

**Exploring the Effects of Tuition Increases on Racial/Ethnic Diversity at
Public Colleges and Universities**

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The goal of this study is to examine the effects of tuition increases at public four-year and community colleges on the racial/ethnic composition of those institutions. We designed our analyses to address the hypothesis that students respond to tuition increases in different ways based on their race/ethnicity, and that, over time, this will lead to shifts in the racial/ethnic composition of institutions. Therefore, this paper was guided by two primary research questions: 1) What are the effects of tuition increases on racial/ethnic diversity at public institutions over time? 2) Does the influence of tuition on racial/ethnic diversity vary by institution selectivity?

Since the mid-1990s, reports have shown increases in both enrollment and levels of student diversity at public colleges and universities (Hinrichs, 2013). During this same time period we have witnessed steady and substantial increasing in average tuition and fees at four-year public colleges and community colleges (Baum and Ma, 2013). As appropriations to public postsecondary institutions have continued to decline, tuition and fees have provided one lever for institutions to address funding gaps and reports clearly show that tuition increases over the last decade have correlated with disinvestment in state aid (Delaney and Doyle, 2011). As highlighted by Zinth and Smith (2012), much of the tuition-setting authority is now also in the hands of local institution boards. Yet, as tuition becomes a more prominent tool to address financial challenges of colleges and universities, it is critically important to examine the implications of tuition increases on institutions and their students.

Researchers have documented the degree to which institutions have become more integrated and diverse over the years, and much of the focus in this area has been on financial aid and admissions practices (e.g., Alon, 2009; Engberg and Wolniak, 2014; Hoxby, 2009). It is

clear from prior research that money matters; lowering costs can improve college access and completion (Dynarski and Scott-Clayton, 2013). While it is true that actual college costs are not necessarily synonymous with published tuition rates, it still remains difficult for students and families to determine the actual cost of attendance. Published tuition and fees, regardless of how they might be supplemented by colleges with institutional financial aid, may have an impact on enrollment patterns, especially for historically underrepresented populations. This paper advances the literature by estimating how various measures of racial/ethnic diversity among public institutions are affected by increases in tuition and the surrounding state and postsecondary context.

Literature Review

Research has shown increases across most measures of postsecondary diversity over the past two decades (see Hinrichs, 2013, for a review), along with a concomitant rise in average tuition and fees at four-year public colleges and community colleges. While studies have well documented the degree to which institutions have become more integrated and diverse over time, only a handful of studies have sought to connect these trends with institutional factors that might be facilitating or hindering these changes. Those studies have focused on segregation levels and trends across time using various measures of diversity and collections of institutions (Clotfelter, 2004; Goldrick-Rab & Kinsley, 2013; Hinrichs, 2013). With the present study we sought to advance the literature on institutional diversity by estimating how various measures of racial/ethnic diversity are influenced by increases in tuition.

Racial/ethnic diversity on college campuses has been associated with significant benefits for students. Research has shown that higher frequencies of interacting with an individual of a different race within a higher education setting leads to positive educational outcomes. (Astin, 1993; Chang, 1999; Chang, Astin, Kim, 2004; Chang, Denson, Saez, and Misa, 2006; Denson

and Chang, 2009; Gurin, Dev, Hurtado, and Gurin, 2002; Milem, 2003; Umbach and Kuh, 2007), mirroring the evidence on the positive influence of school diversity in the k-12 education sphere (Hanushek, Kain, and Rivkin (2009). Clark and Antonio (2012) provide a useful discussion on ways that diverse student bodies can impact higher education. Given the empirical evidence that a racially and ethnically diverse learning environment is helpful for promoting student achievement, additional study is warranted to further understand how trends in tuition levels affect institutional racial/ethnic diversity.

Given the evidence on the benefits of a diverse college student body, surprisingly little is known about the mechanisms whereby policy makers and higher education administrators contribute to racial/ethnic differences in college enrollment patterns. Perna and Titus (2004) found that after controlling for student-level variables, public policy decisions relating to tuition, appropriations, and financial aid all have an effect on college enrollment as well as the type of institutions attended, but researchers have only recently begun to explore how specific institutional policies may affect specific subgroups (see Posselt, Jaquette, Bielby, and Bastedo 2012, for a review).

Perna and others (2005) suggested that, in the face of increasing demand for higher education, colleges and universities will respond by raising the sticker price of a college education, which could potentially disproportionately reduce enrollment among students from underrepresented groups. Conger (2014) has explored the effects of tuition changes in undocumented immigrant students in New York City and found that the removal of a tuition subsidy for undocumented students resulted in a decrease in full-time enrollment. Hemelt and Marcotte, (2011) have found that overall enrollment as a response to tuition increases have varied by institution selectivity. Curs and Jaquette (2013) have also examined the racial and

economic diversity of colleges and how this has been affected by non-resident enrollment growth. Finally, Flores and Shepherd (2014) recently analyzed the effects of tuition deregulation in Texas on college enrollment patterns of underrepresented and low-income populations. Results from their difference-in-difference approach revealed that Hispanic students were negatively affected by tuition deregulation. Outcomes for black students and other subgroups were mixed, however.

Theoretical and Conceptual Framework

The theoretical and conceptual framework for examining the consequences of tuition increases on institutional diversity draws from three different yet complimentary perspectives. First, the sizable literature focused on students' educational decision-making (including postsecondary enrollment decisions) highlights the relevance of human capital theory (Becker, 1962), which postulates that students respond rationally by making choices that maximize their expected return based on comparing the cost of their education in relation to their anticipated future monetary returns (Shin & Milton, 2006; Hilmer, 1998; Mumper, 1996; Woodhall, 1997).

Complimenting human capital theory is a critical quantitative framework (Stage, 2007) that guides our examinations of equity between groups by race, ethnicity, and socioeconomic status. We employ a critical quantitative framework to examine group difference and to highlight specific findings that have implications for student body diversity and segregation. The critical quantitative approach is informed by critical theory as outlined by Kincheloe and McLaren (1994) and builds upon the assumption that mainstream research methods and practices can often function to reproduce class, race, and gender oppression. The approach is based on the idea that researchers should use data to question and illuminate the traditional theories and methods, rather than to simply confirm them. Through the critical quantitative lens, this paper examines the

extent to which tuition increases at public institutions have subgroup-specific impacts that may not be apparent from analyses focusing only on overall average tuition effects.

