higher education, so even less prestigious institutions are likely to find customers, often at prices that might seem at odds with their position in the market (Bekhradnia, 2011). The final access measure included in the regression, total number of available seats in the area, is not statistically significant suggesting that space is typically not a limiting factor.

Some notable findings can be seen by examining the distance measures. Distance from the nearest public four-year institution has a strong negative effect on both measures (associate degree or higher and bachelor's degree or higher), while public two-year institutions do not have a statistically significant effect on either. This suggests that as distance from the nearest public four-year institution increases the share of college educated adults deteriorates. This would suggest that marginal students are being drawn into college by public four-year institutions. Somewhat surprisingly, the distance to the nearest private two-year institution is positively associated with associate degrees (as these institutions get further from the county population center the percentage of the population with at least an associate degree increases). Private four-year institutions have similar associations with the percentage of a county with a bachelor's degree or higher. Perhaps private colleges are located in areas that are underserved by the public system and have lower-than-expected educational levels, holding income constant.

The most unusual result from this pair of regressions is the "no college" marginal effect. This variable, "no college", has a value of 1 when there is no college within a 20-mile driving range of the population center of the county. We would expect that this variable would have a negative effect on educational attainment, but it has the opposite. This is, however, the effect after holding constant a myriad of other access measures. To test this further, distance measures were omitted and educational attainment was regressed on the "no college" variable alone (results are not shown). The variable was indeed negative, as we would expect. Lastly, it is interesting to note the effects of the control variables. Previous education is a significant positive predictor of educational attainment, as is per capita income in 1999. Per capita income in 1989 is actually negative and significant, but when we omit the 1999 per capita variable from the equation, the sign changes to positive, as expected. The positive sign of past income when current income is omitted and negative sign once current income is included suggests that it may be income growth that is strongly associated with growth in degrees.

Table 9 -- OLS Regression Results for All Counties

VARIABLES	(1) Bachelors % BA or BS in 2000	(2) Associates % AA or AS in 2000
% BA or BS in 1990	0.9587***	0.1394***
	(0.0213)	(0.0263)
% AA or AS in 1990	0.0742***	0.8788***
	(0.0179)	(0.0228)
Per Capita Income 1999	0.0007***	0.0007***
	(0.0001)	(0.0001)
Per Capita Income 1989	-0.0006***	-0.0007***
	(0.0001)	(0.0001)
Minimum Tuition	-0.0001**	-0.0001***
	(0.0001)	(0.0001)
Average Tuition	0.0001***	0.0001***
	(0.0001)	(0.0001)
Number of Seats	0.0001	-0.0001
	(0.0001)	(0.0001)
Dist to Nearest Private 2-Year	0.0005	0.0009*
	(0.0004)	(0.0005)
Dist to Nearest Private 4-Year	0.0035**	0.0021
	(0.0014)	(0.0017)
Dist to Nearest Public 2-Year	0.0009	-0.0012
	(0.0019)	(0.0022)
Dist to Nearest Public 4-Year	-0.0096***	-0.0086***
	(0.0018)	(0.0021)
No College within Driving Dist	0.3403***	0.0357
	(0.1052)	(0.1292)
Constant	-2.3275***	-1.0535***
	(0.2265)	(0.2685)
Observations	3,136	3,136
R-squared	0.9519	0.9477

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 10 shows the same regression models, using the share of the population with bachelor's and associate degrees as the dependent variables, for counties with a substantial Black population[7]. One notable difference between these regressions and the previous, seen in Table 9, is the inclusion of the HBCU distance measure as a predictor for Black educational attainment. If

[7] Counties with an adult Black population greater than ten percent of the overall adult population (ages 25 years and over) were included in the analysis

HBCUs truly provide educational benefits to the Black population, we would expect that regions which are further from HBCUs would have lower levels of educational attainment among their Black citizens, and we see from the results in Table 10 that this is, in fact, the case. The HBCU distance measure is negative and highly significant, suggesting that regions further from an HBCU institution have lower levels of educational attainment among their Black population. It is worth noting here that I already control for access associated with the nearest college of any kind (the benefit of being close to any college is already captured in the parameter estimate associated with distance to the nearest public four-year college), so the HBCU parameter reflects additional benefits if the nearest college happens to be an HBCU. In fact, the only other distance measure that is a significant predictor for this population is the distance to the nearest public four-year institution, and that is only significantly related to the share of the Black population with a bachelor's degree, not an associate.

