Income and Access to Higher Education: Are High Quality Universities Becoming More or Less Elite? A Longitudinal Case Study of Admissions at UW-Madison

SARA E. DAHILL-BROWN, JOHN F. WITTE, AND BARBARA WOLFE

Has access to selective postsecondary schools expanded or contracted? Evaluating this question has proven a difficult task because data are limited, particularly with regard to family income. We complement previous work and provide a replicable model of institutional analysis. This paper presents a detailed, quantitative assessment of admissions at the University of Wisconsin-Madison, an elite flagship public university—the type that is supposed to offer excellent opportunities to students from all backgrounds. We use an innovative measure of family income to compare applicant, admissions, and enrollment trends for low-income and minority students from 1972 to 2007. The unique aspects of this study include the more reliable measure of income and the ability to look at the full process from applications, admissions, and matriculations (demand and supply), not generally available in national datasets.

Evidence suggests that access to higher education in the United States has beome more stratified in recent decades, with a growing concentration of wealthy students attending the most selective of colleges and access to the best institutions of higher learning increasingly constrained for low-income college hopefuls (Bailey and Dynarski 2011; Bowen, Kurzweil, and Tobin 2005; Carnevale and Rose 2004; Khadaroo 2008). Several hypotheses have been advanced to explain this broad phenomenon: that low-income students are underprepared academically (Haycock, Lynch, and Engle 2010); that low-income students are systematically "undermatching"—not applying to selective institutions for which they are qualified (Hoxby and Avery 2013); and that low-income students have made substantial gains in their academic preparation but that these gains pale in comparison with those made by high-income students, contributing to a disadvantage in the admissions processes at selective institutions (Bastedo and Jaquette 2011). Institutions of higher learning vary, however, even selective institutions, in the extent to which low-income students are represented in the student body (Leonhardt 2015). We believe that universities, systems, and researchers can benefit from investigating whether low-income students are missing from their applicant pools, likely to be excluded as a result of admissions policies, or failing to matriculate, and

Sara E. Dahill-Brown is assistant professor of politics and international affairs at Wake Forest University. **John F. Witte** is professor emeritus of public affairs and political science at the University of Wisconsin-Madison. **Barbara Wolfe** is professor of economics and population health sciences at the University of Wisconsin-Madison.

Direct correspondence to: Sara Dahill-Brown at dahillse@wfu.edu, Department of Politics and International Affairs, Wake Forest University, P.O. Box 7568, Winston-Salem, NC 27109; John F. Witte at witte@lafollette.wisc .edu, 7418 Cedar Creek Trail, Madison, WI 53717; Barbara Wolfe at bwolfe@wisc.edu, 204 Observatory Hill Office Bldg., 1225 Observatory Dr., Madison, WI 53706.

how access and representation at these different points of the college-going process has evolved over time. These questions of over-time change in the college-going process may be especially important to investigate at more selective four-year institutions because these institutions may also offer low-SES and under-represented minority students the highest rates of return and the best prospects for economic mobility (Dale and Krueger 2002; Hoxby 1998, 2009; Zhang 2005).

However, these questions have historically been challenging to answer at micro levels, where they might provide actionable intelligence. Colleges and universities typically lack accurate data on the family income of applicants and either maintain income data only for the subset of their enrolled students who apply for financial aid or by surveying their students upon entry. Data from the Integrated Postsecondary Education System (IPEDS), which gathers records across institutions of higher learning, are similarly limited. The longitudinal surveys supported by the National Center for Education Statistics (NCES) include detailed family income data for the sample of youth in their surveys, and can therefore be used to address aggregate questions about access and attainment; these surveys, though, are administered to cohorts periodically and so will miss dynamics of over-time change and will not provide large enough samples for institution-specific analyses.

In this paper, we present a technique for using census data to generate an unbiased estimate of family income for all applicants. We demonstrate the utility of this measure by presenting a detailed trend analysis from 1972 to 2007 of the applicant pool and admissions process at the University of Wisconsin-Madison (UW-Madison.)

As one of the largest and most prominent elite public universities in the United States, a profile of access at UW-Madison may be of interest to higher education scholars and practitioners and residents of Wisconsin, but serves primarily to illustrate the utility of our measurement and its potential to support similar analyses at other colleges and universities. Using this measure, we are able to conclude that the proportional representation of

those from the lowest income quintile among applicants changed little between 1972 and 2007 and that those from the second-lowest income quintile declined. Over the same period, the increase in representation of those from the top two income quintiles among applicants is notable, fueled in large part by applicants from outside Wisconsin. In the admission process, we find evidence of increasing consideration granted to economically disadvantaged applicants, though rather than expand the representation among admitted students, these considerations serve to counter the increasing weight of high school grades and standardized test scores, generating an admitted pool that closely reflects the applicants in terms of income distribution. Using yield rates to estimate the income distribution among enrollees between 1988 and 2007 suggests that some of the increase in applications from wealthy students is likely offset during matriculation.

STRATIFIED ACCESS TO POSTSECONDARY EDUCATION

In broad terms, studies demonstrate that college enrollment rates have risen for applicants from all backgrounds. A steadily increasing proportion of high school graduates have attended college since the end of World War II; approximately 68 percent of recent high school graduates enrolled in some form of higher education by the fall after graduation, up from 50 percent of recent high school graduates in 1975 (BLS 2015). On average, students are also graduating from high school at higher rates and are better prepared for college than in the past (Fry 2014; Bastedo and Jaquette 2011). Many selective colleges and universities have explicitly sought to increase enrollments among low-income and underrepresented minority students through affirmative action, targeted recruitment, state-sponsored merit aid, scholarships, and free-tuition programs (Alon and Tienda 2007, 487–88; Astin and Osegura 2004). At the same time, diversity training for faculty and tutoring services for students, among other institutional programs, have been implemented to support low-income, first-generation, and minority students on campus.

Persistent Challenges for Low-Income Students

Yet, even though total enrollment rates have risen both for children from low- and high-income families, large achievement and enrollment gaps persist between low-income students and their more advantaged peers as well as between African American, Hispanic, and white students (Terenzini, Cabrera, and Bernal 2001; Timpane and Hauptman 2004, Reardon and Galindo 2009; Snyder and Dillow 2012). Approximately 50 percent of high school graduates from the bottom income quintile enroll in two- or four-year postsecondary institutions in the year following their graduation—up from 35 percent in 1975—compared with upward of 80 percent for high school graduates from the top income quintile—up from 64 percent in 1975 (Khadaroo 2008; Snyder and Dillow 2012). This suggests a persistent overall enrollment gap of around 30 percentage points.

Postsecondary enrollment gains for children from low-income families also seem to have occurred primarily at two-year institutions, where these students are least likely to be successful (Engle and Tinto 2008; Pallais and Turner 2006). Therefore, although college-going has increased among all groups, recent studies suggest the gaps in enrollment at high quality four-year schools between the highest and lowest income groups may actually have also increased (Bailey and Dynarski 2011; Ellwood and Kane 2005; Kane 2003).

In what is, perhaps, the most comprehensive study to date, Alexander Astin and Leticia Oseguera (2004) study access to the top 10 percent of institutions of higher learning from 1985 to 2000, which is determined by the mean SAT score of the institutions' entering freshman classes in 1999. The authors use data from the Cooperative Institutional Research Program's (CIRP) entering Freshman Survey, an annual instrument administered for four decades. At the beginning of each school year, about "400,000 freshmen from more than 700 institutions complete a comprehensive questionnaire that asks about basic demographic and biographical information, values, self-

concept, attitudes, and educational plans" (2004, 324). The authors find that over this interval, the income level of entering freshman in these top-tier colleges has increased but are unable to identify whether the change can be tied to applicants' self-selection or to shifting admissions preferences.

Philippe Belley and Lance Lochner (2007) and Martha Bailey and Susan Dynarski (2011) use the National Longitudinal Study of Youth (NLSY) cohorts drawn in 1979 and 1997, and find that income effects on the probability of college attendance increased substantially between the two cohorts. Bailey and Dynarski also find that the probability of attending college increased across all quintiles but that the greatest increase was in the highest quintiles. Large increases in college attendance among females in the highest quartile accounted for much of the difference.[1] Using the Mellon Foundation's College and Beyond data, William Bowen, Martin Kurzweil, and Eugene Tobin estimate that students in the bottom quartile of family income make up only 11 percent of enrollments at elite colleges (2005, 98). Analyzing IPEDS data, Kati Haycock and Danette Gerald find that even as the proportion of college enrollees receiving Pell Grants increased between 1992 and 2003, the proportion of students receiving Pell Grants at flagship public universities had fallen (2006, 7).

Looking Beyond Direct Effects of Income

Many reasons have been proffered to explain this stratification. First is that low-income students are underprepared academically by a floundering public school system, though even those who note this emphasize that well-prepared low-income students are nonetheless underrepresented among college freshman (Haycock, Lynch, and Engle 2010). Second, although many high school students are applying to more universities as they face greater competition (Clinedinst, Hurley, and Hawkins 2011; Pryor et al. 2007), Caroline Hoxby and Christopher Avery (2013) find that the vast majority of high-achieving low-income high school students do not apply to any selective,

---

1. These two studies also address measures of persistence and completion of college by family income at baseline or when the potential student was between fifteen and eighteen.

four-year institutions and are thus "under-matching." Failing to adequately match economically disadvantaged students with appropriately rigorous postsecondary schools has broad societal and economic consequences (Roderick, Coca, and Nagaoka 2011).