The third key perspective informing our study is institutional isomorphism, borrowed from organizational theory for considering how entities such as colleges and universities become increasingly similar to one another over time (DiMaggio & Powell, 1983) by way of how organizations respond to external pressure (i.e., coercive isomorphism). Past studies of institutional isomorphism in postsecondary settings have included examinations of mission statements (Lewis, 2002), discipline-specific approaches to teaching and research (Fairweather & Paulson, 2008), and the initial development and implementation of recruitment and retention programs in STEM (George-Jackson, Rincon, & Castro, in review). With the present study we do not examine the processes by which the institutions adopt tuition policies over time; however, we do examine the extent to which institutions tuition policies are influencing student diversity and whether or not this influence is uniform across institutions or conditional on institutional characteristics (e.g., type and selectivity).

The study draws on and utilizes human capital theory, a critical quantitative perspective, and the concept of institutional isomorphism. In doing so, the study aim to examine the response to tuition increases across various student subgroups and to identify how variations in these responses lead to changes in the racial/ethnic composition of institutions. Rather than focus only on the overall or average elasticity of demand, as previous research as done (Hemelt and Marcotte, 2011), this paper explores this elasticity of demand for students from various racial/ethnic groups and attempts to uncover how findings from previous studies may mask important differences across these groups.

Methods

Data and Sample

This paper uses multivariate analyses with fixed effects models to estimate the relationship between observed changes in tuition and racial/ethnic diversity across U.S. public four-year colleges and universities, taking into account characteristics of surrounding four-year and 2-year institution characteristics and tuition levels. Our primary dataset consists of institution-level measures obtained from the Integrated Postsecondary Education Data System (IPEDS) spanning years 1998-1999 to 2011-12. These data include information on institution type, location, demographics, and average tuition and fees. All reporting four-year and two-year public and private institutions were included. While the focus of much prior research and public policy is on four-year public institutions, we included all undergraduate degree-granting institutions in our data set in order to account for the relationships and interactions between four-year publics and the surround institutions of all sectors and types. In other words, it was important that the number, the type, and the average tuition of surrounding colleges and universities be considered as potential factors shaping the relationship between shifting tuition and racial/ethnic diversity.

The resulting data set thus contains institutional characteristics and contextual demographic/economic indicators for each IPEDS-reporting U.S. undergraduate institution from 1998-1999 through 2011-12. For purposes of this analysis, we only included institutions that enrolled at least 50 undergraduates within a given year. Furthermore, we excluded institutions in Alaska, Hawaii, and U.S. territories. Notably, unlike many pre-constructed IPEDS data sets used by researchers, our data set is not on a balanced panel across years; institutions that opened or closed during this time period are included in our data only for years in which the institution

enrolled students. Similar to the approach of Hinrichs (2013), we did not restrict this sample only to institutions who were open and active during this entire time frame, primarily because the entry and exist of nearby institutions may have important effects on how diversity changes across time for a given institution. We also noted when institutions' physical locations had changed. The final data set of four-year institutions, which consists of institutional and geographic-based variables, contains 6,658 records across 14 years. The full sample includes a total of 530 public four-year institutions. Sample descriptive statistics are shown in Table 1.

TABLE 1.
Full sample descriptive statistics: Four-year public institutions, 1998-2011

Variable	<i>n</i>	<i>Mean</i>	<i>SD</i>
Enrollment and diversity			
Total full-time headcount	6,658	8,455	8,688
% Asian	6,658	3.9	6.4
% Black	6,658	12.4	20.4
% Hispanic	6,658	6.9	12.7
% White	6,658	70.8	24.7
% Nonresident alien	6,658	3.5	3.6
% Non-white	6,658	29.2	24.7
Diversity index	6,658	40.98	21.79
Costs			
In-state tuition and fees	6,658	5,610.87	2,454.73
Weighted in-state tuition and fees of surrounding 4-year public institutions	6,658	5,474.14	2,160.75
Weighted in-state tuition and fees of surrounding 4-year private institutions	5,810	19,070.66	5,304.36
Weighted in-state tuition and fees of surrounding 2-year public institutions	6,203	3,092.23	1,405.00
Other primary covariates			
Weighted average unemployment rate	6,297	6.06	2.34
Diversity index of high school graduates	6,319	48.64	21.08
Average institutional financial aid	6,319	3,065.05	1,956.05
Number of surrounding 4-year public institutions (inclusive)	6,319	9.4	6.4
Number of surrounding 4-year private institutions	6,319	18.8	17.3
Number of surrounding 2-year public institutions	6,319	13.7	9.89

Note: All monetary values are expressed in 2012-13 (academic year) dollars. The full sample includes a total of 530 public four-year institutions. Surrounding institutions are those within a 100-mile Euclidian distance from each institution. Averages are weighted based on a distance decay function that gives less weight to institutions and county-based data as the distance from an institution increases.

Measures

Institutional Diversity. Of particular usefulness to this study, complete enrollment statistics by race/ethnicity are available for institutions from 1998-99 through 2011-12 for several populations of students, including total headcount, total undergraduates, and total first-time freshmen, all of which can be disaggregated by full-time/part-time enrollment status. Partial race/ethnicity enrollment counts are available prior to 1998-99 and after 2011-12, but not enough complete data were available to construct our measures of race/ethnicity during these years.

During the study period of 1998-99 to 2011-12, race/ethnicity data were collected based on two different frameworks. The original framework, which was in place from 1977 through the 2009-2010, called for the collection of aggregate data on race and ethnicity across five categories: American Indian or Alaskan Native, Asian and Pacific Islander, Black or African American, Hispanic, and White. Beginning with 2010-2011 reporting cycle, colleges and universities were as to provide data based on new data collection standards that took into account standards set forth in the U.S. Department of Education's published framework in the Federal Register (72 Fed. Reg. 59267). In this new data collection framework, individuals were allowed to self-identify race/ethnicity by indicating multiple categories across expanded reporting options: American Indian or Alaskan Native, Asian, Black or African American, Hispanic, Native Hawaiian or Other Pacific Islander, White, and Two or More Races. Before and after these shifts in data reporting policies, colleges and universities were also required to report students who were not U. S. citizens or nationals and who were in the U.S. on a visa or temporary permit as "Nonresident Aliens" rather than include them in a specific racial/ethnic category. Table A in the Appendix provides details on the definitions of these race/ethnicity

reporting categories for the 2013-2014 academic year. It is important to note that for our study, we took into account these changes and ran validation checks to ensure that our results were not affected by these changes. We found no evidence that the shifting data collection framework for race/ethnicity had any significant impact on our findings or their interpretations.