The impact of our three access measures are identical to what we saw in Table 9 – minimum tuition has a significant negative relationship with educational attainment, average tuition has a significant positive relationship, and the number of available seats is not significant. Again, we can assume this means that lower minimum tuition levels improve educational access, higher average tuition reflects the latent demand for higher education, and availability of seats is probably not a limiting factor for most students. In these regressions, we see that the "no college" marginal effect (or the effect of not having a college within driving distance) has the expected sign, suggesting that counties which do not have a college within 20 miles have fewer citizens with a bachelor's degree. Previous education levels are again significant predictors of current educational attainment. However, in this instance only the corresponding education type is significant (for example, the percentage of the Black population with a bachelor's degree in 1990 positively predicts the percentage of the Black population with a bachelor's degree in 2000) while the other education type is not a significant predictor. Black per capita income in 1999 has a

significant positive relationship with educational attainment, while per capita income in 1989 is not significant (and like the regressions in Table 9, the measure is actually negative).

Table 10 -- OLS Regression Results for Counties with Black Population Greater than Ten Percent

VARIABLES	(1) Bachelors % Black with BA 2000	(2) Associates % Black with AA 2000
% Black with BA 1990	0.8350***	0.1701
	(0.0897)	(0.1324)
% Black with AA 1990	0.0665	0.7751***
	(0.0722)	(0.1101)
Black Per Capita Income 1999	0.0004***	0.0005***
	(0.0001)	(0.0002)
Black Per Capita Income 1989	-0.0001	-0.0001
	(0.0002)	(0.0002)
Minimum Tuition	-0.0002***	-0.0003***
	(0.0001)	(0.0001)
Average Tuition	0.0001*	0.0001*
	(0.0001)	(0.0001)
Number of Seats	-0.0001	-0.0001
	(0.0001)	(0.0001)
Dist to Nearest HBCU	-0.0033***	-0.0044***
	(0.0009)	(0.0016)
Dist to Nearest Private 2-Year	0.0015	0.0011
	(0.0016)	(0.0021)
Dist to Nearest Private 4-Year	0.0049	0.0026
	(0.0047)	(0.0060)
Dist to Nearest Public 2-Year	0.0122	0.0192
	(0.0091)	(0.0126)
Dist to Nearest Public 4-Year	-0.0115**	-0.0109
	(0.0053)	(0.0069)
No College within Driving Dist	-0.3390	-0.6962*
	(0.3062)	(0.4147)
Constant	-2.2137***	-1.7185
	(0.8130)	(1.0665)
Observations	731	731
R-squared	0.8508	0.8470

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 11 -- OLS Regression Results for Falsification Test (HBCU Effect)

VARIABLES	(1) Bachelors % White with BA 2000	(2) Associates % White with AA 2000
% White with BA 1990	0.8880***	0.0532
	(0.0567)	(0.0608)
% White with AA 1990	0.1172**	0.9417***
	(0.0501)	(0.0545)
White Per Capita Income 1999	0.0005***	0.0005***
	(0.0001)	(0.0001)
Per Capita Income 1989w	-0.0004***	-0.0004***
	(0.0001)	(0.0001)
Minimum Tuition	-0.0001	-0.0001
	(0.0001)	(0.0001)
Average Tuition	0.0001**	0.0001*
	(0.0001)	(0.0001)
Number of Seats	-0.0001	-0.0001
	(0.0001)	(0.0001)
Dist to Nearest HBCU	-0.0015***	-0.0011**
	(0.0003)	(0.0005)
Dist to Nearest Private 2-Year	0.0018	0.0006
	(0.0014)	(0.0016)
Dist to Nearest Private 4-Year	0.0022	-0.0019
	(0.0047)	(0.0052)
Dist to Nearest Public 2-Year	-0.0007	-0.0042
	(0.0079)	(0.0092)
Dist to Nearest Public 4-Year	-0.0254***	-0.0252***
	(0.0053)	(0.0059)
No College within Driving Dist	0.0994	0.1369
	(0.2895)	(0.3475)
Constant	-1.4955**	0.6208
	(0.7329)	(0.7903)
Observations	731	731
R-squared	0.9602	0.9536

