Access to College: The Role of Tuition, Financial Aid, Scholastic Preparation and College Supply in Public College Enrollments

By Katherine Baird

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Rapid tuition increases over the last few decades have made public institutions much less affordable than they once were. This and other policy changes may be affecting college enrollment rates across the country. This article examines how student preparation and college supply interact with the usual factors of tuition, financial aid, and family background to explain state by state variation in public college enrollment rates among Black, Hispanic, and White youth over the 1990s. This study finds that rapid tuition increases over the 1990s, changes in federal need-based aid, and steady increases in merit-based financial aid cannot explain variation in public college enrollment rates during the 1990s. What can help explain this variation are a state's expenditures on state need-based aid and its investment in public higher education capacity. The study also finds that differences in the high school completion rate of Hispanic youth, among states and over time, help explain patterns of Hispanic enrollment in public postsecondary institutions. The article concludes that the current policy emphasis of maintaining low tuition may not be the best use of public subsidies in terms of promoting equitable access to higher education.

Significant change is occurring in the public financing of higher education in the United States. Rapid tuition increases over the last few decades have made public institutions much less affordable than they once were. This has been exacerbated by the shift by many state governments from need- to merit-based scholarships, and the failure of federal need-based aid to keep up with tuition increases. The federal government has also dramatically expanded its commitment to higher education by offering a wide range of tax incentives. All of these changes have been the result of state budget shortages that have resulted in higher tuition, and subsequently an increased demand by middle- and upper-middle-class families for tuition relief.

Such changes in higher education policy raise questions about their combined effect on college enrollment decisions. Have tuition increases affected college-going decisions? What effect have changes in state and federal need-based scholarship support had on enrollment decisions? While there is extensive literature on these questions, a consensus has yet to emerge on the importance of tuition versus financial aid versus other policies aimed at increasing the likelihood of college attendance. Because college has increasingly become the gateway to higher

productivity and higher income, it is important to analyze the factors contributing to college enrollment to help address disparities in college attendance rates by race and income.

This study analyzes factors within states that explain variation in their public enrollment rates. These rates vary significantly across states and across socioeconomic groups within states. For instance in 2001, approximately 26% of Black 18-25 year-olds in Arkansas were enrolled in 4-year public institutions, compared with 15% in Alabama. In New Mexico, between 1990-2001 Hispanic enrollment in 2-year public institutions grew from 18% to 25% of the state's 18-25 year old population, while in Texas it remained stagnant at about 14%. Over the 1990s, total Black enrollment in Georgia's public institutions averaged only 18% of the state's 18-25 year old population, while it was 32% in Kentucky (author calculation).

Possibly such variation is due to differences in income, tuition levels, financial aid policies, the availability of public colleges, or the effectiveness of the state's K-12 system in preparing its students for college. While it is common to attribute at least some of the variation across states to state policy differences (Perna 2005), moving beyond conjecture is important in developing effective higher education policy. Given the large amount of resources that have been devoted to closing enrollment gaps, it is important to understand why gaps in college attendance rates by race and income persist (Kane, 2001; Mazumder, 2003).

This study considers factors that influence state enrollment rates by examining state-level public college enrollment data by race from 1990 through 2000. It simultaneously examines a wider array of policy variables that may influence enrollment decisions than has been investigated to date, and it disaggregates this analysis by race. In particular, it examines how student preparation and college supply interact with the usual factors of tuition, financial aid, and family background in explaining variation among states in their public college enrollment rates for Black, Hispanic, and White youth. Through this examination, the study seeks to identify policies that will best improve college enrollment among underrepresented groups.
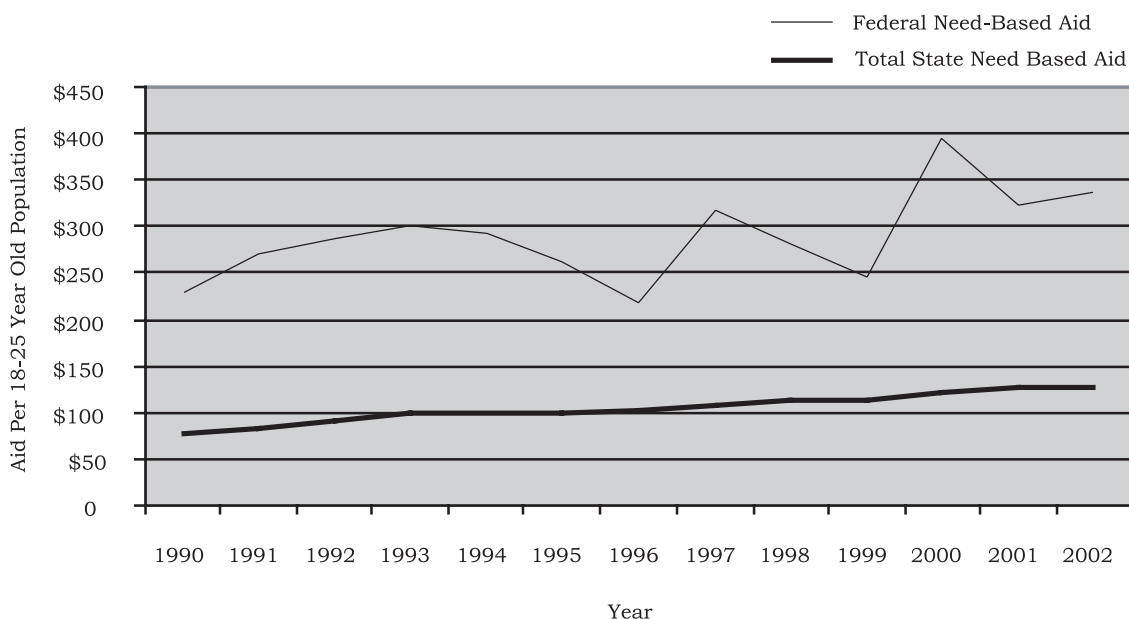
Trends in Higher Education Financing

In the United States, public investment in higher education is largely undertaken by state governments. Since the federal government's role is limited, public investment in higher education takes different forms in different states. In 2000, states provided $63 billion in aid to public higher education institutions (USDE, 2005, Table 329), most of which went to maintain low tuition. Some state support also takes the form of scholarship aid to select individuals, most commonly based on financial need. In 2004-05, states provided $6.4 billion in scholarship aid to select undergraduates, 73% of which was based, at least in part, on financial need (NASSGAP, 2006, Table 1). Such scholarship aid supplements federal need-based grant aid to students (mostly Pell Grants), which in 2003 totaled about $11 billion (U.S. Office of Management and Budget, 2004).