Demographic and Economic Contexts. In addition to IPEDS data, we also wanted to account for differences in local demographic and economic factors that might play a role in impacting campus diversity. To account for the changing racial/ethnic composition of potential college-going populations within a state, we compiled data on *number of high school graduates by race/ ethnicity* for each state from the Digest of Education Statistics, which is produced by the National Center for Education Statistics (NCES). These statistics were merged to IPEDS data by state. We also collected data on *county-level unemployment rates* by year from the U.S. Bureau of Labor Statistics. Year-by-year unemployment was then calculated for each institution based on the county of the institution plus the counties within a 50 mile radius of the institution. Rather than using state-level measures to account for these economic indicators, we took advantage of county-level data to construct economic covariates that were localized to each institution. This relative region-based measure of unemployment takes into account weaknesses of state-level aggregated statistics, especially for large diverse states or for institutions on the border of two (or more) states. According to research on community colleges by Goldrick-Rab and Kinsley (2013), 81 percent of the variation in racial composition of student bodies at those institutions was explained by economic and demographic factors in their surrounding counties. The researchers state that “it is clear that the degree to which racial/ethnic minority students are represented at community colleges depends quite substantially on whether they live in the surrounding county” (p.126).

College Density / Proximity. For the same reasons that we did not restrict our data set to a balanced panel, we chose to create several new variables that reflected the number and tuition levels of surrounding institutions. It is becoming increasingly evident that individual higher education institutions are often part of a larger network and system of postsecondary education opportunities. One could argue that, when it comes to college choice and enrollment behavior, higher education institutions are often viewed by prospective and current students as education options within a larger set of geographic-based postsecondary education choice sets. For instance, the decision for students to enroll in a four-year institution might be determined, in part, by the presence of a nearby community college. Turley (2009) suggests that the college choice model is largely depend on the geographic context in which students' decisions about attending college occurs. Research has shown that college proximity is associated with changes in the odds of applying to and enrolling in college, especially for four-year institutions (Smith and Bers, 1989; Weiler, 1994; Do, 2004; Turley, 2009). According to the 2011 IPEDS Residence and Migration survey, 89.5 percent of four-year college students in 2011 attended a college in their home region (Hinrichs, 2013). Moreover, socio-economically disadvantaged students have been found to be less likely to leave home to go to college (Mulder and Clark, 2002). It follows, then, that the racial/ethnic composition of four-year institutions might not simply be a function of an individual institution's tuition increases, but also the number and tuition hikes of surrounding four-year and two-year institutions within a students' likely choice set. We thus constructed variables to account for this scenario.

Using physical address information for all institutions, we geocoded each institution and then calculated the Euclidian distance, in miles, between every pair of institutions within each year. Using these distances, we then constructed variables for each four-year institution

consisting of the number of surrounding two-year public, four-year public, and four-year private institutions within a 100 mile radius. These three variables—one for each institution type—illustrate the number of institutions that could potentially serve as an alternative postsecondary enrollment option for a student who could enroll in the institution of focus (i.e., the center point of the circular “catchment area” based on the 100 mile radius). Although we calculated these variables based on various radius distances, ranging from 50 miles to 200 miles, we decided on 100 miles based on analyses of model fit. Table 5 presents results of our analyses based on varying radius distances as a robustness check.

Not only is it important to account for the number of surrounding institutions, it is critical to account for changes in tuition charged by surrounding institutions, as the published in-state cost of attending nearby institutions might affect enrollment patterns and, ultimately, the racial/ethnic composition of campuses. Therefore, we create additional variables that aggregate the overall tuition and fees of institutions, by institution type, within the surrounding area (based on the same 100 mile radius). To take into account the fact that the tuition level an institution 100 miles away is perhaps less-likely to influence postsecondary enrollment pattern for students than the tuition for an institution 10 miles away, we then weight these geographic-based tuition variables using a distance decay function. This distance-decay weighting technique, which has been used in research on in other fields such as geography and public health (Luo & Qi, 2009; McGrail and Humphreys, 2009) allows for institutions in closer proximity to carry more weight than institutions farther away.

To better illustrate the distance decay function and its applicability to our research questions, we think of each institutions’ surrounding region (r) as being defined as the circle bounded by 100-mile radius around an institution. For each of the proximity-based tuition

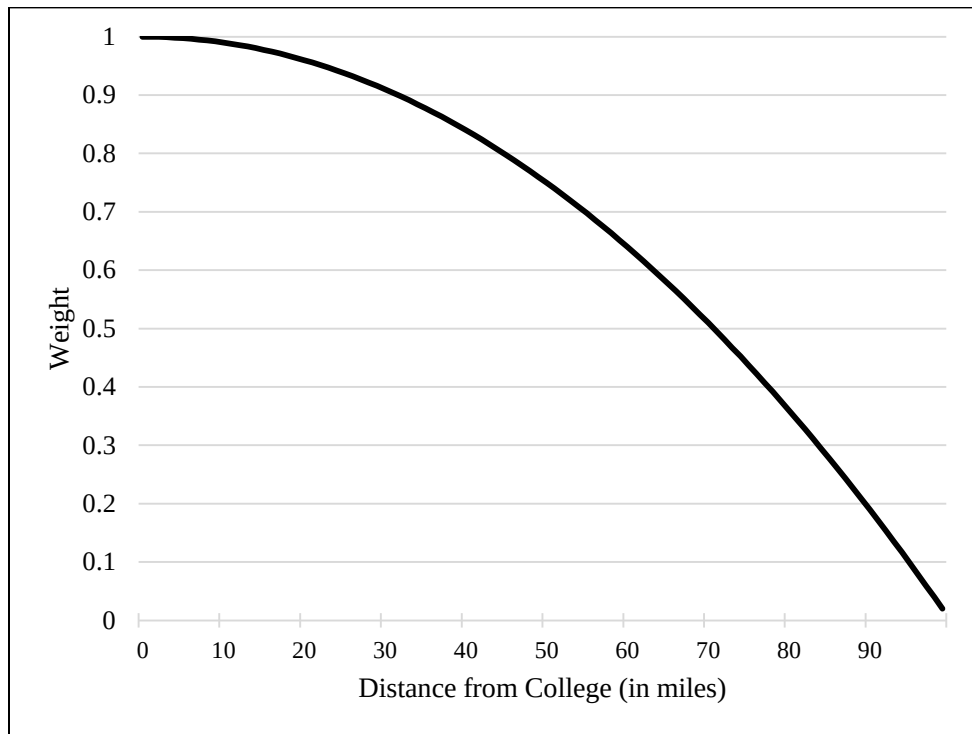
variables that we've created, we weighted the tuition of each surrounding institution (i.e. those *other* institutions that fall within 100 miles of the college of focus) based on the following function:

$$(1) \quad w_{ijt} = 1 - \left(\frac{d_{ijt}}{r}\right)^2$$

where the weight (w) of each surrounding institution j in year t is calculated as 1 minus the squared standardized distance from the center point, which can be represented as the distance between institution j and the college of focus i (i.e. the origination point of the radius) divided by the total radius of the catchment area (r), which is 100 miles in this case. For instance, an institution zero miles away has a weight of 1 and an institution 50 miles away has a weight of 0.75. Figure 1 illustrates the weight values for distances ranging from 1 to 100 miles from the center point. A useful property of the distance decay function is that the weight of a college 99 miles away for the institution of focus has almost the same weight as a college 101 miles away. This effectively means that the boundary line formed by the 100 mile radius, while seemingly arbitrary, does not have the same exclusionary property as a typical boundary line or a state line.¹ In all model specifications presented in this paper, a similar distance decay function was also applied to the unemployment rate variable using 50 miles as the radius.