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 11 shows the results of the falsification test for the HBCU effect. The purpose of this test is to assess whether the effect that we observed in the previous regression results is unique to Black individuals, or if we will see the same results using a different population. To compare, I selected the same sample of counties as in Table 10, but used measures of White educational

attainment and per capita income rather than Black. If the HBCU institutions are achieving their mission of providing unique educational benefits to Black Americans, we would expect that the observed coefficient for the HBCU distance measure would be either insignificant or very small compared with the coefficient from the previous set of regressions. In fact, the HBCU distance measure is a significant predictor of White educational attainment in counties with a large Black population, but the coefficients are much smaller. This makes sense, as Historically Black Colleges and Universities were created to serve the African-American population, but do admit White students, and can be a good low-cost alternative to other colleges in the region. Due to recent court cases many HBCUs have even started to actively pursue a more diverse student population, providing incentives to disadvantaged whites to enroll (Aster, 2011). For example, two institutions included in this analysis had greater than 80 percent White enrollment during the 1999-2000 academic year[8] (U.S. Department of Education, National Center for Education Statistics, 2002).

Table 12 shows the same regression models, using the share of the population with bachelor's and associate degrees as the dependent variables, for counties with a substantial Hispanic population[9]. The results seen here are very similar to what we have observed previously. Average tuition has a positive significant relationship to educational attainment, and the number of available seats is not significant. One interesting difference here is the lack of significance of the minimum tuition variable, for predicting the share of the Hispanic population with a bachelor's degree.

[8] Bluefield State College had 10 percent Black enrollment, West Virginia State College 15 percent during the 1999-2000 academic year.

[9] Counties with an adult Hispanic population greater than ten percent of the overall adult population (ages 25 years and over) were included in the analysis

Table 12 -- OLS Regression Results for Counties with Hispanic Population Greater than Ten Percent

VARIABLES	(1) Bachelors % Hisp with BA 2000	(2) Associates % Hisp with AA 2000
% Hisp with BA 1990	0.7366***	0.3915***
	(0.0961)	(0.1286)
% Hisp with AA 1990	-0.1130	0.2388**
	(0.0717)	(0.1050)
Hisp Per Capita Income 1999	0.0006***	0.0007***
	(0.0001)	(0.0001)
Hisp Per Capita Income 1989	-0.0002	-0.0001
	(0.0001)	(0.0001)
Minimum Tuition	-0.0001	-0.0002*
	(0.0001)	(0.0001)
Average Tuition	0.0002**	0.0002*
	(0.0001)	(0.0001)
Number of Seats	-0.0001	-0.0001
	(0.0001)	(0.0001)
Dist to Nearest Private 2-Year	0.0001	0.0046***
	(0.0012)	(0.0014)
Dist to Nearest Private 4-Year	0.0050	-0.0014
	(0.0032)	(0.0038)
Dist to Nearest Public 2-Year	-0.0041	-0.0099***
	(0.0031)	(0.0036)
Dist to Nearest Public 4-Year	0.0043	0.0103**
	(0.0038)	(0.0042)
Dist to Nearest 2-Year HSI	0.0036	0.0024
	(0.0026)	(0.0032)
Dist to Nearest 4-Yr Priv HSI	-0.0022***	-0.0035***
	(0.0009)	(0.0010)
Dist to Nearest 4-Yr Pub HSI	-0.0074***	-0.0070**
	(0.0026)	(0.0031)
No College within Driving Dist	-0.9599***	-1.7009***
	(0.2983)	(0.3720)
Constant	-1.2544	-0.9260
	(0.7988)	(0.9523)
Observations	364	364
R-squared	0.7904	0.7957