In recent years, budgetary pressures have changed the form that state investments in higher education have taken. Tuition over the last 25 years has increased rapidly, exceeding the growth in median income. (College Board, 2002). Increases in Federal Pell Grants, however, have not kept up with tuition increases (Perna and Li, 2006). Moreover, while on average states' need-based financial aid has increased (see Figure 1), this is not true of all states. Today five states offer no need-based financial aid, and in another ten states need-based aid is less than what it was in 1990. Over the period 1990-2002, only 20 states increased the amount spent on need-based aid at a rate that at least matched the rate of tuition inflation within the state. On the other hand, over the period 1994-2004, state non-need based scholarships grew about 400%, compared with a 100% increase in need-based scholarships (NASSGAP, 2006, Tables 4 and 5). To date it remains an open question as to how these financing trends have influenced enrollment patterns in public institutions, if at all.

The Determinants of College Enrollment

A vast body of literature uses econometric models to examine the determinants of college-going decisions. Yet even the relationship between the college costs and college attendance is not well established. Moreover, many other state policies influence

Figure 1
Federal Versus State Need-Based Aid
Per 18-25 Year Old Population in Constant 2002 Dollars

enrollment decisions besides cost, such as the supply of public institutions in a state and the primary and secondary school education policies,. In the past, econometric studies have tended to ignore these factors. The following discussion summarizes a selection of research on factors influencing college-going decisions.

Tuition
Studies analyzing factors influencing college attendance decisions have disproportionately focused on the price of college. Summarizing research on the role of tuition, Leslie and Brinkman (1987) concluded that higher tuition costs did indeed decrease college enrollment. Much quantitative research has focused on differences among social groups in their sensitivity to college costs. Both McPherson and Schapiro (1991) and Kane (1994) found that enrollments among lower-income students were more sensitive to college costs than were those of higher income students. However, as discussed later in this article, some researchers (Ellwood and Kane, 2000; Cameron and Heckman, 2001), find that controlling for other factors, the overall importance of tuition in enrollment decisions is minimal.

Financial Aid
In theory, financial aid should have the same effect on enrollment decisions as lower tuition: students should care about net rather than gross college costs. The evidence for this, however, is not strong.

In one of the first studies examining the impact of federal need-based aid on enrollment decisions, Hansen (1983) concluded that college enrollment did not increase with the enactment of the Federal Pell Grant program. McPherson and Schapiro (1991) found evidence to the contrary, but Kane (1994) and later Cameron and Heckman (2001) duplicated Hansen's finding. Perna (2000) also found that receiving federal aid did not increase the the probability of college attendance.

Until recently, few researchers had analyzed the relationship between state need-based aid and enrollment decisions. Kane (2003) conjectures that the eligibility requirements for state aid may be more understandable to students and that students (and their parents) may know with greater certainty how much support to expect. Accordingly, state need-based aid may have a greater impact on enrollments than federal need-based aid. As shown in Figure 1, eligibility for state need-based aid certainly appears to be more predictable than eligibility for Federal Pell Grants.

Heller (1999) was one of the first to examine the impact of state financial aid on enrollment decisions. His study of college enrollment rates by state and race found that for all races, state need-based grant expenditures helped explain public enrollment rates, especially at community colleges. More recently, Kane (2003) found that California's CalGrant scholarship program has

led to an increase in college enrollment. These studies provide some evidence that state need-based financial aid in particular can affect enrollment decisions.

The emerging popularity of merit-based scholarship programs has led some to investigate whether merit-based aid increases college enrollments. To date, the evidence is mixed. Dynarski (2000) estimates that about 20% of Georgia's HOPE recipients would not have attended college without the HOPE scholarship, which is a merit-based program. However Binder, Ganderton, and Hutchens (2002), Cornwell and Mustard (2002), and Heller and Rasmussen (2002) report evidence showing that the enrollment effect of merit aid, if any, is small.

Student Preparation

In quantitative studies of college enrollments, the link between state policy influencing students' academic preparation and college attendance has been underinvestigated. Yet college preparation (as measured by test scores) clearly differs significantly by state, by race, and by income.

Evidence of the link between educational outcomes and the quality of high schools attended is strong. For instance in one study, Neal and Johnson (1996) found that Black/White differences in test scores could be largely attributed to differences in the quality of high schools attended. Perna and Titus (2005) likewise attributed some of the explanation of lower college enrollment rates among Black and Hispanic youth to differences in the quality of resources at schools attended. In a separate study, Perna (2000) found that differences in test scores and curriculum helped explain differences in college enrollment patterns among Hispanic and White youth. And both Ellwood and Kane (2000) and Cameron and Heckman (2001) find that high school achievement is the single most important factor explaining college attendance. They even conclude that preparation is of such overriding importance that tuition and financial aid policies have at best a marginal impact on enrollment decisions.

It appears clear that some of the explanation for college-going choices is traceable to the quality of schools attended. If the quality of the K-12 system within states is correlated with a state's commitment to affordable higher education and/or family characteristics, then the role of price and family characteristics on enrollment decisions will be overestimated (Cameron & Heckman, 2001; Ellwood & Kane, 2000).

Supply

The importance of differences in public college supply within a state on enrollment decisions has received little attention by researchers, due largely to the difficulty of quantifying supply. In this usage, supply pertains to the number of public colleges reasonably available to potential students within the state. If demand exceeds supply, the impact of higher tuition (or other variables) on enrollment decisions will not be accurately measured, as

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enrollment levels will reflect both supply and demand factors. Rouse (1994) found that college enrollment increased when people lived nearer to a community college, indicating that supply (at least insofar as more supply means greater proximity to schools) does matter.

Aside from state policy variables, other variables have been found to influence college going decisions, including labor market conditions and family and community background.

Labor Market Conditions
Two separate labor market factors may affect college enrollments. The first is the financial return on a college degree. As returns increase more rapidly for college graduates, one would expect more youth to be drawn to college. Yet contrary to expectations, Perna (2000) found that the college premium—that is, for 25-54 year olds, the median wages and salary for those with at least a college degree divided by the value for those completing 12th grade only--was unrelated to college enrollment decisions. This may have more to do with the age range of the cohort for which the college premium was calculated or the large geographic area over which the premium was calculated.

A second way that the labor market can factor into college-going decisions is the cyclical nature of the labor market—although it is not clear what this relationship is. Two theories have received support. One theory is that because of liquidity constraints, enrollments decline with higher unemployment rates because individuals or their family members are less able to pay for college when jobs are harder to come by. Christian (2003) found evidence for this among lower-income households. More commonly it has been argued that enrollment rates are countercyclical because as unemployment decreases, the cost of attending college goes up. Betts and MacFarland (1995), Dellas and Sakellaris (2003), and Rouse (1994) among others, find support for this position.

Family and Community Background
The student's family and community background matter because these are sources of encouragement, information, resources, and expectations that many researchers have found important in college-going decisions. In quantitative studies where family or community background is included as a predictor variable, it has been found consistently significant in college enrollment decisions. Perna (2000) and Perna and Titus (2005), for example, found that measures of social and cultural capital were nearly as important as academic ability in explaining the enrollment decisions of Black and Hispanic youth. Several studies have also shown that parental education is a stronger predictor of college enrollment than is parental income (Kane 1994; Ellwood & Kane 2000).