¹ One weakness of this method is that state boundaries are not considered. The specific state in which an institution is situated may impact its attractiveness to prospective students; it may also impact the tuition rate charged of students depending on the state in which the prospective student resides.

FIGURE 1.
Relative weights used in the construction of proximity-based covariates by distance from a college



Model Specification

The goal of this study is to estimate the effects of tuition increases on racial/ethnic diversity. We chose to look at diversity across two groups of students: 1) total full-time unduplicated student enrollment and 2) first-time full-time freshmen. For our analysis, we estimate log-log models based on the enrollment elasticity techniques employed by Hemelt and Marcotte (2011). Similar to this prior research on enrollment responses to tuition hikes, we use log-log specifications to enhance model fit and interpretation relative to past research on tuition-based enrollment elasticity. Our general model form is:

$$(2) \quad \ln(DIV_{it}) = \beta_0 + \beta_1 \ln(T_{it}) + \beta_2 \ln(NC_{it}) + \beta_3 \ln(CP_{it}) + \beta_4 \ln(IA_{it}) + \beta_5 \ln(UN_{rt}) + \beta_6 \ln(HS_{st}) + \theta_i + \varphi_t + \varepsilon_{it}$$

The dependent variable, DIV_{it} , is a measure of racial/ethnicity diversity at institution i in academic year t . We use one primary measure of diversity for our analyses (described below), with two other measures used as robustness checks. The primary independent variable, T_{it} , is in-state inflation-adjusted tuition and fees charged to full-time students attending institution i and year t . NC_{it} is a vector of the number surrounding colleges by type; CP_{it} is a vector of the weighted average of the in-state tuition and fees of surrounding colleges (i.e. competitors' prices) by type of institution. For both NC and CP vectors, variables are calculated based on institutions located within a 100 mile radius of the college i . These variables attempt to capture changes in the surrounding set of higher education institutions, which can be an important factor in determining enrollment patterns at a particular institution.

One might hypothesize that tuition increases among institutions may be associated with financial aid and recruitment strategies that specifically target students from underrepresented racial/ethnic groups and other populations who may be more price sensitive in an effort to counteract the tuition hikes. Therefore, we also included the average institution aid disbursed to first-time freshmen (IA_{it}) for each institution i in academic year t .

We introduce a regional-based control for unemployment rates (UN_{rt}) for region r in academic year t to take into account local economic factors that might influence enrollment patterns and diversity over time. Unemployment rates are calculated by averaging statistics for counties within 50 miles (i.e., within region r) and are weighted using the distance decay function (1) described earlier. This ensures that economic indicators based on counties farther

away from an institution have less of a weight in the unemployment rate covariate used in the model.

Changes in the overall racial/ethnic makeup of a campus are also likely driven in part by local demographic changes. In order to account for these, we include a measure of diversity, HS_{st} that indicates the racial/ethnic composition of high school graduates in state s in academic year t . Data on high school graduates by race/ethnicity across this time period were not available at a local or country level that would allow for similar weighting methodology employed for the economic variables.²

Finally, we included college fixed effects (θ_i) to account for unobservable institution-level time-invariable characteristics, as well as year effects (φ_t) to account for systematic differences across years. The resulting model thus allows us to measure within-institution variation over time to estimate effects of tuition increases on diversity. We estimate all models using robust standard errors, clustered at the institution level.

Measuring Diversity. For the primary outcome variable, racial/ethnic diversity, as well as the measure of diversity among high school graduates within a state, we experimented with several measures before deciding on a standardized version of the *U.S. News and World Report* Diversity Index. This Diversity Index was chosen because of its ease of interpretation and common use among many higher education institutional research offices as a simple measure of diversity across various subgroups, whether it be race/ethnicity, gender, age, national origin, or other student characteristics. We wanted a measure that could be used to compare an institution's racial/ethnic distribution with the most diverse distribution possible, but still in an easy-to-grasp methodology. We recognize that measuring something as tenuous and nuanced as

² We did not include institutional-level measures of financial aid disbursement in our models. Inconsistencies in data definitions in IPEDS across this time, as well as the fact that models and results were not significantly impacted by financial aid indicators, led to us excluding them from our analyses.

racial and ethnic diversity require many more types of data and methodologies than what is captured in our Diversity Index. Still, we feel that this is a valid measure that will reflect at least one way of looking at diversity on college campuses.

In order to calculate our Diversity Index for race/ethnicity, we begin by using the model first described by Simpson (1949) and adapted by Meyer and McIntosh (1992) in their *USA Today* index of ethnic diversity. Now mostly identified in the higher education arena as the method used by the *U.S. News and World Report* in its ranking of higher education institutions, the Diversity Index is a probability-based index. The Diversity Index is a statistic that reflects the likelihood that two people chosen at random from a college will differ in terms of race/ethnicity. A value of zero would imply that everyone on a campus was the same race/ethnicity. The first step is to calculate the probability that two randomly chosen students will be the same race/ethnicity:

$$(3) \qquad \text{probability} = (A^2 + B^2 + C^2 + D^2 + E^2 + \dots n)$$

where A, B, C, D, E, etc. are the proportions in the college of each of the n racial/ethnic groups.

Subtracting the resulting probability from 1 yields the probability that the two students are different (Meyer and McIntosh, 1992). For our final diversity outcome measure, we used six racial/ethnic categories based on the reporting categories available in IPEDS: American Indian or Alaskan Native, Asian, Black or African American, Hispanic, White, and Other, which was a recoded variable containing enrollment counts labeled as Two or More Races, Native Hawaiian or Other Pacific Islander, and Non-resident Alien. Alternative groups of these “Other” categories did not substantively change the overall Diversity Index distribution or analysis

findings. Furthermore, removing Non-Resident alien from our calculations does not change the overall conclusions of the model. The goal of our paper is to fully-capture, as best we can, the racial/ethnic diversity on campuses, and we felt that including this group of students as a factor was important in understanding the full scope of student diversity. The same six-category methodology was also used to calculate the Diversity Index for high school graduates within the state.