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

In addition to the four distance measures that have been included in each of the previous regressions (distance to the nearest two-year public, two-year private, four-year public, and four-

year private) I also included the distance to the nearest Hispanic Serving Institutions (two-year, four-year public, and four year-private). Several interesting patterns emerge: For one, both of the four-year Hispanic Serving Institutions are negative and highly significant, suggesting that the further a county is from one of these institutions, the smaller their share of Hispanics with a bachelor's degree will be. However, note that the distance to the nearest "traditional" (non-HSI) public college of any kind is actually positive and approximately equal in magnitude to the negative coefficient for public HSIs. This indicates that the effect of proximity to a non-HSI is zero, and all benefits come from proximity to HSIs. Similarly, traditional two-year colleges do not appear to predict the share of the Hispanic population with degrees. Another point to note on Table 12 is in regards to the "no college" variable. Here we see the marginal effect of not having a college within driving distance is very negative, and significant, suggesting that counties without a college nearby are much less likely to have high levels of educational attainment. Finally, like the previous regressions, education levels significantly predict educational attainment, as does per capita income in 1999 (but not in 1989).

The test for the effect of HSIs on White educational attainment is shown in Table 13. As I mentioned earlier, the purpose of this test is to assess whether the effect that we observed in the previous regression is unique to Hispanic individuals, or if we will see the same results using a different population. To compare, I selected the same sample of counties as in Table 12, but used measures of White educational attainment and per capita income rather than Hispanic. If the Hispanic Serving Institutions are achieving their mission of providing unique educational advantages to Hispanics, we would expect that the observed coefficients for the HSI distance measures would be higher for Hispanics than for whites.

Table 13 -- OLS Regression Results for Effect of HSIs on White Educational Attainment

VARIABLES	(1) Bachelors % White with BA 2000	(2) Associates % White with AA 2000
% White with BA 1990	0.9806***	0.3152***
	(0.1042)	(0.1097)
% White with AA 1990	-0.0241	0.6313***
	(0.0936)	(0.1016)
White Per Capita Income 1999	0.0004***	0.0003***
	(0.0001)	(0.0001)
Per Capita Income 1989w	-0.0002*	-0.0001
	(0.0001)	(0.0001)
Minimum Tuition	-0.0001	-0.0002
	(0.0001)	(0.0001)
Average Tuition	0.0001	0.0001
	(0.0001)	(0.0001)
Number of Seats	-0.0001	-0.0001
	(0.0001)	(0.0001)
Dist to Nearest 2-Year HSI	0.0090***	0.0127***
	(0.0031)	(0.0034)
Dist to Nearest 4-Yr Priv HSI	0.0021**	0.0029***
	(0.0009)	(0.0010)
Dist to Nearest 4-Yr Pub HSI	-0.0087***	-0.0123***
	(0.0031)	(0.0034)
Dist to Nearest Private 2-Year	0.0053***	0.0088***
	(0.0016)	(0.0015)
Dist to Nearest Private 4-Year	-0.0071	-0.0133***
	(0.0043)	(0.0044)
Dist to Nearest Public 2-Year	-0.0053	-0.0107**
	(0.0046)	(0.0045)
Dist to Nearest Public 4-Year	-0.0119**	-0.0081
	(0.0050)	(0.0052)
No College within Driving Dist	0.3682	-0.4991
	(0.3463)	(0.3909)
Constant	-1.1962	0.6858
	(0.9931)	(0.9718)
Observations	364	364
R-squared	0.9307	0.9283

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

The results of this test are quite surprising. The coefficients for the public four-year HSIs are actually larger than the original regression, using Hispanic educational attainment and per capita measures. This would suggest that proximity to these institutions has a greater impact on the

educational attainment levels of Whites than of Hispanics. Additionally, the coefficient associated with distance to any public four-year college is not positive; it is actually negative in both equations. It seems that Whites do gain an advantage from distance to any public college and an additional advantage if the nearest college is an HSI (with this additional benefit exceeding that of Hispanics in magnitude). Some facts about how HSIs are defined can help shed light on these results: First, an institution needs only have a Hispanic population of 25 percent or more to qualify as a Hispanic-Serving Institution, so the fact that HSIs provide an advantage to whites is not surprising, since many matriculate a non-Hispanic majority. Also, HSIs were not defined until the 1990s, so it could be that those institutions which were able to successfully obtain funding as HSIs were simply the most efficient institutions in areas with high Hispanic populations. This could explain why institutions defined as HSIs are able to provide advantages to Whites that exceed those of other colleges in the area not defined as HSIs. This hypothesis, however, demands further investigation.