Quantitative research on college enrollment choices typically focus on some subset of the aforementioned variables,

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omitting other important variables such as state financial aid (Cameron & Heckman, 2001; McPherson & Shapiro, 1991; Perna, 2000), academic preparation (Heller, 1999), family background (Heller, 1999), labor supply conditions (Strayer, 2002), or supply (Kane, 1994). This article is an attempt to improve on prior studies by evaluating a wider range of policy variables influencing public college enrollment decisions than has been undertaken to date.

Method

Theoretically, college enrollment decisions are the result of both demand for and supply of college spaces. Almost all studies reduce enrollment decisions to a problem of demand, so that enrollment decisions (e) are thought to reflect demand (Q^D). But this is only true if there is no supply constraint. If a binding supply constraint exists, then enrollment decisions are below demand ($e < Q^D$) and the factors influencing demand will be imprecisely measured when demand is assumed to be the same as enrollment (e). A more appropriate model is:

$$e = Q^D$$

as long as

$$Q^D < Q^S$$

This leads to a reduced form equation of the type:

$$e = e(Q^D, Q^S)$$

where Q^S measures supply.

This study uses multivariate regression analysis to simultaneously investigate the effects on college enrollment rates of school achievement, family background, tuition, financial aid, state supply of higher education, and labor market conditions. College enrollment rates are measured at the state level as the share of White, Black, and Hispanic youth in both 2- and 4-year public institutions (explained later in the article). The precise model examined here is:

$$(4)\ e_{ijt} = \beta_{0i} + \beta_{1i}P_{jt} + \beta_{2i}F_{ijt} + \beta_{3i}A_{ijt} + \beta_{4i}L_{jt} + B_{5i}D_j + B_{6i}T_t + \lambda_i Q^S_{jt}$$

where e is the enrollment rate in either a 2- or 4-year public institution, P is a vector of variables capturing the price of public institutions in the state, F measures family background variables, A is a measure of academic achievement, L is a vector of variables measuring labor market conditions, D is a vector of state fixed effects, and T is a trend variable. The subscript i is a race subscript (Black, White and Hispanic), j is a state subscript, and t is a year subscript.

Specifically, the dependent variable e is the enrollment rate of a state's White, Black, and Hispanic population enrolled in 2-year, 4-year, or all public institutions. Thus nine different equations are estimated using annual state data from 1990-2000 for a possible 550 observations (50 states over 11 years) based

on Current Population Survey data (King, 2003). We eliminated observations in states with fewer than 20,000 youth because of concerns over data reliability. Moreover, some data for certain variables were missing or irrelevant (e.g., some states for some years had no community college, non-need based aid data were not available for 1994-96). The actual number of observations used in this study thus ranges from 147 to 546. Descriptive statistics on the variables used in this study are found in Table 1. The following are descriptions of the variables used in this analysis. Additional comments appear in the Appendix:

(1) College Enrollment Rates: Data on enrollments by state for each year, and for public 2- and 4-year institutions (U.S. Department of Education, various years) The 1990 data are for academic year 1990-91. The population of 18-25 year olds for each state and year were obtained through CPS estimates (King 2003). Population data for each year is from that year's March CPS.

(2) Number of Community Colleges: Number of public 2-year institutions (U.S. Department of Education, 2003; 2005). The 1990 data are for 1990-91 academic year; however, data for 1990 was not available, so 1989 data was used.

(3) State Higher Education Expenditures: Current fund revenue from state appropriations to public higher education institutions (U.S. Department of Education, 2003; 2005). The year begins with the beginning of the academic year.

(4) Public Tuition: Average undergraduate tuition and fees paid at public 4-year institutions and average tuition at public 2-year institutions (U.S. Department of Education, 2003; 2005). The 1990 data are for the 1990-91 academic year.

(5) Private Tuition: Weighted average of in-state tuition at 4-year private institutions. (U.S. Department of Education, 2003; 2005).

(6) State Need-Based and Non Need-Based Grants: Data on grants to undergraduates, in millions. (NASSGAP, 2006).

(7) Federal Need-Based Grants: Value of federal Title IV grants, including Federal Pell Grants, Federal Supplemental Education Opportunity Grants, Leveraging Educational Assistance Partnership Program (formerly the State Student Incentive Grant) (U.S. Department of Education, 2003; 2005).

(8) College Premium: Mean earnings from wages and salaries within a state for 25-35 year olds with four or more years of college divided by mean earnings from wages and salaries for 25-35 year olds who have completed 12 years of primary and secondary school but no college. The data are organized by year and state (King, 2003).

(9) Unemployment: Yearly unemployment rate calculated as average of monthly unemployment rates. (U.S. Bureau of Labor Statistics, March 2005).

(10) Inflation Conversion: The Consumer Price Index for All Urban Consumers (CPI-U; compiled by Sahr, 2004).

Table 1
Descriptive Statistics

	N	Minimum	Maximum	Mean	Standard Deviation
Median household income					
White	550	$30,002	$74,945	$49,797	$7,999
Black	317	$11,904	$59,743	$29,575	$8,128
Hispanic	209	$13,601	$61,794	$33,605	$8,356
2-year enrollment rate					
White	548	0.00	0.47	0.17	0.09
Black	317	0.04	0.47	0.14	0.07
Hispanic	209	0.03	0.34	0.14	0.07
4-year enrollment rate					
White	550	0.11	0.59	0.26	0.08
Black	317	0.05	0.36	0.14	0.05
Hispanic	209	0.03	0.33	0.10	0.05
Total enrollment rate					
White	548	.20	.85	.42	.11
Black	317	.12	.62	.27	.08
Hispanic	209	.06	.67	.24	.10
High school graduation rate					
White	550	0.70	1.00	0.86	0.05
Black	317	0.35	1.00	0.79	0.09
Hispanic	209	0.22	0.95	0.62	0.14
Distribution of 18-25 year old population					
White	550	20,773	1,878,565	393,727	348,693
Black	317	20,094	473,646	141,192	99,086
Hispanic	209	20,160	1,514,730	187,397	332,290
Public 2-year tuition	548	0	$4,162	$1,664	$686
Public 4-year tuition	550	$1,356	$7,498	$3,266	$1,145
Unemployment percent	550	2.20	11.39	5.27	1.54
College premium	550	1.10	2.92	1.79	0.26
Amount of state need-based aid per 18-25 year old	550	0	$393	$72	$78
Number of 18-25 year olds in population per community college	547	5,671	123,779	31,688	19,872
Amount of federal aid per 18–25 year old in population	550	$218	$397	$282	$46
State education expenditures per 18–25 year old in population	550	$700	$4,810	$1,889	$603
State non-need-based aid per 18–25 year old in population	408	0	$396	$16	$41

Note. All dollar amounts are adjusted by the CPI-U and are expressed in 2002 dollars.

(11) Household Income by Race: The total money income during the previous calendar year of all adult household members (King, 2003). Hispanic is defined as all those reporting themselves as Mexican, Mexican American, Chicano/Chicana, Mexicano, Mexicano/Chicano, Puerto Rican, Cuban, Other Spanish, Central/South American.