For ease of interpretation in our models, we employed a standardization procedure on the original Diversity Index based on guidelines set forth by Lieberson (1969) and Herring (2009) which translates the raw probability into a diversity score from 0 to 100. We thus calculate the final diversity measure not as a probability, but the proportion of the maximum level of diversity possible within 6 possible racial/ethnic categories. That is, we calculated our final diversity measure as:

$$(4) \quad DIV = (US\ News\ Diversity\ Index / (1-1/6)) \times 100$$

In a population with completely even racial distribution across the categories, the measure would equal 100. As Herring points out, a key limitation of this methodology—as with most indices of diversity and integration—is that it treats all subgroups as mathematically equivalent.

For sensitivity checks for some analyses, we also estimate the effect of tuition increases on the percentage non-white students at a campus, and although they are not shown here, these models produced similar results to those presented here that are based on this standardized Diversity Index.

In addition to the initial analyses using our basic empirical model for t , we extend our analysis to look at differential effects across subpopulations populations of students (i.e. first-time freshmen versus total college headcount), as well as across institutions by selectivity. First, we consider how tuition hikes effect diversity among the total full-time student body compared to the diversity of full-time fist-time freshmen entering cohorts. This first-time freshmen group is useful in understanding effects on diversity among new students, who are hypothesized to be the most likely to change enrollment patterns due to tuition hikes. Second, based on results of research by Hemelt and Marcotte (2009), we suspect that enrollment patterns that lead to greater or less racial/ethnic diversity could different across institutions by selectivity. Using the Undergraduate Profile Carnegie Classification (2010), we identified all institutions that were classified as most elective in admission, meaning that first-year students' tests scores placed the institution in roughly the top fifth of four-year institutions. We then compared these institutions to those identified as least selective according to the Carnegie Classification, meaning that test scores of incoming students indicated that the college offered opportunities to the widest range of students with respect to prior test scores.

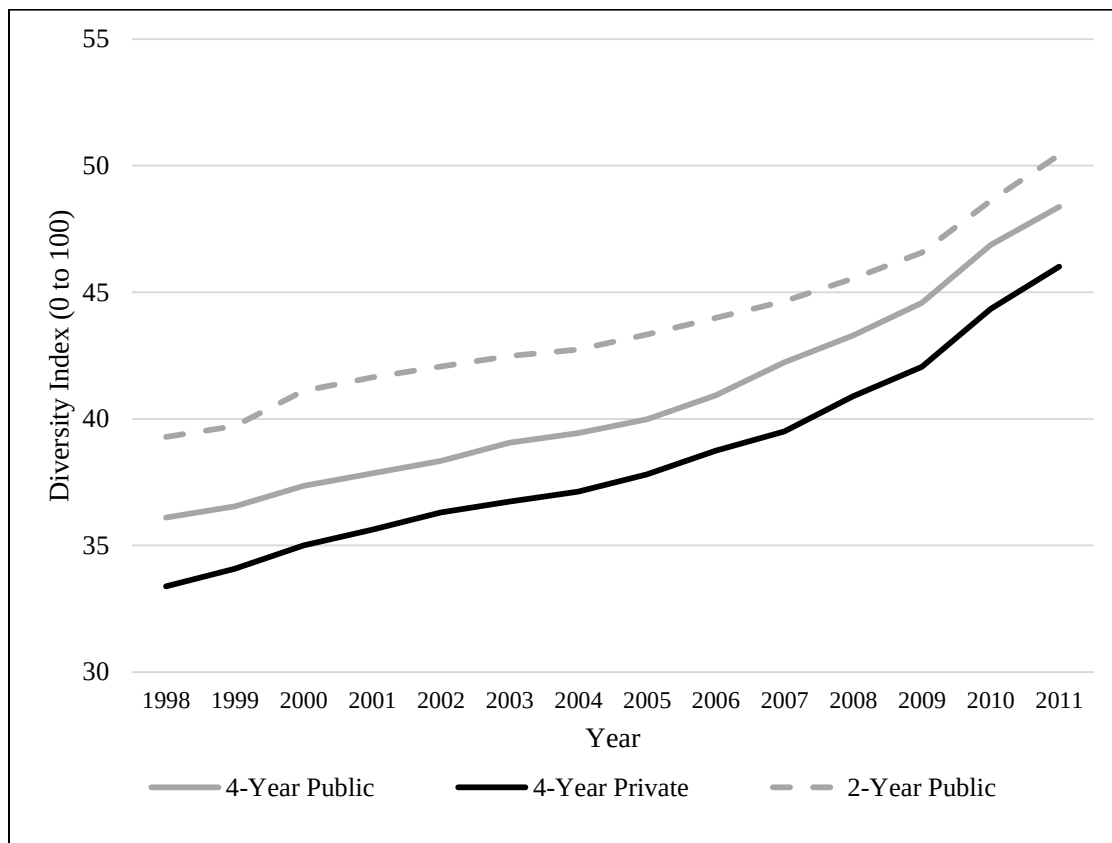
Results

Descriptive Results

Average enrollment percentages by race/ethnicity and diversity measures are presented in Table 1, together with tuition levels, surrounding higher education institutions, and other characteristics of the sample of four-year public institutions. Across the entire sample during this time period, we see that the average total full-time enrollment was approximately 8,455. Approximately seven in 10 students (70 percent) were white, while another 12 percent were black or African American. Almost six percent were Hispanic and almost four percent were