Summary of Findings

My results can be summarized as follows: Minimum tuition is negatively related to educational attainment in every instance and for every population, while average tuition is always positively associated with educational levels and almost always significant. This implies that perhaps the most efficient way to induce marginal students to attend post-secondary institutions is to further reduce costs at the least expensive institutions: most likely two-year colleges and the relatively non-selective four-year colleges. Cost reductions in the state's more selective institutions may affect the composition of the student body across universities but are not likely to improve the share of adults who attend overall. This study, however, does not imply that simply increasing the share of adults that attend college is the best goal to pursue: such prescriptions would require information on returns to degrees by institutional selectivity. The number of seats within a 20-mile radius does not appear to affect the population share with degrees, indicating that there is not

a significant capacity constraint among higher educational institutions in general. Overall, these results suggest that lower minimum tuition levels improve educational access, higher average tuition reflects the latent demand for education, and availability of seats is probably not a limiting factor for most students.

The distance measures vary more widely, and are therefore more difficult to generalize. In almost all cases, the distance to the nearest public four-year institution is negative and significant, suggesting that these institutions provide the greatest benefit to counties in terms of higher levels of educational attainment. Results are similar for public two-year institutions, although associations are less precise in some specifications. Public two-year institutions seem to provide the greatest benefit to associate-level degree attainment, particularly in areas with large Hispanic populations.

The impact that distance to the nearest minority serving institution has on the educational attainment of that minority population is mixed, depending on the type of institution. Distance to HBCUs is negatively associated with educational attainment of Blacks in the region (as the distance to the institution decreases, educational attainment increases) even after controlling for all other measures of access, indicating that Blacks see advantages that go beyond those offered simply by proximity to non-HBCUs. These advantages are most pronounced for Blacks, but they exist for Whites as well, though to a much lesser extent. Distance to four-year Hispanic Serving Institutions (both public and private) is negative and significant for Hispanics in counties with a high Hispanic population. However, proximity to non-HSIs does not appear to have notable effects on Hispanic education in these counties. Interestingly, while Whites in counties with a high Hispanic population see some advantage from proximity to non-HSIs they see much larger advantages from proximity to HSIs. As noted previously, HSIs were defined in the 1990s as institutions with at least 25% Hispanic matriculations and a large share of low income Hispanic

students. Therefore, it is not surprising that Whites see advantage from being located near these institutions. What is somewhat surprising is the fact that even Whites see larger returns from HSIs than from other schools. In fact, the magnitude exceeds even that for Hispanics. This empirical result would be consistent if colleges with the highest potential for matriculating "marginal students" of any race and ethnicity self-selected into HSI status during the '90s. This is a very interesting hypothesis but demands further investigation.

It should be mentioned here that there could be potential endogeneity problems with using distance as an indicator of access. If institutions locate in places with high demand, then the relationship between distance and educational attainment could be attributed to the demand rather than the location. However, a number of preventative measures were taken to counterbalance this potential concern. First, removing for-profit institutions from the analysis eliminates those institutions that are motivated primarily by demand. Second, very few institutions were added or removed between 1990 and 2000, so controlling for the lagged dependent variable and per capita income helps control for regional economic changes.

CHAPTER 5 – SUMMARY AND DISCUSSION

INTRODUCTION

This study had two primary objectives. First, to contribute to current literature with the design of more precise county-level measures of physical and financial access to education, and second, to determine which regional investments in higher education (community colleges, minority-serving institutions, tuition levels, number of available college seats, among others) contribute most to educational attainment on a county level.