Third, as the number of capable applicants has skyrocketed, institutional capacity at elite colleges and universities has not grown apace, and competition for limited seats has grown fiercer (Karabel 2005; Lemann 1999; see also Alon and Tienda 2007, 489). Students from low-income families often find themselves with fewer opportunities to practice for entrance exams, and are less prepared to write essays and solicit recommendations. Many argue that increased reliance on standardized tests for admissions decisions is "incompatible with the goal of increasing the representation of people of color or poor people" (Zwick 2007, 422; Rooney 1998).[2] Measures of academic merit are likely to reflect investments by the family including special SAT (originally Scholastic Achievement Test) and ACT (originally American College Testing) prep courses, the ability to choose better schools that offer more AP (Advanced Placement) courses, hire tutors, a richer home environment in terms of reading materials, and attendance at special summer programs. And though these measures predict potential college success (Bridgeman, Pollack, and Burton 2004; Burton and Ramist 2001; see also Zwick 2007, 421), they may also mask true potential (Bowen, Bok, and Shulman 1998). Michael Bastedo and Ozan Jaquette (2011) find that even though low-income students have increased their academic preparedness for college on average, high-income students have managed to make larger academic gains, preserving their advantage.

Institutional Analyses and Difficulties in Measuring Applicant Family Income

In addition to the multiple explanations offered for the increased stratification of postsecondary education, it is also important to acknowledge the wide variation across institutions of higher learning, even among selective institutions, in the extent to which low-income students are represented in the student body; more than 30 percent of enrolled students receive Pell Grants at three campuses in the University of California system (Leonhardt 2015). Because different levels of and explanations for the underrepresentation of low-income students would suggest different action steps for colleges and universities, we believe that universities, systems, and researchers would benefit from conducting close case studies of access at their own institutions. They should investigate whether low-income students are missing from their applicant pools, likely to be excluded as a result of admissions policies, or failing to matriculate once admitted, and how access and representation at these different points of the college-going process has evolved over time. However, studies of income effects on access to elite postsecondary institutions are characterized by a number of notable data limitations.

First, the longitudinal surveys supported by NCES (such as NLSY and National Education Longitudinal Survey, or NELS) cannot be easily adapted for institutional analyses. They include detailed, validated, family income data for the nationally representative samples of youth included their surveys, and can be used to address aggregate questions about access from application to attainment, but would not include large enough samples attending specific institutions. Further, because the surveys are administered irregularly, they do not allow for close tracking of over-time changes and should not be substituted for detailed trend data (Kane 2003, 89; Alon and Tienda 2007, 488).

Second, colleges and universities typically lack accurate data on the family income of applicants and either maintain only income data for the subset of their enrolled students who apply for financial aid or that supplied by surveying their students on entry. The Free Application for Federal Student Aid requires extensive data on family's income and assets, but

---

2. Philippe Belley and Lance Lochner (2007) include the AFQT score, a measure of IQ in their analysis, rather than score on the SAT or ACT. They find those in higher quartiles of the AFQT are more likely to attend college by age twenty but that the pattern does not appear to steepen over time.

these data are only available for those who request such aid. This limits the population that can be studied to enrolled students who request financial aid. In the 1999–2000 school year, for example, approximately one-third of students attending college full time failed to apply for financial aid, and approximately 850,000 who failed to apply would likely have been Pell eligible (King 2004). In addition, these applications have only been used since 1992, limiting the period that could be covered for historical analysis. Data from the IPEDS, which gathers records across institutions of higher learning, are similarly limited.

Surveys used to supplement these institutional sources of data are also limited instruments for measuring student economic status, income levels, and financial aid receipts. The most common sources for supplementing measures of family income are student responses to survey questions administered during ACT and SAT examinations as well as during the CIRP Freshmen survey. For a number of reasons, these responses can be woefully, sometimes systematically, inaccurate; most students simply do not have accurate information on family income and wealth (Olivas 1986; Trusheim 1994; Smith and McCann 1998; Gonyea 2005). To enable in depth institutional analyses, a new approach is needed.

OUR STUDY

We consider the issue of access to higher education, particularly for low-income students, by presenting a detailed analysis of admissions at UW-Madison, a major public university and the kind of school that is supposed to offer excellent educational opportunities to students from all backgrounds—over more than three decades.

Our data, though limited to one institution, offer several contributions to the existing body of scholarship on access to high quality higher education. First, we take a unique approach to obtain an unbiased measure of family income for more than 90 percent of applicants in the sample. This measure allows us to investigate the correlation between income and merit and to compare the influence of low-income status

with that of minority status on admission. Second, the data are longitudinal and cover a substantial period during which higher education and the national economy experienced dramatic changes, and therefore facilitate not just measurement of change between two points in time, but the description of dynamics. Third, detailed data are available for applicants, as well as admitted students.

Measuring Applicant Income Through Matching

Obtaining a valid, reliable measure of applicant family income is at the center of our analysis. We use U.S. Census data at the block level to estimate family income for all applicants to UW-Madison from 1972 through 2007 who are residents of the United States and report a valid address in their application file. These measures are based upon reported income data for approximately 1,200 individuals (600 households) at the census block level. With our large sample of applicants, and this smallest of the census units, this method promises to estimate family income imperfectly but with less bias and greater reliability than student self-reports (Olivas 1986). When this measure of applicant income is included in regression models, coefficients theoretically reflect the combined effect of contextual (neighborhood) and individual-level income factors, but should serve as a more valid method for drawing inferences about income than self-reports (on using aggregate data as a proxy, see Geronimus, Bound, and Neidert 1996; Smith, Ben-Shiomo, and Hart 1999). For each applicant with a home residence in the fifty states, we used the Applied Population Lab at UW-Madison to match prospective students' home addresses as reported on their initial application to a census block.[3] Blocks are the smallest geographic and population group available from the census. They are "bounded on all sides by visible features, such as streets, roads, streams, and railroad tracks, and by nonvisible boundaries, such as selected property lines and city, township, school district, and county limits and . . . roads. Generally, census blocks are small in area" (U.S. Census Bureau 2010).

3. Addresses were provided to the population lab with a randomly generated ID to protect privacy.

They are thus small geographic units within census tracts, which are designed to be homogeneous.[4]

Once a student had been matched to a particular census block, we merged into our original applicant files, median family income for that block.[5] We use the 1980, 1990, and 2000 censuses. Applicants between 1972 and 1980 are matched only to the 1980 data. Applicants between 1981 and 1989 are matched to their census block for both the 1980 and 1990 Census data. We match 1990 applicants only to the 1990 Census. Applicants between 1991 and 1999, are matched to both 1990 and 2000 data, and applicants from 2000 on are matched only to the 2000 data. We convert all incomes into 2009 dollars and interpolate incomes for those with two block matches (applicants from 1981 to 1989 and from 1991 to 1999). We are able to match more than 90 percent of all U.S. resident applicants by this procedure. That is, we obtain an imputed measure of family income for more than 90 percent of all U.S. applicants to UW-Madison from 1972 to 2007 based on census block data.[6] The lowest percentage of matches occurred in the first year, 1972 and again in 1987, for which we matched 87 percent of the applicants. Once applicants are matched to census block income, geographic information is stripped from the dataset to protect the privacy of the applicants. We preserve an indicator identifying residence status: out-of-state residents face the highest rates of tuition and

until December of 2012 could make up no more than 25 percent of new freshmen at UW-Madison. Minnesota residents are not counted as out-of-state residents and pay tuition that is only slightly higher than Wisconsin residents. For this reason, we analyze applicants as a total population but control for residency status.[7]

ANALYSIS

Descriptive indicators in this analysis relate to the size, geographic composition, absolute and relative income, racial and ethnic diversity, and level of academic preparation of the applicant pool over three decades. We believe this descriptive project is an important one. We cannot understand the dynamics that contribute to inclusion or exclusion, nor assess the impact of admissions policies on access for disadvantaged students without first identifying the students who choose to apply in the first place. We estimate logistic regressions to identify the effects of these characteristics on admission.

Our research focuses on applicants to a single institution of higher learning, but one that increasingly draws students from throughout the United States. Figure 1 illustrates the changing residency patterns of applicants from 1972 to 2007. Three trends are worth noting. First, the proportion of applicants from Wisconsin has declined—from approximately 70 percent in 1972 to just over 40 percent in

---

4. Census tracts are themselves defined as "small, relatively permanent statistical subdivisions of a county or equivalent entity that are updated by local participants prior to each decennial census as part of the Census Bureau's Participant Statistical Areas Program," population sizes ranging from 1,200 to 8,000 (U.S. Census Bureau 2010).

5. Data on income in 1999 are derived from answers to long-form questionnaire items 31 and 32, which were asked of a sample of the population fifteen years old and older. Total income is the sum of the amounts reported separately for wage or salary income; net self-employment income; interest, dividends, or net rental or royalty income or income from estates and trusts; social security or railroad retirement income; Supplemental Security Income (SSI); public assistance or welfare payments; retirement, survivor, or disability pensions; and all other income. See: http://www.census.gov/prod/cen2000/phc-2-a.pdf (accessed February 17, 2015).

6. Yearly matching rates and all other results are available on request in a document containing supplementary tables that correspond with the analysis, figures, and discussion in this paper.