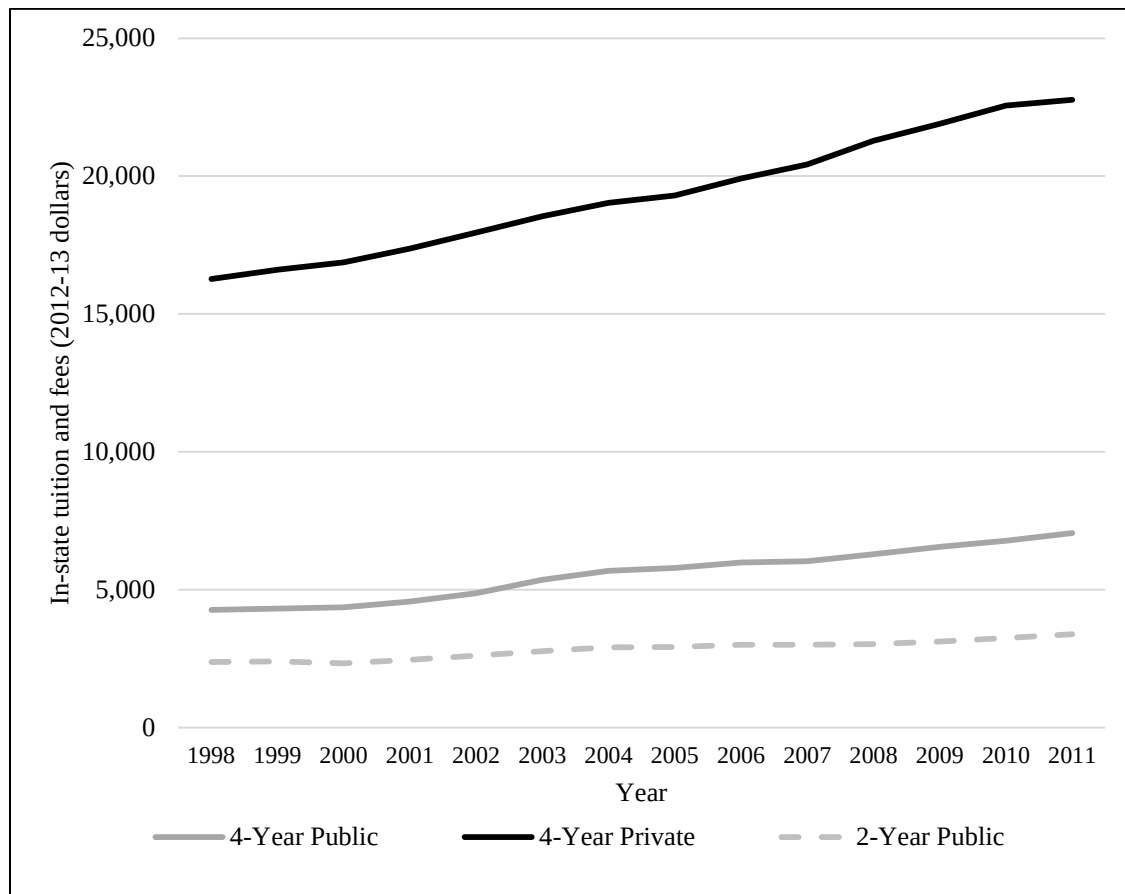
Asian. These statistics, being averages across all years, mask the increasing diversity of students over the last several decades. As shown in Table 1, the percent of non-white students was 29.2 percent. This percentage, however, was 23.6 in the 1998-99 academic year and increased to 33.2 in the 2011-12 academic year. Similarly, the standardized Diversity Index, our outcome variable, has increased significantly during this period across institution types (see Figure 2), clearly illustrating the steady rise in diversity of college students over this time period.

FIGURE 2.
Year-by-year trends in the racial/ethnic diversity index by institution sector and type



Institution characteristics differ significantly across college types. Just like trends in diversity, trends in tuition have demonstrated that tuition has increased significant across institution types. Figure 3 shows average in-state tuition and fees across time.

FIGURE 3.
Year-by-year trends in in-state tuition and fees by institution sector and type



Multivariate Results

Turning to our multivariate estimates of the effects of tuition increases in four-year institutions on diversity, we first examine the impacts of increases on total full-time enrollment counts at public four-year colleges and universities. Table 3 shows results of our basic model, with columns (1), (2), and (3) showing results as more covariates are added to the model. The first column shows the straight correlation between the log of in-state tuition and fees and the logged diversity index. Column (2) includes additional controls for the number of surrounding institutions, tuition of surrounding institutions, institution fixed effects, and year effects. Finally, the third column, our preferred model specification, includes average institution financial aid and the unemployment rate of the surrounding region, plus the diversity index of high school graduates in the preceding academic year.³ Results shown in Table 3 column (3) reveal that the average *elasticity of diversity* for in-state tuition and fees is -0.1447. This coefficient can be thought of in similar ways to price elasticities in traditional economic models; for everyone one percent increase in in-state tuition and fees, there is a corresponding 0.14 percent decrease in the racial/ethnic Diversity Index. To put this into context, according to Baum and Ma (2013) in-state tuition and fees at public four-year institutions increased 2.9% in 2013-14, which followed an increase of 4.5% in 2012-12 and 8.5% in 2011-12.

For ease of interpretation, assume that an institution's in-state tuition and fees equaled the average of \$5,611 and had a Diversity Index of 40.98 (e.g., the sample average for public four-year institutions). A large but not implausible hike in tuition and fees of \$1,000 would lower racial/ethnic diversity of full-time students on a campus by more than 2.5 percent,. Overall, results suggest that tuition hikes have a negative and statistically significant effect on campus diversity.

The coefficient for surrounding community colleges is also notably negative and statistically significant. This suggests that increasing numbers of community colleges in the vicinity of a four-year public university decreases diversity on the four-year public institution. Moreover, the coefficients for in-state tuition and fees for surrounding private four-year colleges and other surrounding four-year public colleges (i.e., the tuition elasticity for surrounding four-year institutions) are both positive and statistically significant. This suggests that tuition increases at surrounding institutions that serve as potential enrollment alternatives for students, tend to increase diversity at public four-year institutions. All of these findings point to the idea that colleges do not operate in isolated, but rather within in the context of a larger system of postsecondary institutions.

TABLE 2.

OLS estimates of the effects of tuition increases on the logged diversity index: Four-year public institutions, full-time total headcount

Variable	(1)	(2)	(3)
Log in-state tuition and fees	-0.0708 (0.0367)*	-0.0934 (0.0252)***	-0.1447 (0.0260)***
Log surrounding 4-year public institutions		0.0486 (0.0157)***	0.0125 (0.0141)
Log surrounding 4-year private institutions		0.1635 (0.0279)***	0.0665 (0.0250)***
Log surrounding community colleges		-0.0415 (0.0307)	-0.0641 (0.0271)**
Log weighted average tuition and fees of surrounding 4-year public institutions		0.1843 (0.0271)***	0.0588 (0.0242)**
Log weighted average tuition and fees of surrounding 4-year private institutions		0.6241 (0.0379)***	0.3725 (0.0356)***
Log weighted average tuition and fees of surrounding 2-year public institutions		-0.0844 (0.0247)***	-0.0082 (0.0233)
Log weighted average unemployment rate			-0.0106 (0.0150)
Log diversity index of high school graduates			0.4421 (0.0303)***
Log average institutional financial aid			0.0021 (0.0037)
Observations	6,003	6,003	6,003
R ²	.0021	.9494	.9546

Note: Values in parentheses are robust standard errors. Models (2) and (3) include institution and year effects. Model (3) also includes a dummy variable indicating the imputation of high school graduate diversity index.

* Significant at 10%. **Significant at 5%. ***Significant at 1%.

The estimates presented in Table 2 reflect effects of diversity on full-time headcount at public four-year institutions. However, tuition hikes might have differential impacts on new students compared to the overall student body. Our next set of analyses examine the same model as above, but focus solely on full-time, first-time freshmen. As shown in columns (1) and (2) in Table 3, the tuition elasticity of racial/ethnic diversity is -0.1193 and is statistically significant.