(12) Percent High School Graduates: Number of 18-25 year olds with at least a high school degree, by year, state and race, divided by total population of 18-25 year olds (King, 2003).

Before discussing the data in greater detail, four methodological points deserve mention.

This study is limited to an analysis of enrollments in public institutions. This is because examining total college enrollments (public and private) within the state is subject to significant error (about 90% of public college enrollment consists of students from in-state compared with about 60% of private school enrollment; Heller, 1999). While private sector enrollments do vary between states, as long as enrollment remains relatively unchanged over the 1990s, the effect of the private sector will be captured by the state fixed-effect (i.e., dummy) variable. An analysis of the determinants of state private school enrollments over the 1990s revealed that 95% of the variation across and within states is explained by state fixed effects.

Still, private institutions can be substitutes for public institutions. A possible shortcoming of this study is that it provides an incomplete control for the existence of substitutes via a state fixed effect, and thus speaks only to the factors influencing enrollments in the public sector. However the author maintains that the increased accuracy gained by limiting the study to public institutions (an approach also used by Heller, 1999) justifies this. The concluding section of this paper revisits this issue in light of the paper's findings.

The analysis is based on aggregate state-level data. Many previous college enrollment studies use individual-level data, but most individual-level data do not have information on receipt of financial aid or academic preparation, so these variables are generally omitted (Mazumder, 2003; Rouse, 1994; Strayer, 2002). Omitting financial aid is likely to underestimate the role of college costs on enrollment decisions, (Kane, 2001). Kane's (2003) findings on the importance of California's student aid program, and Heller's (1999) findings on the effect of state need-based aid on enrollment decisions suggest that this may be an important omission. Studies that fail to account for state aid will undoubtedly lead to biased estimates of other explanatory variables. When individual-level variables are missing, aggregate-level data (where the missing values are available) allow more accurate assessment of the factors associated with college enrollment.

This study is based on state panel data. In contrast, cross-sectional studies (limited to a single year) cannot accurately capture the effect of state-specific policies on college enrollment decisions. For example, a state that has low tuition may have also undertaken more extensive investments in higher education supply. Thus, any effect that tuition policy is found to have on enrollment decisions could actually be the effect of capacity rather than price. Rouse (1994) has shown that the importance of tuition on college enrollment decisions declines once other state policy variables are controlled for. Panel data has the advantage of factoring out relatively fixed but important characteristics of states through the state dummy variables. It also has the advantage of capturing the importance of underlying time trends such as in the returns to education, income, and unemployment rates.

This study examines college enrollment decisions for all 18-25 year old students. Studies of college enrollment often examine the decisions of a subset of college-age youth by omitting those who, for instance, do not have a high school degree (Kane, 1994; Rouse, 1994; Strayer, 2002). Excluding some potential 18-25 year-old college goers can result in self-selection bias in that tuition and financial aid policies can affect preparation for college, and consequently influence the size of the college-eligible pool. This self-selection bias can lead to underestimating the role of cost on college enrollments (Heller, 2003).

Dependent Variables
Public college enrollment rates are calculated as actual state enrollments in public institutions by race, divided by the state's young adult, college-going population (defined here as ages 18-25). Rates will be higher than the true share of the state's population enrolled in higher education due to out-of-state students attending in-state public institutions, but lower due to in-state students attending private and out-of-state schools. However, as long as these factors change uniformly across states over time, and/or are consistent within a state, this shortcoming will not bias the results insofar as it will be captured by state fixed effects and a trend variable. (A trend variable allows you to factor out the importance of an underlying trend that is not captured by the variables. For instance, if college enrollments are increasing over time due to underlying factors not adequately captured by income, college premium, etc., a time trend allows you to factor it out. It thus essentially captures the importance of other omitted variables in explaining an upward trend in enrollments.)

Independent Variables
The cost of public tuition in each state is measured as the student-weighted average of tuition and fees at 2- or 4-year public institutions. Over the period examined, public 2-year tuition averaged $1,664, and 4-year tuition averaged $3,266. State

need-based aid, Federal Pell Grants, and state merit-based aid are defined per dollar spent per 18-25 year old in the state (or the nation, in the case of Pell Grants), whether or not they go to college. State need-based aid for undergraduates averaged $72 per young adult, non-need based state aid averaged $16 per young adult, and federal aid averaged $282 per young adult (see Figure 1). Unfortunately, data on institutional aid from public colleges—which has become an increasingly important way to attract students at some schools (Wirt et al., 2004)—are not available for the 1990s.

With need-based aid, the availability of funds for students will depend not so much on dollar allocations relative to the population, but on the cost of tuition (which is often a reference point for aid eligibility) as well as eligibility requirements. Since the analysis controls for tuition, this shortcoming is addressed. The study does not, however, account for differences among states in their eligibility requirements. All else the same, a state with stricter financial eligibility requirements might be expected to see a larger impact on enrollments than a state with either more lenient criteria, or more eligible citizens (and hence smaller grants).

The variable used to approximate the state's success in preparing youth for college is the percentage of the state's 18-25 year olds (by race) with a high school degree. This averaged 86% for White, 79% for Black, and 62% for Hispanic youth. A better measure of college preparation might be high school test scores, but with the exception of the National Assessment of Educational Progress (NAEP) test, which is given every two to four years, states do not collect uniform information on student achievement. Moreover, NAEP scores by state and race are only available for 4th and 8th graders.

High school coursework, which could be another measure of academic achievement, is available by race or state, but not both. SAT or ACT scores by state and race suffer from self-selection bias which varies over time and across states. While high school completion rates are far from perfect, they are the best measure that is comparable across states, races, and years.

As previously mentioned, capturing the public supply of colleges in a state is problematic. In particular, it is not apparent how to measure college enrollment capacity in a way that is independent from actual enrollments (the dependent variable). Yet clearly the supply of public higher education varies significantly by state. To attempt to address the issue of supply, this study measures state higher education capacity in two different ways.