7. Even in the most recent years of our study, the students from states other than Wisconsin and Minnesota are distributed well across the country, with the notable exception of Illinois, who apply in large numbers each year and regularly make up 15 percent of the applicant pool. At their peak presence, applicants from relatively wealthy states like New York and California make up only 5.4 and 3.7 percent of the applicant pool respectively.

Figure 1. Total Applicants and Proportion by Residence, 1972–2007
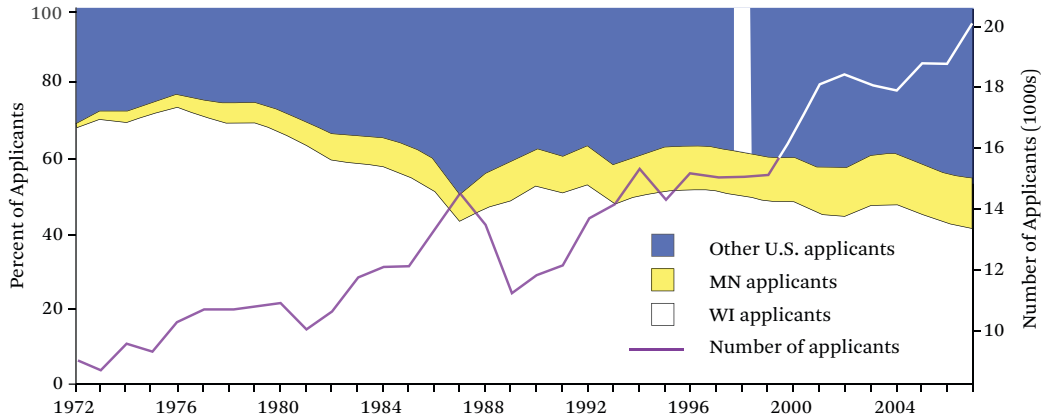
Source: Authors' compilation.

2007. Second, as at other colleges and universities, the increase in the total number of applicants for a roughly steady number of first-year spaces has been considerable, from just over nine thousand in 1972 to just over twenty thousand in 2007. Third, the rising number of applicants results primarily from an increase in applications from out-of-state students. This third factor mirrors other findings (Hoxby 2009) suggesting that privileged students now apply broadly to increase their odds of admission to at least one high quality institution.

Income Among Applicants

Applicant median family income (in 2009 U.S. dollars) appears to have increased in real terms over the thirty-six years of our study across all residency groups (figure 2). However, differences by residency are substantial and the gap between groups is widening. The estimated median income for applicants from Wisconsin increased by 20 percent between 1972 and 2007, from $67,560 to $81,097. In contrast, the median income of Minnesota applicants increased by 35 percent, from $80,112 to $108,335 and by 51 percent for out-of-state residents, from $86,955 to $131,106. This reflects, in part, a slower rate of real income growth in Wisconsin than in Minnesota and the nation as a whole.

Absolute real income therefore should not be our only metric for assessing change. Trends in real income may differ from those revealed by relative income, the ratio of applicant me-

dian family income to the relevant populations' median family income. We identify the comparisons by computing a median family income from census data for Wisconsin, Minnesota, and other U.S. states. For each of these three geographies, to identify the most accurate comparison group, we compute the median income for families that include at least one child between the ages of fifteen and twenty-four, and in which the head of household is younger than sixty-five. Excluding childless homes, and homes in which heads of households are sixty-five or older produces higher estimates of the median family income than when these two groups are included. We were unable to condition on these factors when imputing income for applicants in census blocks, suggesting that our estimate of family income for applicants may be slightly biased down, though residential sorting should make this small. We compare applicants with this median family income based on their reported state of residence, and plot those ratios over time in figure 3. Combined, these constraints yield a comparison with the potential to underestimate relative income of the applicant pool, providing a conservative estimate of disparities between applicants and the universe of possible applicants.
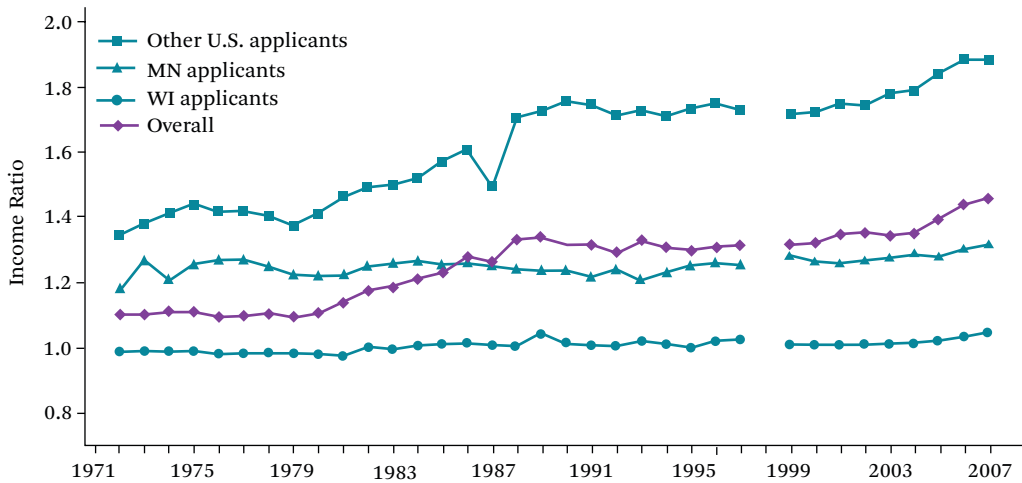
The median income of applicants from Wisconsin closely reflects the median family income for the state; the relative ratio ranges from a minimum of 0.97 in 1981 to a high of

Figure 2. Real Median Family Income of Applicants, 1972–2007 (2009 dollars)
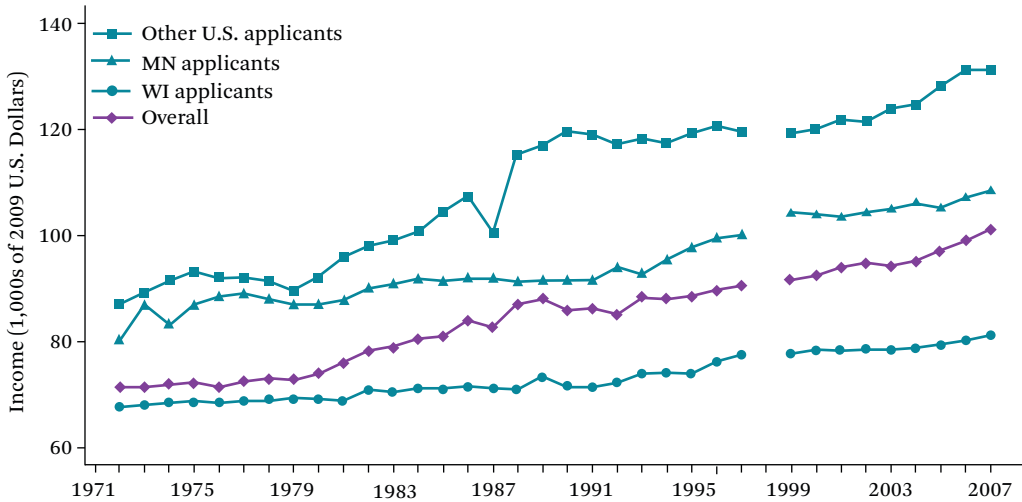
Source: Authors' compilation.

Figure 3. Family Income of Applicants to State Median Income, 1972–2007 (2009 dollars)
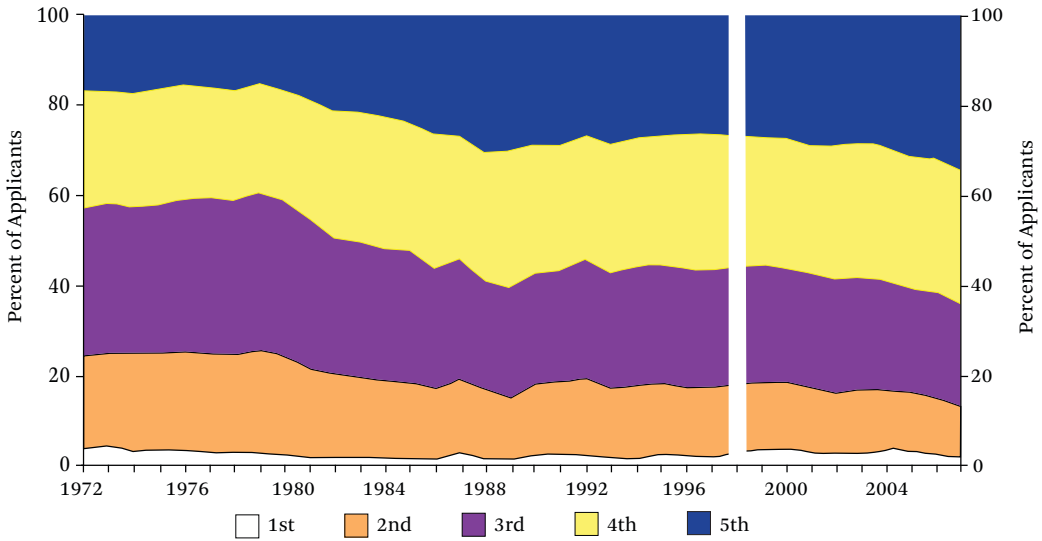

Source: Authors' compilation.