TABLE 3.
OLS estimates of the effects of tuition increases: Four-year public institutions by student population

Variable	FT total headcount (1)	FT first-time freshmen (2)
Log in-state tuition and fees	-0.1447 (0.0260)***	-0.1193 (0.0413)***
Log surrounding 4-year public institutions	0.0125 (0.0141)	0.0295 (0.0180)
Log surrounding 4-year private institutions	0.0665 (0.0250)***	0.0825 (0.0378)**
Log surrounding community colleges	-0.0641 (0.0271)**	-0.0312 (0.0368)
Log weighted average tuition and fees of surrounding 4-year public institutions	0.0588 (0.0242)**	0.0153 (0.0420)
Log weighted average tuition and fees of surrounding 4-year private institutions	0.3725 (0.0356)***	0.4061 (0.0557)***
Log weighted average tuition and fees of surrounding community colleges	-0.0082 (0.0233)	-0.0159 (0.0321)
Log weighted average unemployment rate	-0.0106 (0.0150)	-0.0073 (0.0163)
Log diversity index of high school graduates	0.4421 (0.0303)***	0.5755 (0.0480)***
Log institutional financial aid	0.0021 (0.0037)	-0.0040 (0.0061)
Observations	6,003	5,625
R ²	.9546	0.9221

Note: Values in parentheses are robust standard errors. All models include institution and year effects, as well as dummy variables indicating the imputation of high school graduate diversity index. FT = full-time.

* Significant at 10%. **Significant at 5%. ***Significant at 1%.

Results by Institutional Selectivity

Next we examine tuition elasticities of racial/ethnic diversity across institutions of varying selectivity. We hypothesized that because more selective institutions have more resources to counter tuition hikes, students admissible to selective institutions may be less

impacted by changes in tuition than students with fewer, less-selective college options. Hemelt and Marcotte (2011) found supporting evidence that tuition increases have more of an effect on overall college enrollment levels for Research I institutions who rank in the top 120 of all institutions on the *U.S. News and World Report* rankings. Hoxby (1997) highlighted considerable variation in the various types of colleges and universities and how the increasing geographic integration of the college marketplace has led to more stratification in terms of institutional quality and costs. How then does tuition increases across institutions with very different admissions profiles and “quality” affect campus diversity?

In order to examine impacts of tuition increases on campus diversity across different types of institutions in terms of selectivity, we first identify those colleges and universities who were classified by as highly selective based on the 2010 Carnegie Classification. Highly selective institutions, whose incoming freshmen have the highest exam scores, include 89 public institutions. We then compare the tuition elasticities of most-selective institutions to those who were identified by the 2010 Carnegie Classification as inclusive, non-selective.

Table 4 shows results across selectivity for public four-year institutions. The effect of tuition increases is significant and large for non-selective institution. With every one percent increase in in-state tuition and fees at non-selective institutions, racial/ethnic diversity dropped by approximately 0.17 percent among total full-time campus populations. For the highly selective institutions, the coefficient is still negative but quite small and not statistically significant. It appears, then, that the effect of tuition is strong at non-selective institutions but essentially zero at high selective public colleges and universities. It is worth noting that for public selective and non-selective institutions, the coefficients for the tuition and fees for surrounding four-year private institutions are large and statistically significant across the board.

TABLE 4.

OLS estimates of the effects of tuition increases on the logged diversity index by student population and institution selectivity

Variable	FT total headcount		FT first-time freshmen	
	Non-selective (1)	Highly selective (2)	Non-selective (3)	Highly selective (4)
Log in-state tuition and fees	-0.1724 (0.0466)***	-0.0363 (0.0327)	-0.2746 (0.0934)***	0.0107 (0.0481)
Log surrounding 4-year public institutions	0.0559 (0.0315)*	0.0506 (0.0279)*	0.0884 (0.0475)*	-0.0181 (0.0310)
Log surrounding 4-year private institutions	-0.0031 (0.0502)	0.1015 (0.0539)*	0.1118 (0.0812)	0.0560 (0.0495)
Log surrounding community colleges	-0.0694 (0.0555)	0.0866 (0.0508)*	-0.0373 (0.0846)	0.0400 (0.0626)
Log weighted average tuition and fees of surrounding 4-year public institutions	0.0246 (0.0529)	0.0717 (0.0327)*	-0.0867 (0.0948)	0.1031 (0.0564)*
Log weighted average tuition and fees of surrounding 4-year private institutions	0.3324 (0.0773)***	0.3789 (0.0703)***	0.3943 (0.1266)***	0.3101 (0.0920)***
Log weighted average tuition and fees of surrounding community colleges	-0.0366 (0.0536)	0.0307 (0.0302)	0.0686 (0.0890)	0.0295 (0.0446)
Observations	1,990	923	1,656	921
R ²	0.9536	0.9665	0.9125	0.9417

Note: Values in parentheses are robust standard errors. All models include institution and year effects, log institutional financial aid, log weighted unemployment rate, log diversity index of high school graduates, and dummy variables indicating the imputation of high school graduate diversity index.

* Significant at 10%. **Significant at 5%. ***Significant at 1%.

When looking exclusively at full-time first-time freshmen at these institutions, the trends in effects of tuition on racial/ethnic diversity appear similar to those for all students. Elasticities of racial/ethnic diversity among new students are negative and significant for non-selective public four-year institutions; the tuition elasticity is -0.2746. Analyzed at the mean for all non-selective public institutions (approximately \$4,730 tuition/fees and Diversity Index of 41.56), a \$1,000 increase in tuition and fees would lead to an drop in campus racial/ethnic diversity of

nearly 6 percent. This point difference is great than the average point different that separates public four-year institutions from community colleges.

This result is particularly notable because non-selective public institutions are much more likely to be the points of entry into higher education for underrepresented populations, including ethnic/racial minorities. Among these institutions, the average percentage of nonwhite enrolled students overall all years was 41.1. Among the highly selective institutions in the sample, just 23.3 percent of all enrolled students were nonwhite.

Discussion

Estimates of tuition elasticities of our Diversity Index provide important new evidence on the changes that published in-state tuition and fees have on the enrollment patterns of certain groups students, which in turn leads to changes in the racial/ethnic composition of students bodies at four-year public colleges and universities. Based on these results, our conclusions back up other recent studies, such as research by Flores and Shepherd (2014) that found evidence that Hispanic students were negatively affected by tuition deregulation in Texas.