- This study estimates the availability of community college by calculating the size of the state's college-going population (18-25 year-olds) per public 2-year institution. Two-year institutions tend to be relatively uniform in size. Of the 1,204 public 2-year institutions in 2000, 85% enrolled less than

Figure 2
Scarcity of Community Colleges Nationwide:
**18-25 Year Old Population Per Number of Community Colleges**
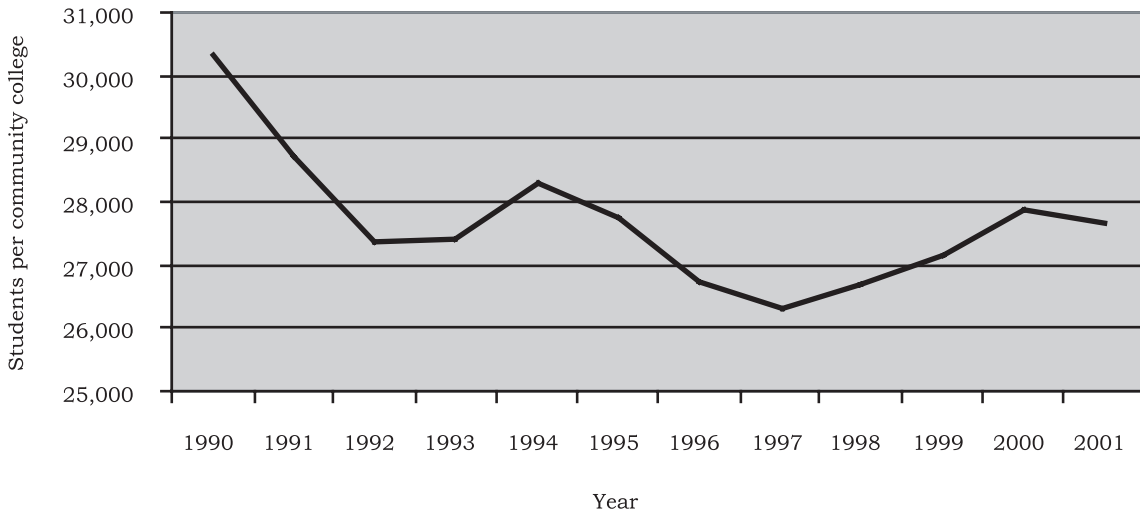
5,000 students according to NCES's Integrated Postsecondary Education Data System (available at http://nces.ed.gov/ipeds/). Investments in community colleges are frequently thought to represent a state's commitment to equal opportunity (Rouse, 1994). On average, there were 31,688 young adults for each 2-year public institution across the nation. Figure 2 shows the national trend in the availability of 2-year colleges, and indicates that during 1990-1997, supply grew (indicated by fewer people per institution) but between 1997 and 2000, the number of 2-year institutions has declined relative to the size of the college-going population.

- This study measures college supply by state higher education expenditures per 18-25 year old. Holding constant need-based aid and tuition, this amount serves as a measure of a state's expenditure on capacity. State education expenditures per young adult ranged from $700 to $4,810, and averaged $1,889 over the period examined. Nationwide, these expenditures have grown modestly over the period of this study (Figure 3).

Results

Tables 2 through 4 present the estimated standardized coefficients resulting from ordinary least squares regression analyses of state-level panel data covering the period 1990-2000. Nonlinear specifications based on the logit of enrollment rates (which models the relationship between the independent and dependent variables as a logistic rather than a linear relationship) were

Figure 3
State Expenditures on Higher Education Nationwide
Per 18-25 Year Old
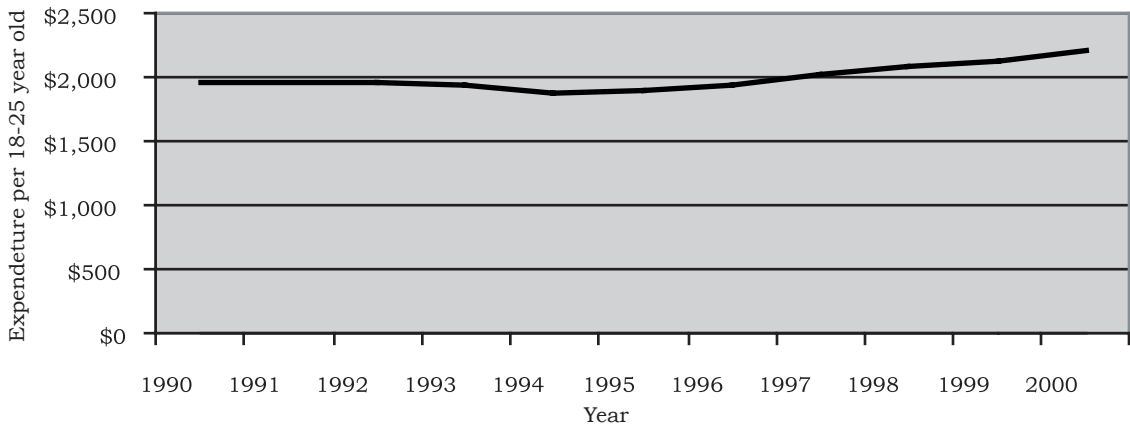
also examined, but because the results were consistent with the linear models, they are not reported here.

For all variables, the year indicates either the year in which the school year begins or the calendar year. Standardized coefficients represent the estimated change in standard deviations of the dependant variable that occurs with a one standard deviation change in the independent variable. All models account for a time trend and state fixed effects. Estimated coefficients corresponding with enrollment rates in 2-year public institutions are presented in Table 2; 4-year public institutions are presented in Table 3; and total public college enrollment rate is presented in Table 4.

Each estimate of the determinants of public college enrollment draws on two separate models: one includes and one excludes state non-need based aid. Data on non-need-based aid are not available for 1994-1996, thus including this variable in the regression reduces the number of observations. Since its coefficient is neither large nor significant, a second regression drops this variable in order to increase the number of observations available.

Two-Year Enrollment Rates
Table 4 presents the estimated effect of policy, labor market, and family variables on 2-year public school enrollment rates. As shown, there is some variation among races in the factors that are correlated with their enrollment rates. For all races, however, 2-year enrollment rates are unrelated to tuition, federal need-based grants, and state non-need-based aid. Also for all races, state need-based aid shows a substantial and statistically significant relationship with enrollment rates. More community

colleges in a state leads to a larger White 2-year enrollment rate, as do more state expenditures on higher education. The evidence also indicates that this is true for Hispanic youth as well. This suggests that for White and Hispanic youth enrolling in 2-year institutions, the state's expenditure on higher education matters, independent of tuition and financial aid. It is interesting to note that 2-year enrollment among Black youth does not appear to be influenced by state higher education expenditures.

Increases in median household income among the White population leads to a fairly large reduction in White 2-year public enrollment rates, perhaps because White youth with higher incomes are more likely to enroll in public 4-year and private institutions. Both Black and Hispanic (but not White) 2-year enrollment rates increase during years of higher unemployment. In sum, state need-based aid and supply are the two factors most consistently related to enrollment rates in public 2-year institutions.