1.05 in 2007. The median income of applicants in Minnesota is slightly higher than for the state; the relative ratio ranges from a minimum of 1.18 in 1972 to a maximum of 1.32 in 2007. By this measure, Wisconsin and Minnesota applicants, relative to the population in their states, have remained at similar income levels over the period of study, using calculated median family income as the comparison. On the other hand, out-of-state applicants have a much higher relative median income. The me-

dian applicant from other states comes from families earning at least 1.35 times the median family income in the United States in 1972, and by 2007 the median relative income had risen to nearly twice the national median (a ratio of 1.88). More and more out-of-state applicants seem to come from a higher income strata, though relative median income for both Minnesota and Wisconsin applicants were at maximum values in the last year of our data.

Several recent reports and studies have doc-

**Figure 4.** All Applicants by Family Income Quintile, 1972–2007

Source: Authors' compilation.

umented an increase in residential segregation by income (Bischoff and Reardon 2014; Fry and Taylor 2012). Because this increased sorting suggests that our measure of applicant income is likely to be more precise in the later years of our study, but noisier early on, we also investigate the distribution of applicant family income by treating the data as a categorical indicator. Although this produces an estimate that is less precise and may not perfectly correct for segregation, it should be a more consistent operationalization over time. In figure 4, we present the proportion of UW-Madison applicants by income quintiles. As with relative income, quintile determinations are made by comparing the student's estimated family income with the family income distribution for households that include at least one child between fifteen and twenty-four and in which the head of household is sixty-five or younger. Again, this has the potential effect of understating the representation of applicants from high-income groups and overstating the representation of low-income applicants.

This measure suggests that only a tiny proportion of applicants have ever come from the bottom income quintile; averaging 2.9 percent across years, peaking at 4.9 percent during 1973 and reaching a low point of 1.8 in 1988. In the 1970s and 1980s, applicants appear to have come primarily from middle-income families, and their representation has declined dramatically. Applicants from the second-lowest income quintile constituted 20 percent or more of the applicant pool until 1982, and by the last year of the study only 11.5 percent. Applicants from the middle quintile similarly declined from 30 percent or more through 1983 to 22.4 percent by 2007, still a representation greater than the percentage of the population. Conversely, applicants from the top two income quintiles increased from 42.6 to 64.1 percent, the majority of that increase occurring at the very top of the income distribution. In every year from 1983 onward, the majority of applicants to this public university come from families in the top two quintiles of the income distribution. Both the stagnant representation of the lowest-income applicants and the declining representation of middle-income applicants are striking.

Figure 4 must be interpreted with an eye toward figure 1. Both the Minnesota and out-of-state applicant pools are weighted much more heavily toward the top two income quintiles than that for Wisconsin residents. The distribution of in-state applicants is different than the distribution for these groups, and Wisconsin resident applicants must be the majority of the incoming freshman classes. None-

Figure 5. Proportion of Applicants by Race and Ethnicity, 1972–2007
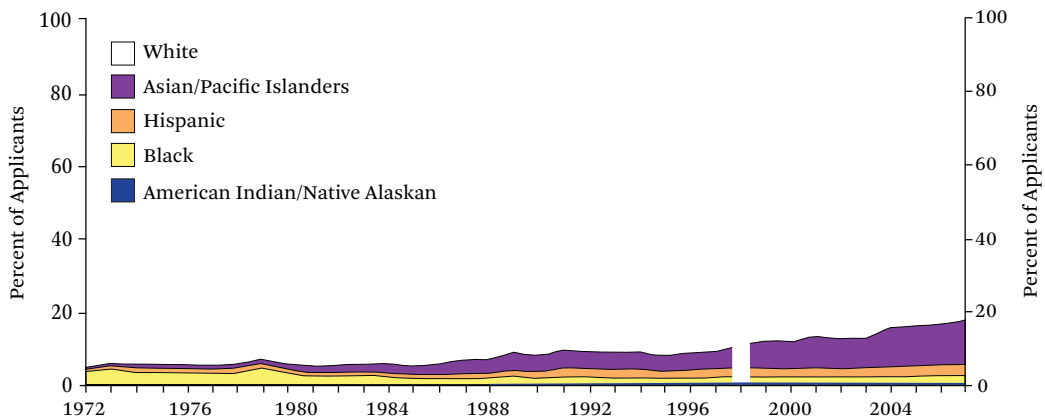
Source: Authors' compilation.

theless, the in-state distribution of applicant income yields a more muted, but similar story to the one figure 4 suggests. Representation of the top two income quintiles has increased among in-state applicants from 31.3 to 39.5 percent. The middle income quintile is consistently overrepresented, upward of 35 percent of Wisconsin applicants coming from this group in all but a few years, though this groups' presence is no longer the 40 percent it was the early years of the series.

The bottom two quintiles are substantially underrepresented even for the in-state group. In 1972, 4.274 percent of applicants from Wisconsin came from the lowest income quintile. In 2007, after rising briefly in the early 2000s, this proportion was essentially unchanged: 4.0 percent of Wisconsin applicants—just 335 applicants—were from the lowest income quintile. Applicants from the second-lowest income quintile declined steadily from 25.9 percent in 1972 to 20.7 percent in 2007. By 2007, students from the poorest 40 percent of families in the state had declined to less than 25 percent.

Racial and Ethnic Diversity and Income

To the extent that membership in a historically underrepresented minority group correlates with lower levels of family income, the racial composition of UW-Madison applicants over time is relevant to our question of how access has evolved; we describe the diversity of the applicant pool below. Figure 5 shows a consid-

erable increase in the diversity of applicants to the university over the thirty-six years of this study. However, that increase is almost entirely due to a sharp rise in the proportion of applicants who identify as Asian. The proportion of Hispanics in the applicant pool increases some from 0.5 to 3.0 percent. For Native Americans, representation remains very small, shifting from 0.2 percent to 0.5 percent. The proportion of the African American applicants actually declines. In 1972, 356 African Americans sought admission, 3.9 percent of the pool. In 2007, despite the applicant pool having more than doubled, the number was 508, just 2.5 percent of the total. Unlike median family income, minorities are not better represented among applicants.

Comparing the applicants coming from families in Wisconsin with demographics for the state's college-age population (fifteen to twenty-five), it is possible to more critically assess the racial and ethnic composition of the applicant pool. We find a stark discrepancy that grows over time. In 1972, 2.3 percent of applicants residing in Wisconsin identified as black, versus 3.4 percent of the fifteen to twenty-five population. By 2007, 7.8 percent of that population identified as black, but only 3.1 percent of Wisconsin applicants did. The magnitude by which African Americans are underrepresented has grown, which is especially striking given rising high school graduation rates for African American students in Wisconsin during these years (Snyder and Dillow 2012).

Overlap between membership in an underrepresented minority and low-income status is also less than it was in the 1970s. (We investigated this overlap by pooling applicants in five-year increments to compensate for small sample sizes). From 1972 through 1976, 39.1 percent of black applicants and 37.5 percent of Hispanic applicants were in the lowest quintile of the income distribution. From 2002 to 2007, only 22.2 percent of black applicants and 7.0 percent of Hispanic applicants were. Racial and ethnic diversity appears to be an increasingly poor proxy for economic disadvantage.

Academic Achievement and Income

Unsurprisingly, we also find that the applicant pool has become increasingly academically competitive. The average SAT score of applicants rose from 1082 to 1274, though the proportion of applicants taking the SAT declined from 43.4 to 33.1 percent. Perhaps more impressively, the average ACT score of applicants has also steadily risen from 23.6 to 27.3 even as the percentage of applicants who report taking the ACT increased from 38.7 to 81.0. Average high school rank among applicants also climbed from 107.8 to 65.9, though the percentage of students reporting a high school rank declined from 95.7 to 64.1.

Using simple, bivariate regression predicting ACT from estimated family income, we find a small, positive relationship in the applicant pool between scores on admissions tests and our estimate of family income. Higher scores are related to higher family incomes; the two are statistically significantly associated with one another in each year from 1972 through 2007. However, the relationship between the two measures within the population of applicants is quite small in the early years of the data; Pearson's correlation coefficient only reaches 0.087 in 1972 and does not consistently exceed 0.100 until after 1997. The size of the correlation coefficient has strengthened, suggesting a progressively tighter relationship between income and measures of academic merit. The correlation coefficient between ACT and income reaches 0.220 by 2007; this is unlikely to be an artifact of increased rates of ACT test-taking given that the percentage of applicants taking the ACT does not fluctuate sub-

stantially after 1990. The applicant pool to this public university is, without question, increasingly elite in terms of academic merit. Like other high-quality institutions, UW-Madison now confronts a glut of highly qualified applicants for whom it does not have adequate space, and those students with the highest incomes are increasingly likely to also be better qualified according to these measures of merit.

Modeling Admission During Increasing Selectivity: 1972 to 2007

We demonstrate that the applicant pool has doubled in size, primarily as a result of increased demand from outside Wisconsin. Regardless of residency, the proportion of the lowest-income students in the applicant pool has remained stagnant while that of middle-income applicants has declined. The racial and ethnic diversity of the applicant pool has increased, but not with regard to the most disadvantaged group, African Americans. Status as an underrepresented minority is increasingly unlikely to be associated with membership in the lowest income quintiles. The level of academic merit in the applicant pool has increased, as merit seems to have become more closely linked with economic status. Ultimately, admission officials must make decisions based on the applications they receive, and they do not receive many from low-income students. But perhaps the pool of admitted students is more representative than the pool of applicants. Some previous work casts doubt on this hypothesis, showing that income and related factors like legacy preference may serve to further limit access for low-income and underrepresented groups (Kahlenberg 2010).