Our results suggest that the number of colleges and universities surrounding an institution—that is, the number of competitors in the higher education marketplace—as well as the tuition increases of these surrounding colleges and universities may have an effect on the overall diversity of the institution’s student body. While more research and data are needed to fully explore this idea, we believe our findings suggest that students who have more community colleges and other postsecondary options nearby are more able to adjust their enrollment at the margin. Students on the margin are more likely to be low-income and belong to an underrepresented racial/ethnic group. Thus, having access to college alternatives appears to have

an important compensatory influence that mitigates the overall effect of tuition increases on the racial/ethnic composition of institutions.

Limitations in our data highlight additional areas for analysis. Our diversity measures were exclusively focused on full-time students, either among all enrolled students or just those who entered as first-time freshmen. Although we attempted to run analyses on part-time students within institutions, data inconsistencies prevented us from thoroughly examining the impact on diversity among this group of students. Over the time period that we examined, the reporting of institutions to IPEDS has focused primarily on full-time students across a variety of metrics. While part-time student statistics are currently collected and reported by most colleges and universities, specific student characteristics, such as race/ethnicity, were not always complete or accurate. Furthermore, part-time students vary significantly across campuses in terms of how they are defined and counted. Still, part-time students present a significant proportion of students in American higher education, especially at community colleges. Further research is needed to determine whether shifts in campus diversity among full-time students reflects various racial/ethnic subgroups shifting enrollment status to part-time in response to tuition hikes, or whether changes in diversity reflect enrollment shifts to other universities or outside of postsecondary education altogether.

We also acknowledge the limitations in our ability to understand recruitment and enrollment patterns of international students. Although we conducted several robustness checks to ensure that the nonresident alien category was not driving some of our results (see Appendix Table B) we still acknowledge the different types of international institutions may shift ways of recruiting and enrolling students who pay out of state tuition or international students, which typically pay full tuition.

Finally, it is important to mention that these estimated effects are averages. Institutions' level of diversity and policies surrounding tuition increase are extremely varied. These institution-level data are limited in that they cannot capture individual student enrollment patterns or individual institution policy shifts as a result of tuition changes. Our line of research can, however, highlight the need for high education policy makers and administrators to be mindful of the idea that tuition hikes might not only effect how many students enroll in an institution, but also effect which students enroll, and that the effect of any change in policy at a single institution will be moderated by larger education landscape, particularly the proximity and density of other postsecondary institutions. In other words, tuition decisions at any one individual institution will have ripple effects that influence enrollment patterns at surrounding institutions.

Conclusion

We use the pooled IPEDS data from 1989-99 to 2011-12 to estimate effects of tuition increases by including a rich set of covariates, including the number of surrounding institutions, the surrounding institutions' tuition levels, diversity of high school graduates, average institutional financial aid, local unemployment, and a set of year and institution fixed effects. Our findings suggest that tuition increases at public four-year institutions have negatively and significantly affect the racial/ethnic diversity of college student bodies. Furthermore, these average effects appear to be driven by the open-access, non-selective institutions. All else equal, a \$1,000 tuition increase for full-time undergraduate students is associated with a drop in campus diversity of almost 6 percent.

Setting tuition levels is one level that policy makers and administrators use to address funding challenges within the public higher education sector. It is therefore important to

understanding the impact of these tuition hikes on the student bodies at these institutions.

Results from this study highlight the need for education leaders and research to look critically at how the cost of higher education intersects with access for underrepresented populations. In their study of economic and racial composition among the nation's community colleges, Goldrick-Rab and Kinsley (2013) hypothesize that racial/ethnic integration could be achieved by reducing the difference in costs of attendance between community colleges and four-year institutions. The idea put forth is that students on the margin who are economically disadvantaged or more loan averse (disproportionally minority populations) are constrained to community colleges due to the cost differential. The findings we have presented in this paper provide some of the first evidence that this might indeed be the case. Non-selective-public institutions, which represent the most likely alternative for students "on the fence" between deciding on a community college versus a four-year institutions, have shown to be the institutions that are effected most in terms of racial/ethnic diversity's response to tuition increases. One of the areas of future research should be an exploration of the differences in tuition effects on community colleges student populations.

This paper draws attention to specific factors that might contribute to the racial/ethnic diversity of colleges, at a time when discussions of affirmative action and equity in admissions are still at the forefront. As researchers and policymakers examine ways to ensure and to expand access for underrepresented populations, it is important to understand the impacts of relative tuition increases on the enrollment of underrepresented populations and on the overall diversity of institutions themselves. It is also important to rethink common notions of institutional diversity to better understand the contours of postsecondary opportunity structures across the country.

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Appendix

TABLE A.
IPEDS Race/Ethnicity Category Description: 2013-2014

Nonresident Alien	A person who is not a citizen or national of the United States and who is in this country on a visa or a temporary basis and does not have the right to remain indefinitely. Note: Report resident aliens and other eligible (for financial aid purposes) non-citizens who are not citizens or nationals of the United States and who have been admitted as legal immigrants for the purpose of obtaining permanent resident alien status (and who hold either an alien registration card (Form I-551 or I-151)), a Temporary Resident Card (Form I-688), or an Arrival-Departure Record (Form I-94) with notation that conveys legal immigrant status such as Section 207 Refugee, Section 208 Asylee, Conditional Entrant Parolee or Cuban-Haitian) in the appropriate racial/ethnic categories along with United States citizens.
Black or African American	A person having origins in any of the black racial groups of Africa.
American Indian or Alaskan Native	A person having origins in any of the original peoples of North and South America (including Central America) who maintains cultural identification through tribal affiliation or community attachment.
Asian	A person having origins in any of the original peoples of the Far East, Southeast Asia, or the Indian Subcontinent, including, for example, Cambodia, China, India, Japan, Korea, Malaysia, Pakistan, the Philippine Islands, Thailand, and Vietnam
Native Hawaiian or Pacific Islander	A person having origins in any of the original peoples of Hawaii, Guam, Samoa, or other Pacific Islands.
Hispanic or Latino	A person of Cuban, Mexican, Puerto Rican, South or Central American, or other Spanish culture or origin, regardless of race.
White, Non-Hispanic	A person having origins in any of the original peoples of Europe, the Middle East, or North Africa.

TABLE B.
Robustness of effect estimates on diversity index: four-year public institutions

Variable	Smaller area: 50 mile radius (1)	Midsized area: 100 mile radius (2)	Large area: 150 mile radius (3)	Removal of nonresident alien from calculations (3)
Log in-state tuition and fees	-0.1187 (0.0254)***	-0.1447 (0.0260)***	-0.1505 (0.0312)***	-0.1130 (0.0260)***
Observations	5,179	6,003	5,683	6,003

Note: Values in parentheses are robust standard errors. Each column within a panel represents a separate regression. All models include institution and year effects, as well as dummy variables indicating the imputation of high school graduates and institutional aid.

* Significant at 10%. **Significant at 5%. ***Significant at 1%.