Table 2
Estimated Standardized Coefficients
Determinants of College Enrollment Rates at 2-Year Public Institutions

	White		Black		Hispanic	
Policy variable						
Tuition	-.14	.08	-.13	-.16	.02	.15
State need-based aid	.15**	.17***	.21*	.19*	.45**	.29
Federal need-based aid	-.03	-.01	0	.01	.02	0
State non-need-based aid	.01		.03		.02	
Number of 18–25 year olds in population per community college	-.31***	-.34***	-.03	-.05	-.21	-.25
State education expenditure per 18–25 year old in population	.14***	.15***	.04	.04	.28***	.26***
Labor market						
Unemployment	.03	.01	.18***	.17***	.18**	.11
College premium	.02	0	-.01	0	.05	.03
Family background						
Median household income	-.39***	-.31***	.02	-.01	.05	.01
Academic preparation						
Percentage of high school graduates among 18–25 year olds in population	-.04*	-.07***	-.01	-.01	.08	.09**
Time trend	yes	yes	yes	yes	yes	yes
State fixed effect	yes	yes	yes	yes	yes	yes
Adjusted R^2	.91	.91	.84	.85	.81	.79
Number of observations	396	546	232	316	147	208

*significant at the 10% level   **significant at the 5% level   ***significant at the 1% level

	White		Black		Hispanic	
Policy variable						
Tuition	.19**	.20***	.24	.22	.19	.26
State need-based aid	.06	.12*	-.05	.05	.50**	.28
Federal need-based aid	-.05**	-.05***	-.03	0	.03	.01
State non-need-based aid	-.03		-.05		.03	
Number of 18–25 year olds in population per community college	.01	.04	.26***	.18***	-.09	-.22
State education expenditure per 18–25 year old in population	.70***	.70***	.15**	.11	.12*	.14
Labor market						
Unemployment	.17***	.16***	.07	.02	.21	.02
College premium	0	-.02	.03	.04	0	.03
Family background						
Median household income	0	0	.09	.06	.03	-.02
Academic preparation						
Percentage of high school graduates among 18–25 year olds in population	-.01	-.03	.03	-.03	.13**	.15***
Time trend	yes	yes	yes	yes	yes	yes
State fixed effect	yes	yes	yes	yes	yes	yes
Adjusted R^2	.88	.89	.68	.65	.76	.73
Number of observations	396	535	232	316	147	208

*significant at the 10% level   **significant at the 5% level   ***significant at the 1% level

Four-Year Enrollment Rates
Table 3 shows the estimated coefficients associated with 4-year public enrollment rates. First, there is a positive correlation between tuition and enrollment rates for Whites that is hard to explain. However, it is possible that the tuition variable is capturing a time trend insofar as the value and statistical significance of this variable is sensitive to whether a trend variable is included in the regression (the positive relationship vanishes, for instance, when a trend variable is removed). With this exception, some of the main results are similar to those for 2-year enrollment rates: tuition, federal need-based grants, and state non-need based aid do not explain differences over time and across states in public 4-year enrollment rates. There is some evidence that state need-based aid increases enrollment rates amount White and Hispanic youth, but the evidence is not as strong as it is for 2-year enrollment rates.

For White youth, public expenditures on higher education have a very large impact on 4-year public enrollment rates,

	White		Black		Hispanic	
Policy variable						
Tuition	.14	.09	.17	.10	.26	.36*
State need-based aid	.17**	.23***	.16	.19	.60**	.34
Federal need-based aid	-.06***	.04**	-.02	.02	.02	0
State non-need-based aid	-.01		.01		.04	
Number of 18–25 year olds in population per community college	-.26***	-.29***	.11	.05	-.17	-.25
State education expenditure per 18–25 year old in population	.60***	.62***	.13	.10	.32**	.28**
Labor market						
Unemployment	.13***	.11***	.17*	.14*	.17	.07
College premium	.02	-.01	.01	.02	.04	.04
Family background						
Median household income	-.33***	-.27***	.07	.02	.06	-.01
Academic preparation						
Percentage of high school graduates among 18–25 year olds in population	-.04	-.08***	.01	-.03	.12**	.14**
Time trend	yes	yes	yes	yes	yes	yes
State fixed effect	yes	yes	yes	yes	yes	yes
Adjusted R^2	.87	.86	.61	.60	.72	.69
Number of observations	396	546	232	316	147	208

*significant at the 10% level   **significant at the 5% level   ***significant at the 1% level

and there is some evidence that public investments also increase Black and Hispanic 4-year enrollment rates as well. A smaller supply of community colleges increases 4-year Black public enrollment rates, suggesting a substitution effect for Black students, but not for White and Hispanic students. It would appear then that more community colleges in a state lead to more Hispanic and White college-going, but Black students substitute community colleges for 4-year institutions.

Finally, higher unemployment rates are associated with more Whites enrolling in 4-year public institutions, and Hispanic (but not White and Black) 4-year enrollment rates increase when a higher percentage of Hispanic youth obtain a high school degree.

Total public enrollment rates
To measure the affect of the explanatory variables on overall college-going decisions, Table 4 presents the estimated coefficients where 2- and 4-year public enrollment rates within a state have been combined. The evidence presented here confirms many of

the previous findings: We find no evidence that tuition, federal need-based grants, or state non-need-based aid has influenced decisions to enroll in public institutions. On the other hand, the evidence is quite strong that state need-based aid has led to larger public enrollments among White students, and probably among Hispanic youth as well. State higher education capacity, as measured by state expenditures and the availability of community colleges, is strongly correlated with White and Hispanic public enrollment rates, but curiously is not related to Black enrollment rates. Thus the evidence suggests that White and Hispanic, but not Black youth's enrollment in public institutions is constrained by supply.

Higher unemployment rates are also estimated as leading to larger public enrollments rates among White and Black youth, but not Hispanic youth. The large negative coefficient on White household income could indicate that in the aggregate for Whites, public institutions are an inferior good, with demand for public institutions decreasing and demand for private institutions increasing as income increases. Increases in high school graduation rates among White youth are associated with slightly lower public institution enrollment rates, perhaps suggesting that improved high school performance among Whites is associated with a movement to private or out-of-state public schools. However, Hispanic high school graduation rates are strongly correlated with public college enrollment rates.

Discussion and Conclusions

Despite fears to the contrary, the evidence in this study suggests that the fairly rapid tuition increases in the 1990s have had no effect on enrollment decisions in public institutions.

Federal need-based grants also appear to have had no measurable effect on enrollment rates, which supports the contention of some that federal aid is not transparent and is too complex to influence the marginal college student (Kane, 2003). Moreover, students generally do not know the amount of the Federal Pell Grant they will receive until they are accepted to a particular college and receive an award notice, which is late in the decision-making process. It could be that the complexity and timing of federal aid means that grants go primarily to students who would attend college with or without the additional aid. It may also be due to the difficulty of accurately measuring the size of federal aid programs, where total appropriations may not be a very good indicator of grant availability. However, substituting Federal Pell Grant maximum and average awards for each year in place of the total expenditures normalized by the size of the 18-25 year old population also revealed that these measures of federal grant availability are also not associated with public enrollments (results available from author).

The analysis highlights the important role that state need-based aid and state higher education capacity play in explaining a state's public enrollment rates. Academic preparation

as measured by high school completion rates is as an important predictor explaining Hispanic enrollment decisions, although not the enrollment decisions of White or Black youth.

Supporting institutions that advance equality in college opportunity requires identifying policies that best promote college attendance for those currently underrepresented. Despite vast resources devoted to tuition and federal financial aid policies, large differences in access exist, suggesting a need to reevaluate the policies used to promote college access.

This study found that the most effective policies for promoting college access are expanding state need-based financial aid, although since many states base their need-based awards on FAFSA's estimated family contribution, it is possible that state need-based funds complement federal need-based funds. Given the evidence found in this study of a likely limited supply of public higher education institutions, in many states demand-side policies will likely be limited in their effect on enrollments unless coupled with an expansion in the supply of higher education.