The first important trend is a predictable but dramatic increase in selectivity. Admission to UW-Madison has become much more competitive. Except for in 1975 and 1976, through the mid-1980s, nearly 90 percent of those who applied were admitted. However, since the mid-1980s, the proportion of applicants admitted has declined steadily, 63.6 percent for the final year in our data. This is undoubtedly explained by the dramatic increase in applicants, which has far outstripped space available for first-year students.

To understand how income, achievement,

Figure 6. Predicted Probability of Admission by Income Quintile, Selected Years
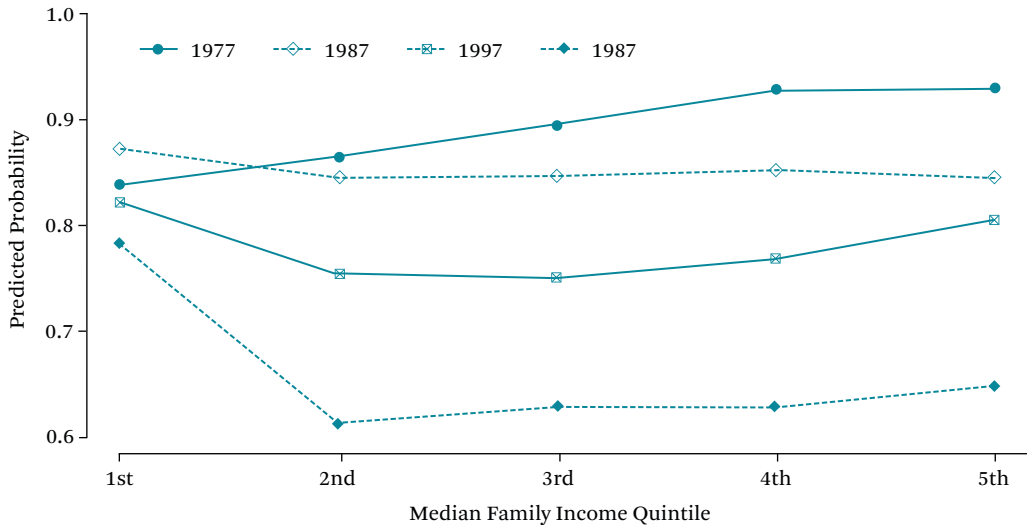
Source: Authors' compilation.

race, and other individual-level variables affect the admission process in this increasingly competitive environment, we estimate a series of logistic regressions, one for each year, in which acceptance is the dependent variable. That is, we model the following equation for each year and compare effects across applicant cohorts:

$$A_i = \beta Y_i + \gamma L_i + \delta P_i + \lambda X_i + \alpha + \varepsilon$$

where A is acceptance of individual i modeled as a function of that individual's characteristics. Y indicates a vector of dummy variables denoting family income quintile (the middle income quintile serves as the reference category in models); L indicates a vector of dummy variables denoting the applicant's geographic location (Wisconsin, Minnesota, or other); P represents a vector of measures describing an applicant's performance as captured by ACT and SAT scores, and high school rank; X describes a vector of other characteristics including age, gender, race-ethnicity; and α represents the constant. β, γ, δ and λ indicate the effects for each of these variables and are estimated separately for each year. Pseudo R squareds suggest models explain roughly 30 percent of the variance in acceptance in most years. For ease of interpretation and to facili-

tate cross-year comparisons, we present effects in terms of changes in probability of admission.

Income Effects

Is it more or less difficult now for low- and middle-income applicants to gain admission to UW-Madison? We find that the effect of applicant income on admission, after controlling for other individual-level factors, has changed considerably over time. Figure 6 illustrates the differences in the probability of acceptance by the income quintile for selected years. In the early period, holding all other variables constant, applicants from the lower and middle income quintiles are less likely to be admitted, and those from the upper quintiles are more likely. These effects are statistically significant only in some years and are generally small, though moving from the poorest to the most elite income quintile is occasionally substantial, from 83 percent to 93 percent probability of admission in 1977. In the middle years of our series, illustrated by 1987, the effect of applicant income quintile dissipates; membership in the lowest and highest income quintiles does not produce significantly different probabilities of admission relative to applicants from the middle quintile. In later years, from the mid-1990s on, applicants in the low-

Figure 7. Effect of Membership in the First Income Quintile Versus the Fifth, 1972–2007
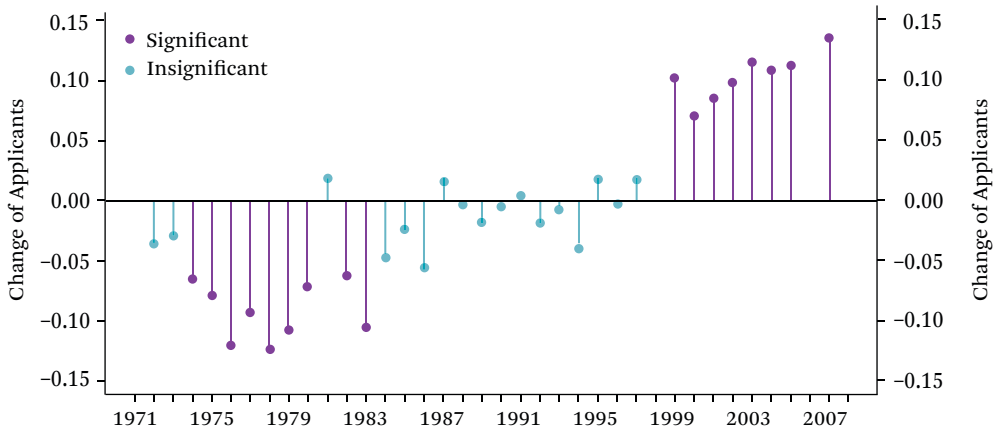
Source: Authors' compilation.

est income quintile are statistically significantly more likely to obtain admission relative to applicants from other income quintiles. This effect is large, consistent, and represents an increase in the probability of admission of between 10 and 15 percentage points, depending on the comparison quintile.

However, from 2004 to 2007, students in the highest income group were also statistically significantly more likely to obtain admission than those from the middle quintiles, though the effect was modest. These models suggest that applicants from both the lowest and highest income groups are somewhat more likely to be accepted, holding all other measures constant. In considering how this might affect access, we emphasize that applicants from the highest income quintile are far more numerous than those from the lowest.

Figure 7 illustrates further the difference in the probabilities of admission for students from the first (lowest) to the fifth (highest) income quintiles, again controlling for other observed characteristics. This figure presents the ratio of admissions for the lowest and highest quintiles. It is apparent that in the earliest years, that difference favored those in the highest quintile of the U.S. population for admission. From 1984 to 1997, differences are not significant between the lowest and highest income quintiles. However, since 1999, the advantages of the poorest students in gaining ac-

ceptance are considerable, compared with those from the richest households. Holding other factors constant, applicants from the bottom income quintile are significantly less likely than those from the top to earn admission in the early years of the data series and significantly more likely in the later years.

We find in this analysis that access for the lowest-income students does not appear to be explicitly limited at UW-Madison as a result of the admission process. In support of these results, the median family income for the rejected and admitted groups of students is roughly equivalent in most years and the distribution of incomes for admitted students (see figure 8) is nearly identical to that for applicants.

We also used our models to test whether traditionally underrepresented minority status is significant in the admissions process. As was true of low-income students, African American and Hispanic students do not apply in large numbers, but are statistically significantly more likely to be admitted when they do, in the later years of the study period. Holding all other factors constant, including income, the change in predicted probability of admission for applicants from these groups is significant and substantial from 1986 onward, as illustrated by figure 9. This effect manifests much earlier than the effect for the lowest-income applicants, and the magnitude is generally

Figure 8. All Admitted Students by Family Income Quintile, 1972–2007
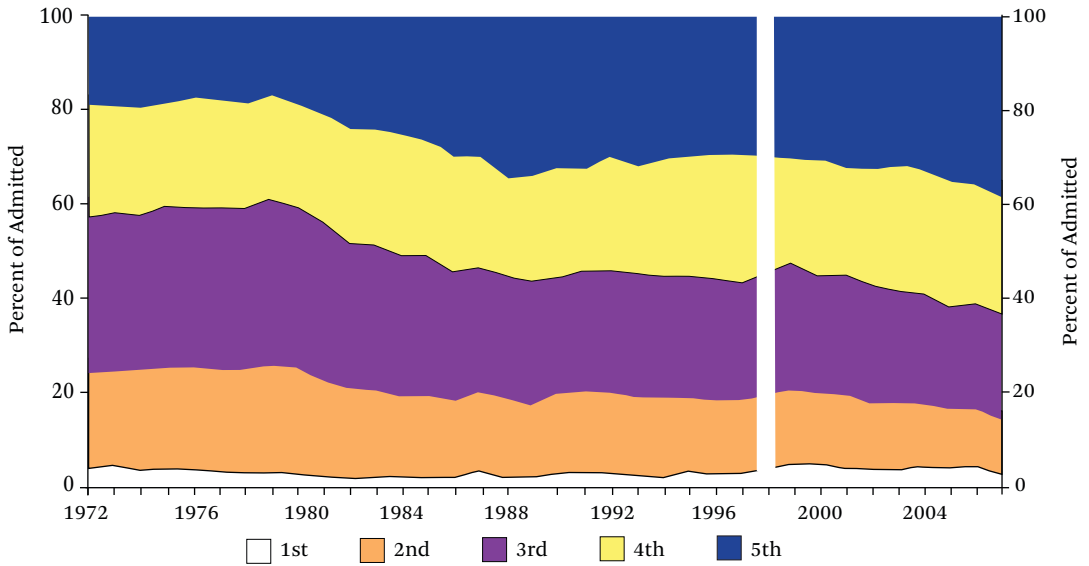
Source: Authors' compilation.