To accomplish these objectives, I first explored the role of access to higher education as a predictor of educational attainment. While there is much literature available on traditional access

measures such as tuition, family income, and educational preparedness, research on geographic access measures are lacking. This is troubling, as it is widely accepted that location is a key factor for many students when deciding whether to pursue a college education, particularly low income students. The design of a more precise geographic access measure, which accounts for tuition rates and availability of college seats within driving distance, is a vast improvement over the measures available up to this point. In addition, the inclusion of distance to a variety of institutions (two-year, four-year, public, private, minority-serving) allows for a more detailed examination of whether certain institutions better serve the college-going population of a region. The key findings of this study are discussed below, along with implications for policymakers, and suggestions for further research.

Discussion of Principal Findings

The primary hypothesis of this thesis is that counties with better measures of access (more available seats for first-year full-time students, lower tuition within a reasonable driving distance, shorter distance between population center and nearest institution, etc.) should have a higher percentage of educational attainment among their adult population. To test this hypothesis, I regressed the educational attainment (bachelor's degree or higher and associate degree or higher) of each county in the United States on the eleven geographic access measures I developed. In addition, I performed similar regressions using only those counties with a significant share of Hispanic or Black residents, to test the impact of minority-serving institutions on the educational attainment of their target populations. In all, ten regressions were performed. The results of these regressions help us better understand the relationship between access and educational attainment.

Three access measures were included in each regression: minimum tuition, average tuition, and number of available seats within a 20-mile radius of the county population center[10]. Of the access measures, minimum tuition was negatively related to educational attainment in every instance, and almost always statistically significant, while average tuition was always positively associated with educational levels and almost always significant. Finally, the number of seats within a 20-mile radius was generally negatively associated with educational attainment, but not significant. These results suggest that lower minimum tuition levels improve educational access, higher average tuition reflects the latent demand for education, and availability of seats is probably not a limiting factor for most students.

Also included in the analysis are distances from each county population center to the nearest institution. To capture the effect that different institutions might have on educational attainment, eight categories of institutions were included: public two-year and four-year institutions, private two-year and four-year institutions, two-year Hispanic-serving institutions, four-year public and private Hispanic-serving institutions, and Historically Black Colleges and Universities. The inclusion of these distance measures provides interesting insight into the role different institutions play in the educational attainment of a region. Public two-year institutions seem to provide the greatest benefit to associate-level degree attainment, particularly in areas with large Hispanic populations, and four-year public institutions provide the greatest benefit to bachelor's degree attainment. Conversely, private two-year institutions are more likely to locate in areas with low levels of educational attainment, perhaps even more so in counties with large Hispanic populations, but they do not seem to greatly improve the educational attainment of those regions. The distance to HBCUs and public four-year Hispanic Serving Institutions are both negatively

[10] All access measures are based on IPEDS reporting data. Number of available seats was measured in terms of first-time full-time freshmen. The county population center is a weighted distance measure based on the college-aged (16-19 year old) population of the county.

associated with educational attainment of the region (as the distance to the institution decreases, educational attainment increases). Of course, these relationships more strongly predict the educational attainment of the minority population in the region, but they exist for White residents as well, to a lesser extent. This suggests that four-year minority serving institutions are successfully serving their target populations, and also provide benefit to the entire region, regardless of race.

IMPLICATIONS/RECOMMENDATIONS

The findings of this study could be of significance to researchers who can use the geographic model as a tool for analysis. The county-level measures created for this study are some of the most accurate estimators of educational access possible using currently available data. These measures apply to "the average young person" in each county in the United States, so even researchers using individual-level datasets such as the NLSY will be able to use these tools to quantify access. The geographic measure developed as part of this study could also be used as a tool for further research related to health care or the concentration of poverty.

These findings may provide researchers with useful insights into “marginal college attendees”, students who are on the fence about college attendance, as well. Including measures that represent “extra convenience” (access to education within a 20-mile radius, distance to the nearest institution) offers insight into the factors that matter most to these marginal students. The marginal attendee will not likely relocate to attend college so it is not surprising that distance is a primary factor in determining educational access for them. Similarly, changes in average tuition may not affect the marginal participant as they probably had no intention of attending the “average” institution, but rather the lowest-priced institution within driving distance. Therefore, minimum tuition seems to have a much greater impact on these students.