In this study, the effect of academic achievement is imperfectly measured by high school completion rates. For Hispanic youth, but not for other groups, differences in these rates are a strong predictor of state college enrollment rates. Thus, the marginal Hispanic high school graduate may, as a result of graduating from high school, attend a public institution. This makes sense given that Hispanic high school graduation rates (62% over the study period) are much lower than White (86%) or Black (79%) graduation rates. Such a low rate surely indicates that many more academically-capable Hispanic youth are simply not finishing high school. States that do a better job attaining higher high school graduation rates find that the marginal Hispanic graduate is more likely to attend college than is the marginal White or Black graduate.

However, given all we know about the effect of students' experiences during their K-12 career and college-going decisions (e.g., Swail and Perna, 2002), states would be well advised to base some of their evaluation of ongoing K-12 educational reforms on their relationship with college-going decisions.

It is curious that White and Hispanic public enrollment rates appear to be strongly influenced by supply conditions, but Black public enrollment rates do not. One possible explanation could be that in many states, Black students have the option of enrolling in Historically Black Colleges and Universities (HBCU). There are currently 50 public HBCUs located in 20 states; together these enroll over 200,000 students, 78% of whom are Black (U.S. Department of Education, 2003, Table 224). There is some dispute among researchers over whether or not HBCUs enhance the college attendance of Black students (Ehrenberg, Rothstein & Olsen, 1999). However, the presence of these institutions in some states—for which state geographical boundaries are less important insofar as tuition is the same for in-state

The analysis highlights the important role that state need-based aid and state higher education capacity play in explaining a state's public enrollment rates.

and out-of-state students—may make the state-level analysis of college-going decisions among Black youth problematic. In fact, in an analysis not reported here, the evidence is overwhelming that Black public enrollment rates within states dramatically increase with more public HBCUs located within the state.

Limitations of the Study

A few caveats to this study are worth mentioning. One is that the study has only examined the determinants of enrollments in public institutions. This raises the important question of how the inclusion of the private sector might have changed the results. One clear conjecture, for example, is that income would likely be shown as positively correlated with total college enrollments. By leaving out the private sector, the effect of tuition on enrollments may be overestimated; its inclusion would not likely change this study's finding on the role of tuition. On the other hand, the estimated effect of scholarship aid will be underestimated by leaving out the private sector. It is possible that federal need-based and state non-need based grants, in the aggregate, leave enrollments in public institutions unchanged while increasing enrollments in private institutions.

It is also conceivable that the association between measures of state public higher education capacity and public enrollment only means that for states with lower public capacity, citizens disproportionately attend private or out-of-state public institutions. However, a separate analysis not reported here found no evidence that within-state variation in private enrollments is associated with changes in state higher education policy.

For these reasons, the findings on the ineffectiveness of federal need-based and state non-need based aid, and the importance of public capacity in explaining enrollment rates, only speak to enrollment in the public sector. It is possible that the effect of these policies on total college-going decisions is different than estimated here. Yet this study also concludes that our estimate of the significance of state-need based aid on enrollment may be underestimated with respect to college going decisions in general.

A second caveat to this study is that college enrollment is only one of many policy concerns surrounding college attendance. In particular, this study examined the determinants of initial public college enrollment, not college completion. This is important given recent evidence of differences in college completion rates by income (Leonhardt, 2005; Tinto, 2004), and evidence that Pell Grants may aid in student persistence (Wei and Horn, 2002).

Finally, this study did not address the issue of whether larger numbers of college enrollees yield a social benefit. From a social point of view, public investments to increase college enrollment are desirable only insofar as the social benefit from

these investments exceeds the public cost. It could be that higher enrollment rates are associated with less able and less highly-motivated students attending college. Caucutt and Kumar (2003) and Sahin (2004) argue that under these circumstances, increased enrollment could be inefficient in that human capital accumulation may not increase as much as expected.

With these three caveats, the conclusion of this study is that dollars spent on two policies in particular—more state need-based aid, and greater college capacity—would go farther toward promoting equitable and efficient higher education policies than would current policies.

References

Betts, J. and McFarland, L. (1995). Safe port in a storm: The impact of labor market conditions on community college enrollments. *Journal of Human Resources, 30*(4), 741-765.

Binder, M., Ganderton, P., & Hutchens, K. (2002). Incentive effects of New Mexico's merit-based state scholarship program: Who responds and how? In: D. Heller & P. Marin, *Who should we help? The negative social consequences of merit scholarships*. Cambridge: The Civil Rights Project at Harvard University.

Cameron, S., & and Heckman, J. (2001). The dynamics of educational attainment for black, Hispanic and white males. *Journal of Political Economy 109*(3), 455-499.

Caucutt, E., & Kumar, K. (2003). Higher education subsidies and heterogeneity—A dynamic analysis. *Journal of Economic Dynamics and Control 27*, 1459-1502.

Christian, M. (2003, October). *Liquidity constraints and the cyclicality of college enrollment*. Unpublished manuscript. Available at http://www-personal.umich.edu/~mschrist/christian2001.pdf.

Christian, M. (2004, March). *The responses of state universities to changes in demand for public higher education, 1980-1995: Enrollment, tuition, quality, and admissions*. Unpublished manuscript. Available at http://www-personal.umich.edu/~mschrist/christian2003.pdf.

College Board (2002). *Trends in college pricing 2002*. New York: The College Board.

Cornwell, C. & Mustard, D. (2002). Race and the effects of Georgia's HOPE scholarship. In: D. Heller and P. Marin, *Who should we help? The negative social consequences of merit scholarships*. Cambridge: The Civil Rights Project at Harvard University.

Dellas, H. & Sakellaris, P. (2003). On the cyclicality of schooling: Theory and evidence. *Oxford Economic Papers 55* (1), 148-172.

Dynarski, S. (2000). Hope for whom? Financial aid for the middle class and its impact on college attendance. *National Tax Journal 53*(3), 629-661.

Ehrenberg, R., Rothstein, D., & Olsen, R. (1999). Do historically black colleges and universities enhance the college attendance of African American youths? In Moen, Dempster-McClain & Walker (Eds.), *A nation divided: Diversity, inequality, and community in American society*. Ithaca: Cornell University Press.

Ellwood, D., & Kane. T. (2000). Who is getting a college education? Family background and the growing gap in enrollment. In Danziger & Waldfogel (Eds.), *Securing the future: Investing in children from birth to college*. New York: Russell Sage Foundation.

Goldin, C., & Katz, L. (1999). The shaping of higher education: The formative years in the U.S. *Journal of Economic Perspectives, 13*(1), 37-62.

Grunfeld, Y., & Griliches, Z.. (1960). Is aggregation necessarily bad? *Review of Economics and Statistics, 41*, 1-14.

Hansen, W. (1983). Impact of student financial aid on access. In Joseph Froomkin (Ed.). *The crisis in higher education*. New York: Academy of Political Science.