**Figure 9.** Effect of Identification as African American, 1972–2007
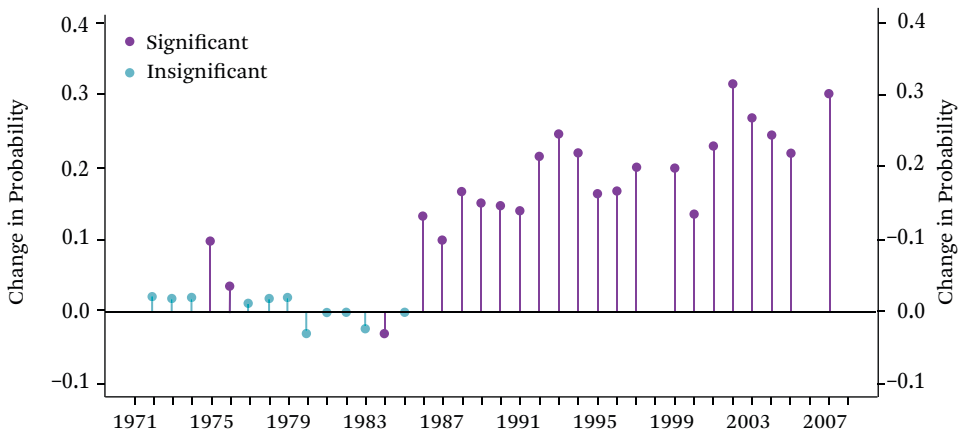
Source: Authors' compilation.

larger. The change in predicted probability of admission ranges between 0.15 and 0.30 in most years. As noted, the decreasing overlap between membership in a disadvantaged minority group and low-income status means that any admissions preference that improves access based on one category of demographic membership is no longer as likely to also improve access based on the other.

Academic Merit Effects

With the exception of the last few years of our series, which saw a small but significant increase, stratification of access by income or race-ethnicity does not appear to be increasing as a result of direct income effects on admissions decisions. However, we cannot assert that the admissions process does not privilege wealthier applicants, given the well-docu-

**Figure 10.** Predicted Probability of Admission, 1972 and 2007
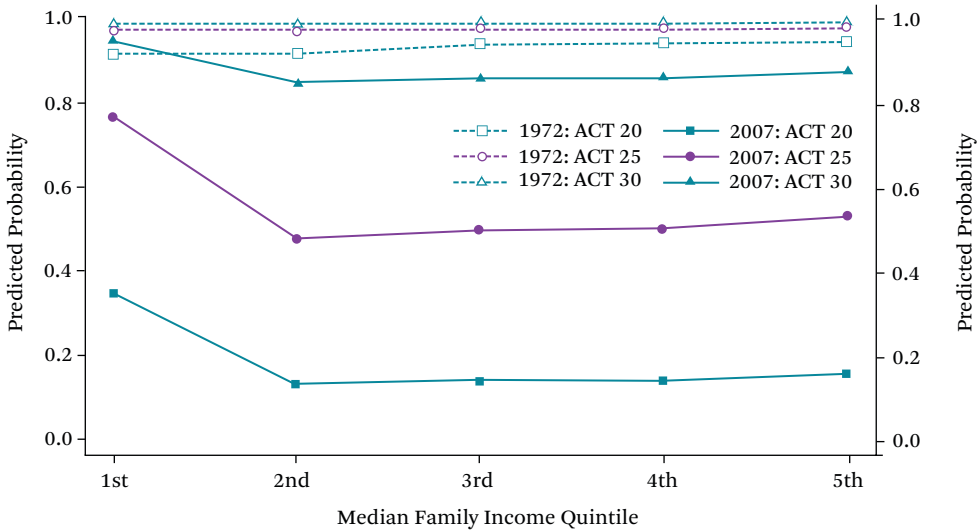
Source: Authors' compilation.

mented, positive relationship between family income and academic performance, the increase in reliance on test scores by high-quality four-year colleges and universities, and the significant effect of membership in the highest income quintile in the last years of our admission data. During the same period, when the negative effects of membership in the lowest income quintile disappeared and then reversed, the effect of achievement measures on the probability of acceptance increased. Our clearest evidence for that is presented in figure 10, which contrasts the probability of admission for the first and last years in the study: 1972 and 2007. The probabilities are broken down by income quintile (as in figure 7), but also by the student's score on the ACT admissions test. Neither income nor ACT score has a substantial effect on admission in 1972. Going from an ACT score of 20 to 30 improves the chances of admission by less than 10 percentage points.

However, by 2007, the admissions process changes considerably. The effect of applicant test score in our models is substantial and statistically significant, students across all income groups having a greater chance of acceptance as test scores increase. The difference in the predicted probability of admission, holding all other variables at their model means,

jumps from less than 15 to 87 percent, more than 70 percentage points for students scoring 30 on the ACT over those scoring 20 (holding all other variables at model means). A comparison of the effect of a 10 point increase in ACT score (from 20 to 30) is plotted in figure 11.

The increase in the weight of academic merit is dramatic, and the rise of standardized test scores as the primary factor determining acceptance roughly corresponds with the beginning of significant effects for low-income and minority students. Given both this increasing emphasis on college entrance exams and the steadily rising correlation between test scores and family income, considering low-income and minority status during admission may have become necessary to prevent access from being further constrained. On the other hand, the relationship between income, test scores, and admission is not entirely clear. The applicant pool as whole is academically elite. This may result from low-achieving high school students opting out of the application process. If those who opt out are also disproportionately members of the lowest income quintile, then we are unlikely to see a strong relationship between income and achievement within the applicant pool. Similarly, possible selection dynamics make it unclear whether the increasing correlation between income and

Figure 11. Effect of ACT Score Change from 20 to 30, 1972–2007
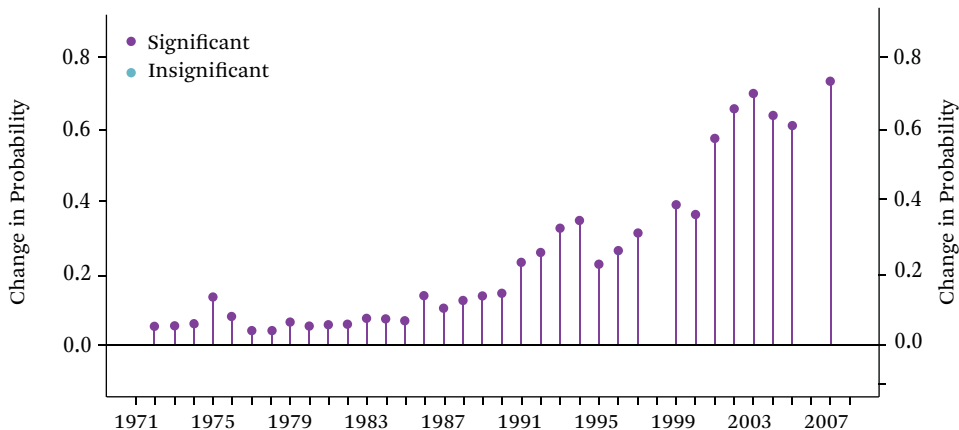
ACT signals an intensifying relationship between income and precollege achievement, or is simply a by-product of greater participation in ACT testing among applicants. Because the correlation between income and ACT increases well after the initial increase in rates of ACT taking, we believe that the first explanation, a closer relationship between precollege achievement and family income is more likely.

Estimating Income Distribution of Enrolled Students

We conduct one final analysis to estimate how the distribution of income among applicants and admitted students is likely to translate into the distribution of income among enrollees. Although we are unable to track applicants across the entire period to matriculation, UW-Madison has routinely published yield rates based on residency back to 1989. Using these yield rates, and a breakdown of the income distribution of admitted students by residency, we estimated the distribution of income among enrollees (see figure 12). Because yield rates are higher for Wisconsin residents (typically 60 to 65 percent versus 40 to 45 for Minnesota residents and 20 to 25 percent for residents of other states), the estimated income distribution for enrollees that emerges is less skewed than the distribution for either applicants or admitted students. However, it still suggests that well over 50 percent of enrollees are likely to be from the top two quintiles. This figure further suggests that the narrowing of access for those from the third quintile of family income may be less of a concern at UW-Madison than the application or admission data suggest but that access may have narrowed for those from the second income quintile and expanded only marginally for those from the lowest part of the distribution. Yields are likely to be somewhat higher for students from the lowest income quintiles, but even a 100 percent yield of admitted applicants from the bottom two income quintiles of our sample would only mean that they composed 31.8 percent of newly enrolled freshman in 2007.[8]

DISCUSSION AND CONCLUSIONS

A major advantage of this study is that we analyze the entire admissions process from application to admission to enrollment and do so over several decades. That is seldom the case with national databases such as NLSY, NELS, or High School and Beyond. Many of our insights flow from describing this process over many years. The picture that emerges from this analysis suggests a slow but steady accumulation of opportunities for students at the top of the income distribution, a small decrease in

[8.] The most recent of these reports are available at https://apir.wisc.edu/students-admissions.htm (accessed December 14, 2015).