These results can also be useful to policymakers. We now see that the greatest benefit to educational attainment comes when a region has reasonable access to institutions with affordable tuition, and when the distance to the nearest public institution (either two-year or four-year) is minimized. Therefore, policymakers should focus more resources on lowering tuition and investing in public institutions. As mentioned previously, changes in average tuition levels don't offer the same impact as minimum tuition levels, so the greatest benefits to enrollment will likely be found by reducing tuition levels among the lowest priced institutions (two-year public institutions) rather than, say, the state's flagship college. Lower average tuition rates are not likely to draw "marginal" students into the market; they will more likely divert students who would have otherwise attended a less-expensive alternative. Furthermore, capacity constraint is not a problem, and while distances to institutions matter, those coefficients are rather small. Therefore, for policymakers, expanding infrastructure is unlikely to provide the same benefit to a region as improving affordability among colleges located near problem areas.

FURTHER RESEARCH

More research must be done to better understand the complex relationship between access to higher education (both traditional and geographic) and educational attainment. This study only begins to scratch the surface on what is a multifaceted issue. For example, these results show that if policymakers intend to maximize degrees, investments in the elite, private or even flagship public colleges are not likely to provide the greatest benefits. Rather, investments in reducing tuition levels among the lowest-priced institutions would likely have greater impacts. Yet it is still unclear if maximizing degrees should be the primary aim. Empirical evidence on relative returns by college selectivity would be necessary to determine the most beneficial path for a given region. Similarly, additional research on the relationship between tuition levels and the quality of education provided is needed to confirm whether the lowest-priced institutions are the most deserving of public investment.

My findings on HBCUs suggest that these institutions improve levels of educational attainment in regions with large Black populations. This is important because lately, their legitimacy has come under attack. Recent work (Fryer, 2010) found that, since the 1990s, returns associated with HBCUs have declined relative to comparable White colleges. Therefore, a more careful study that factors improved odds of attending college along with returns on education would help clarify the relationship between HBCUs and Black educational attainment.

Similarly, further research is needed with regard to Hispanic Serving Institutions. My research shows that HSIs do provide regional educational benefits and appear to be the only institutions to positively affect Hispanic degrees. What's more, they provide educational benefits not just to Hispanics, but for everyone nearby. HSIs were defined in the 1990s as institutions with at least 25% Hispanic enrollment and at least 50% low-income Hispanic students. Therefore, one explanation for these findings is that the institutions which were best at attracting marginal students were the same institutions designated as HSIs during the 1990s. This is consistent with their mission to help disadvantaged students and with our previous findings that the lowest-cost colleges attract the most marginal students. More research would need to be done to test this theory and to clarify the role of HSIs in educating regions with a large Hispanic population.

Finally, including the most recent census data would provide a more current and thorough assessment of the situation and might help clarify some of the unanswered questions from my research.

CONCLUSION

Research shows that investment in higher education provides countless benefits, both to the individual and the community. Educational attainment is associated with lower unemployment, higher wages, higher income, and better health for adults and their children (Council of Economic Advisers, September 1998). Research has also shown that a highly educated population can

increase the total productivity in a region, through the 'spillover effect' (Lucas, 1988). Therefore, many studies have attempted to explain how best to improve access to higher education. By focusing on geographic access measures, my thesis isolates the impact of access on community outcomes and takes a regional look at what has long been considered only at the individual or state level. The results show that the greatest benefit to educational attainment comes when a region has reasonable access to institutions with affordable tuition, and when the distance to the nearest public institution (two-year, four-year, or minority-serving) is minimized. These results suggest that communities will see the greatest benefits by devoting more resources to lowering tuition, investing in public institutions, and the creation and sustainability of minority-serving institutions. These results support the findings from many previous studies, but because of the uniqueness of this analysis (looking at access from a regional level rather than an individual level) the results are especially significant, and will, I hope, provide researchers and policymakers with a new perspective on a critical issue.

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