Heller, D. (1999). The effects of tuition and state financial aid on public college enrollment. *Review of Higher Education, 23*(1), 65-89.

Heller, D. (2003, September). *Review of NCES research on financial aid and college preparation*. Report Prepared for the Advisory Committee on Student Financial Assistance. Available at http://www.ed.gov/about/bdscomm/list/acsfa/Heller_BeckerFinalReports.pdf.

Heller, D. & Rasmussen, C. (2002). Merit scholarships and college Access: Evidence from Florida and Michigan. In Heller & Marin (Eds.), *Who should we help? The negative social consequences of merit scholarships*. Cambridge, MA: The Civil Rights Project at Harvard University.

Kane, T. (1994). College entry by blacks since 1970: The role of college costs, family background, and the returns to education. *Journal of Political Economy, 102*(5), 878-911.

Kane, T. (2001). *College-going and inequality: A literature review*. Unpublished manuscript. New York: Russell Sage Foundation.

Kane, T. (2003). A quasi-experimental estimate of the impact on financial aid on college-going. NBER Working Paper #9703. Cambridge: NBER.

King, J. (2003). 2003 Status Report on the Pell Grant Program. Washington, DC: American Council on Education, available at http://www.acenet.edu/bookstore/pdf/2003_pell_grant.pdf

King, M., Ruggles, S. & Sobek, M..(2003). *Integrated public wse microdata series, Current Population Survey: Preliminary version 0.1*. Minneapolis: Minnesota Population Center, University of Minnesota. Available at http://beta.ipums.org/cps/.

Leonhardt, D. (2004, April 22). As wealthy fill top colleges, new efforts to level the field. *New York Times*.

Leonhardt, D. (2005, May 24). The college dropout boom. *New York Times*.

Leslie, L. & Brinkman, P. (1987). Student price response in higher education: The student demand studies, *Journal of Higher Education, 58*, 181-204.

Mazumder, B. (2003). Family resources and college enrollment. *Federal Reserve Bank of Chicago Economic Perspectives, 27*(4), 30-41.

McPherson, M. & Schapiro. M. (1991). Does student aid affect college enrollment? New evidence on a persistent controversy. *American Economic Review 81*(1), 309-318.

NASSGAP (2006). *NASSGAP 36th annual survey report 2004-2005 academic year*, National Association of State Student Grant and Aid Programs, available at http://www.nassgap.org/researchsurveys.

Neal, D., Johnson, W. (1996). The role of pre-market factors in black/white wage differences. *Journal of Political Economy, 104*(5), 869-895.

Perna, L.W. (2000). Differences in the decision to enroll in college among African Americans, Hispanics, and Whites. *Journal of Higher Education, 71*, 117-141.

Perna, L.W. and Li, C. (2006). College Affordability: Implications for College Opportunity. *Journal of Student Financial Aid, 36*(1): 7-24.

Perna, L.W., & Titus, M. (2005). The relationship between parental involvement as social capital and college enrollment: An examination of racial/ethnic group differences. *Journal of Higher Education*.

Rouse, C. (1994). What to do after high school: The two-year versus four-year college enrollment decision. In R. Ehrenberg (Ed.), *Choices and consequences: Contemporary policy issues in education*. Ithaca: ILR Press.

Sahin, A. (2004, August). *The incentive effects of higher education subsidies on student aid*. Federal Reserve Bank of New York Staff Report, 192. Available at http://www.newyorkfed.org/research/staff_reports/sr192.pdf.

Sahr, R. (2004). *Inflation conversion factors for years 1665-2014*. Available at www.oregonstate.edu/Dept/pol_sci/fac/sahr/cf16652014.xls.

Strayer, W. (2002). The returns to school quality: College choice and earnings. *Journal of Labor Economics, 20*(3), 475-503.

Swail, W.S., & Perna, L.W. (2002). Pre-college outreach and early intervention programs: A national perspective. In W.G. Tierney & L.S. Hagedorn (Eds.), *Increasing access to college: Extending the possibilities for all students* (pp. 15-34). Albany, NY: State University of New York Press.

Tinto, V. (2004, July). Student retention and graduation: Facing the truth, living with the consequences. The Pell Institute Occasional Paper #1.

U.S. Bureau of Labor Statistics (2005, March 25). *College enrollment and work activity of 2004 high school graduates*. News Release. Available at http://www.bls.gov/news.release/hsgec.nr0.htm.

U.S. Department of Education (2003). *Digest of education statistics*. Available at http://www.nces.ed.gov//programs/digest/d03/.

U.S. Department of Education (2005). *Digest of education statistics*. Available at http://www.nces.ed.gov//programs/digest/d05/.

U.S. Office of Management and Budget (2004). *Budget of the United States Government, FY 2005*. Available at http://www.whitehouse.gov/omb/budget/fy2005

Wei, C., & Horn, L. (2002). *Persistence and attainment of beginning students with Pell Grants* (NCES 2002-169). U.S. Department of Education. Washington, D.C.: National Center for Education Statistics. Available at http://nces.ed.gov/pubsearch/pubsinfo.asp?pubid=2002169.

Wirt, J, Schoy, S., Rooney, P. Provasnik, S., Sen, A., and Tobin, R. (2004). *The Condition of Education 2004* (NCES 2004-077). U.S. Department of Education, NCES. Washington, DC: US GPO.

Appendix
Comments on Data Used in this Study

Observations Used in this Study	Estimates of population size, income, and educational attainment by race and state come from the Bureau of Labor Statistics' Current Population Survey (CPS; King, 2003). The CPS is an annual survey of about 150,000 people from which population characteristics are estimated. For some states and years, the number of Black or Hispanic people surveyed is very small, and thus population inferences are subject to large errors. For this reason, estimates of Black and Hispanic enrollment rates are limited to states where the Black or Hispanic youth population (18-25 years old) is at least 20,000. This resulted in many fewer observations, but a much better fit with the data. (Regressions were also run for states with Black or Hispanic youth populations of greater than 40,000, and greater than 10,000, with very similar results to those reported here. Thus while the cutoff of 20,000 is arbitrary, it is also not determining the results). A few additional observations were dropped because of missing data. Thus out of 550 possible observations, there are at most 546 for White youth, 316 for Black youth, and 208 for Hispanic youth.
Racial and Ethnic Classification	The CPS asks respondents to identify their race (Hispanic not being an option), and then in a separate question to identify their Hispanic status. For this reason, many respondents identify themselves as both White and Hispanic, or Black and Hispanic. This raises the problem of identifying the White from Hispanic, and Black from Hispanic populations. For this study, Whites and Blacks are defined as those who identify their race as White or Black, and Hispanic status as non-Hispanic. Hispanics are defined as those who identify themselves as Hispanic, regardless of their race. Racial data on college enrollment came from the National Center for Education Statistic's Integrated Postsecondary Education Data System (IPEDS), where White is defined as non-Hispanic White, and Black is defined as non-Hispanic Black.