Figure 12. Enrollees by Family Income (Estimated), 1989–2007
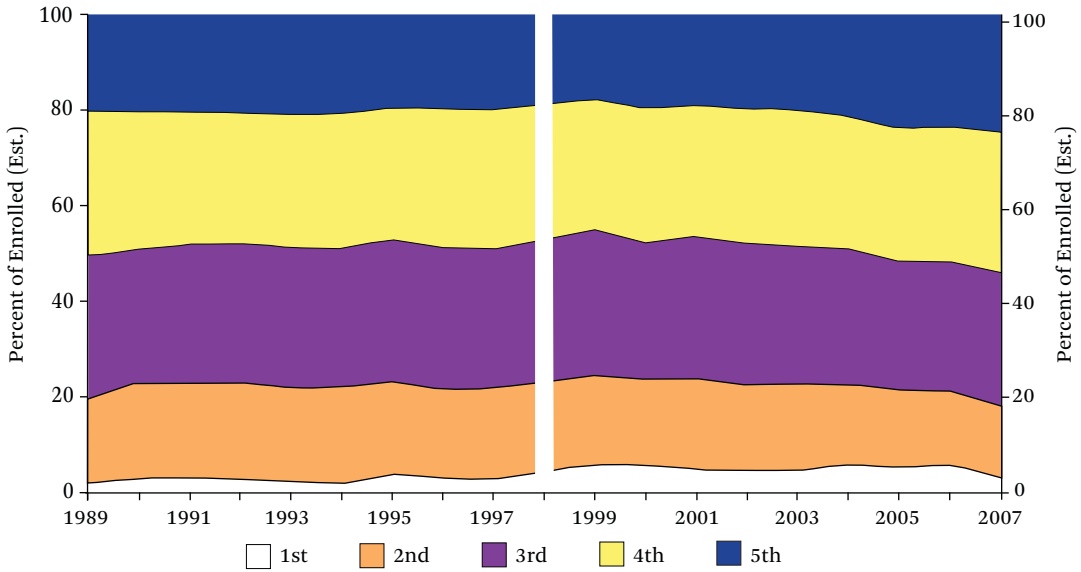
Source: Authors' compilation.

the access afforded to those in the middle (especially those falling between the 20th and 40th percentiles for family income), and small improvements in access for the poorest, though they remain grossly underrepresented. UW-Madison, and possibly other elite, flagship public universities more broadly, are likely confronting a substantially more elite applicant pool than they were several decades ago.

As academic merit rises, a higher proportion of applicants hail from the top two income quintiles; this proportion is more substantial when we focus on out-of-state applicants, but the finding holds even when we focus exclusively on Wisconsin residents. The inverse holds when we consider the bottom two income quintiles. A smaller proportion of applicants are from these two groups. Again, the decline is more extreme when out-of-state applicants are considered, but is also true of Wisconsin residents. The shrinkage in representation of low-income applicants occurs almost entirely as a result of diminished representation of students from the second-lowest income quintile. Students from families in the very bottom of the income quintile constitute the smallest proportion of the applicant pool, but their representation has been by and large

constant. This picture differs from the one we imagined. Access seems to be improving for those at the top, not at the expense necessarily of those at the very bottom, who remain most underrepresented, but rather at the gradual expense of those in the middle, the second and third income quintiles. Perhaps decades of burgeoning income inequality and labor market polarization trump decades of K–12 policy interventions designed to reduce the impact of economic inequality (for example, Reardon 2011).

Also very concerning is that, even as the state, and the nation have become more racially and ethnically diverse, the presence of traditionally disadvantaged minority groups in the applicant pool at the University of Wisconsin—Hispanics, African Americans, and Native Americans—has not grown apace. African Americans in particular, when compared against the state and national populations, are less well represented among applicants than they were in the 1970s. Given the statistically significant and in some cases sizeable advantage that has been accorded to this group of applicants since 1986, the declining representation of minority applicants is particularly striking.

The admission process seems to have responded to this increasingly stratified, unrepresentative applicant pool. First, although the impact of test scores on the likelihood of admission has increased substantially over the last thirty-six years, the same appears to be true for minority status and membership in the lowest income quintile. In short, admissions officers seem to have worked to ensure that increasing reliance on measures of academic merit—which often reflect the applicants' socioeconomic status—does not produce a corresponding decrease in access and opportunity for students who may be disadvantaged on those measures. Those students in the most recent years are approximately 15 percentage points more likely to be admitted, holding a number of relevant factors constant, than applicants from any other income quintile. This difference holds across varying levels of merit measured by ACT scores. But admissions officers can only do so much given the applicant pools they now confront each year. Significant or substantive differences are minimal between the applicants and the admitted students in terms of median family income in real, relative, or distributional terms. In short, inequalities in the applicant pool are closely replicated in the admitted pool. Perhaps admissions preferences for traditionally marginalized groups or recognition of lower yields simply prevent more egregious inequalities among admitted students.

As noted, the matriculation process, in which Wisconsin residents and disadvantaged students are more likely to enroll after being accepted dampens but does not obviate the effect of an elite, unrepresentative pool of applicants. For students at the top, access has slightly improved; for those in the middle, it has slightly narrowed; and for those at the very bottom, it remains limited.

Since 2007, admissions reports indicate a modest increase in the racial and ethnic diversity among applicants, but other changes suggest that economic pressures may continue to expand access for the wealthy. The Wisconsin university system has long imposed a requirement on its universities that the freshman class be no more than 25 percent non-Wisconsin residents who are not covered by a reciprocity agreement (Minnesota). In the past, this requirement has limited the degree to which high-income applicants from out of state might displace students from the lower and middle income quintiles. However, the policy was reviewed and changed in December of 2012 as the UW-System Board of Regents approved a new, higher limit, stipulating that nonreciprocity students could now make up 27.5 percent of the total undergraduate enrollment. In October of 2015 the Board voted on the policy again, deciding to suspend the limit on out-of-state students for four years. Because the state contributes a smaller and smaller proportion of UW-Madison's operating budget, the university administration naturally considers alternative ways of raising revenues, and the many wealthy applicants offer a quick, attractive alternative.[9] In fact, although the board of regents raised the cap on nonreciprocity students only after the 2012–2013 school year, international students and domestic nonresidents have made up more than 25 percent of new freshman in every year since 2004, the same year in which we identified a statistically significant, positive effect of membership in the top income quintile. Given the distribution of income among these applicants, the raised cap will likely further increase representation of those from higher income families.

This research is a single case study that we believe creates a unique and replicable methodology. It has considerable advantages of longitudinal analysis of a complete university admissions process using an income measure we believe is superior to self-reported income, especially those based on student responses concerning family income. But as a single case study, it has its own considerable limitations in terms of generalizability. Given the enormous variation in types of colleges and universities across the country, we are not certain

---

9. State funds accounted for 33 percent of UW-Madison's revenues in 1990 and just 17 percent in the 2013–2014 school year. See UW-Madison *Data Digest* by school year at https://apir.wisc.edu/datadigest.htm (accessed December 14, 2015).

that conventional notions of generalizability, such as from samples to populations or generalizations from random field trials, apply. Therefore, what we hope is that this study is replicated by other and varying types of colleges and universities from small publics to financially marginal privates to other large state universities and to elite wealthy private schools. All these types of colleges should have the data necessary to replicate this approach and we would be very willing to share our methods and analytical tools.

REFERENCES

Alon, Sigal, and Marta Tienda. 2007. "Diversity, Opportunity, and the Shifting Meritocracy in Higher Education." *American Sociological Review* 72(4): 487–511.

Astin, Alexander, and Leticia Osegura. 2004. "The Declining 'Equity' of American Higher Education." *Review of Higher Education* 27(3): 321–41.

Bailey, Martha J., and Susan M. Dynarski. 2011. "Inequality in Postsecondary Education." In *Whither Opportunity?: Rising Inequality, Schools, and Children's Life Chances*, edited by Greg J. Duncan and Richard J. Murnane. New York: Russell Sage Foundation.

Bastedo, Michael N., and Ozan Jaquette. 2011. "Running in Place: Low-Income Students and the Dynamics of Higher Education Stratification." *Educational Evaluation and Policy Analysis* 33(3): 318–38.

Belley, Philippe, and Lance Lochner. 2007. "The Changing Role of Family Income and Ability in Determining Educational Achievement." *NBER* working paper no. 13527. Cambridge, Mass.: National Bureau of Economic Research.

Bischoff, Kendra, and Sean Reardon. 2014. "Residential Segregation by Income, 1970–2009." In *Diversity and Disparities: America Enters a New Century*, edited by John Logan. New York: Russell Sage Foundation.

Bowen, William G., Derek Curtis Bok, and James Lawrence Shulman. 1998. *The Shape of the River: Long-Term Consequences of Considering Race in College and University Admissions*. Princeton, N.J.: Princeton University Press.

Bowen, William G., Martin Kurzwell, and Eugene Tobin. 2005. *Equity and Excellence in American Higher Education*. Charlottesville: University of Virginia Press.

Bridgeman, Brent, Judy Pollack, and Nancy Burton. 2004. "Understanding What SAT Reasoning Test Scores Add to High School Grades: A Straightforward Approach." College Board research report no. 2004–4. New York: College Entrance Examination Board.

Bureau of Labor Statistics (BLS). 2015. "College Enrollment and Work Activity of High School Graduates News Release." Washington: U.S. Department of Labor. Accessed December 14, 2015. http://www.bls.gov/news.release/archives/hsgec_04162015.htm.

Burton, Nancy, and Leonard Ramist. 2001. "Predicting Success in College: SAT Studies of Classes Graduating Since 1980." College Board research report no. 2001–2. New York: College Entrance Examination Board.

Carnevale, Anthony, and Stephen Rose. 2004. "Socioeconomic Status, Race/Ethnicity, and Selective College Admissions." In *America's Untapped Resource: Low-Income Students in Higher Education*, edited by Richard Kahlenberg. Ann Arbor, Mich.: Century Foundation Press.

Clinedinst, Melissa E., Sarah F. Hurley, and David A. Hawkins. 2011. "2011 State of College Admission." Arlington, Va.: National Association for College Admission Counseling. Accessed December 14, 2015. http://www.thecollegesolution.com/wp-content/uploads/2011/10/NACAC-report.pdf.

Dale, Stacy B., and Alan B. Krueger. 2002. "Estimating the Payoff to Attending a More Selective College." *Quarterly Journal of Economics* 117(4): 1491–527.

Ellwood, David, and Thomas Kane. 2005. "Who Is Getting a College Education? Family Background and the Growing Gaps in Enrollment." In *Securing the Future: Investing in Children from Birth to College*, edited by Susan Danziger and Jane Waldfogel. New York: Russell Sage Foundation.

Engle, Jennifer, and Vincent Tinto. 2008. *Moving Beyond Access: College Success for Low-Income, First-Generation College Students*. Washington, D.C.: The Pell Institute for the Study of Opportunity in Higher Education.

Fry, Richard. 2014. "U.S. High School Dropout Rate Reaches Record Low, Driven by Improvements among Hispanics, Blacks." *FactTank*, October 2. Accessed December 14, 2015. http://www.pewresearch.org/fact-tank/2014/10/02/u-s-high-school-dropout-

rate-reaches-record-low-driven-by-improvements
-among-hispanics-blacks/.

Fry, Richard, and Paul Taylor. 2012. "The Rise of Res-
idential Segregation by Income." Washington,
D.C.: Pew Research Center. Accessed December
14, 2015. http://www.pewsocialtrends.org/files
/2012/08/Rise-of-Residential-Income-Segre
gation-2012.2.pdf.

Geronimus, Arline T., John Bound, and Lisa Neidert.
1996. "On the Validity of Using Census Geocode
Characteristics to Proxy Individual Socioeco-
nomic Characteristics." *Journal of the American
Statistical Association* 91(434): 529–37.

Gonyea, Robert M. 2005. "Self-Reported Data in In-
stitutional Research: Review and Recommenda-
tions." *New Direction for Institutional Research*
127(1): 73–89.

Haycock, Kati, and Danette Gerald. 2006. "Engines
of Inequality: Diminishing Equity in the Nation's
Premier Public Universities." Washington, D.C.:
The Education Trust. Accessed December 14,
2015. https://edtrust.org/resource/engines-of
-inequality-diminishing-equity-in-the-nations
-premier-public-universities/.

Haycock, Kati, Mary Lynch, and Jennifer Engle. 2010.
"Opportunity Adrift: Our Flagship Universities
Are Straying from Their Public Mission." Wash-
ington, D.C.: The Education Trust. Accessed Feb-
ruary 23, 2016. https://edtrust.org/resource
/19453/.

Hoxby, Caroline M. 1998. *The Return to Attending a
More Selective College: 1960 to the Present.* Un-
published manuscript. Department of Econom-
ics, Harvard University.

——. 2009. "The Changing Selectivity of American
Colleges." *Journal of Economic Perspectives*
23(4): 95–118.

Hoxby, Caroline M., and Christopher Avery. 2013.
"The Missing 'One-Offs': The Hidden Supply of
High-Achieving, Low-Income Students." *Brook-
ings Papers on Economic Activity* 2013(1): 1–65.

Kahlenberg, Richard D. 2010. *Affirmative Action for
the Rich: Legacy Preferences in College Admis-
sions*. New York: Century Foundation Press.

Kane, Thomas. 2003. *The Price of Admission: Re-
thinking How Americans Pay for College*. Wash-
ington, D.C.: Brookings Institution Press.

Karabel, Jerome. 2005. *The Chosen: The Hidden His-
tory of Admission and Exclusion at Harvard, Yale,
and Princeton.* New York: Houghton Mifflin Har-
court.

Khadaroo, Stacy Teicher. 2008. "Too Few Low-
Income Students? Pressure Mounts on Colleges
to Reduce Barriers for that Pool of Talent." *Chris-
tian Science Monitor*, August 7.

King, Jacqueline E. 2004. "Missed Opportunities:
Students Who Do Not Apply for Financial Aid."
ACE issue brief. Washington, D.C.: American
Council on Education Center for Policy Analysis.

Leonhardt, David. 2015. "Top Colleges Doing the
Most for Low-Income Students." *New York
Times*, September 16. Accessed December 14,
2015. http://www.nytimes.com/interactive
/2015/09/17/upshot/top-colleges-doing-the
-most-for-low-income-students.html.

Lemann, Nicholas. 1999. *The Big Test: The Secret
History of the American Meritocracy*. New York:
Farrar, Straus and Giroux.

Olivas, Michael A. 1986. "Financial Aid and Self-
Reports by Disadvantaged Students: The Impor-
tance of Being Earnest." *Research in Higher Edu-
cation* 25(3): 245–52.

Pallais, Amanda, and Sarah Turner. 2006 "Opportu-
nities for Low-Income Students at Top Colleges
and Universities: Policy Initiatives and the Distri-
bution of Students." *National Tax Journal* 59(2):
357–86.

Pryor, John H., Sylvia Hurtado, Victor B. Saenz, Jose
Luis Santos, and William S. Korn. 2007. *The
American Freshman: Forty Year Trends, 1966–
2006*. Los Angeles: Higher Education Research
Institute.

Reardon, Sean F. 2011. "The Widening Academic
Achievement Gap between the Rich and the
Poor: New Evidence and Possible Explanations."
In *Whither Opportunity?: Rising Inequality,
Schools, and Children's Life Chances*, edited by
Greg J. Duncan and Richard J. Murnane. New
York: Russell Sage Foundation.

Reardon, Sean F., and Claudia Galindo. 2009. "The
Hispanic-White Achievement Gap in Math and
Reading in the Elementary Grades." *American
Educational Research Journal* 46(3): 853–91.

Roderick, Melissa, Vanessa Coca, and Jenny Naga-
oka. 2011. "Potholes on the Road to College: High
School Effects in Shaping Urban Students' Par-
ticipation in College Application, Four-Year Col-
lege Enrollment, and College Match." *Sociology
of Education* 84(3): 178–211.

Rooney, Charles, with Bob Schaeffer. 1998. *Test
Scores Do Not Equal Merit: Enhancing Equity and
Excellence in College Admissions by Deemphasiz-*

ing SAT and ACT Results. Cambridge, Mass.: Fair Test and the National Center for Fair and Open Testing.

Smith, George Davey, Yoav Ben-Shiomo, and Carole Hart. 1999. "Re: 'Use of Census-Based Aggregate Variables to Proxy for Socioeconomic Group: Evidence from National Samples'." *American Journal of Epidemiology* 150(9): 996–97.

Smith, Kris M., and Claudia W. McCann. 1998. "The Validity of Students' Self-Reported Family Incomes. AIR 1998 Annual Forum Paper." Paper presented at the 38th Annual Forum of the Association for Institutional Research. Minneapolis, Minn. (May 17–20, 1998).

Snyder, Thomas D., and Sally A. Dillow. 2012. *Digest of Education Statistics*. NCES 2012–001. Washington: U.S. Department of Education. Accessed December 14, 2015. http://nces.ed.gov/pubs2012/2012001.pdf.

Terenzini, Patrick, Alberto Cabrera, and Elena Bernal. 2001. "Swimming Against the Tide: The Poor in American Higher Education." Research report no. 2001–1. New York: College Board.

Timpane, Michael, and Arthur Hauptman. 2004. "Improving the Academic Preparation and Performance of Low-Income Students in American Higher Education." In *America's Untapped Resource: Low-Income Students in Higher Education*, edited by Richard Kahlenburg. Ann Arbor, Mich.: Century Foundation Press.

Trusheim, Dale. 1994. "How Valid Is Self-Reported Financial Aid Information?" *Research in Higher Education* 35(3): 335–48. doi:10.1007/BF02496827.

U.S. Census Bureau. 2010. "2010 Geographic Terms and Concepts." *Geography*. Accessed December 14, 2015. http://census.gov/geo/reference/terms.html.

Zhang, Liang. 2005. "Do Measures of College Quality Matter? The Effect of College Quality on Graduates' Earnings." *Review of Higher Education* 28(4): 571–96.

Zwick, Rebecca. 2007. "College Admissions in Twenty-First-Century America: The Role of Grades, Tests, and Games of Chance." *Harvard Educational Review* 77(4): 419–28.