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James Monks

University of Richmond, jmonks@richmond.edu

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Institutional Variation in Enrollment of Low-income Students

By James Monks

Socioeconomic diversity in tertiary education has come under heightened scrutiny in the past few years. This paper estimates the relationship between prices (both sticker price and net price), financial aid policies, and selectivity on the variation of low-income students across postsecondary institutions. All three factors are significant in identifying variation across postsecondary institutions in the representation of Pell Grant recipients as a percentage of an institution's entering class. A focus on net price alone ignores the correlation between sticker price, selectivity, and financial aid policies on low-income students' enrollment outcomes.

Keywords: *Student debt, college financial aid, loan burden, Pell Grants*

Tertiary institutions in the United States have recently come under increasing scrutiny and pressure to enroll an economically diverse student body. Rising levels of student borrowing and defaults on student debt, in the context of escalating tuition and uncertainty regarding the job prospects of college graduates, have prompted some critics of higher education to question whether colleges and universities are doing enough to assure that a bachelor's degree is accessible and affordable for low-income students. Colleges and universities are being challenged on whether they are placing enough emphasis on socioeconomic diversity and providing opportunities for low-income students.

For example, David Leonhardt (2011), in a *New York Times* article, pointed out that while many selective universities have made tremendous strides in increasing diversity along other fronts (religious, racial, gender), their student bodies remained “shockingly affluent” (para. 4). He noted that in 2003, at the University of Michigan, more students came from families earning at least \$200,000 a year (approximately the top 4% of the income distribution), than enrolled from the bottom half of the income distribution. Similarly, according to an analysis by Hill and Winston (2006a), approximately 10% of the students enrolled at a set of private, highly selective colleges and universities (the colleges and universities composing the Consortium on Financing Higher Education [COFHE]) were from the bottom 40% of the U.S. family income distribution. Carnevale and Strohl (2010) analyzed data from the National Educational Longitudinal Survey (NELS) and found that only 7% of high school graduates from the bottom quartile of socioeconomic status complete a baccalaureate degree.

Hoxby and Avery (2013) and Hoxby and Turner (2013) focused on the underrepresentation of high-ability, low-income students at the most selective colleges and universities. They concluded that for low-income students with high standardized test scores, there is a significant “undermatching” with institutional

James Monks is associate dean for undergraduate business programs and professor of economics at the University of Richmond Robins School of Business.

quality. Similarly, Posselt, Jaquette, Bielby, and Bastedo (2012) concluded that despite clear increases in pre-collegiate academic preparation by Black and Latino students, there has not been a commensurate increase in Black and Latino student representation on college campuses relative to Whites. Clearly, low-income students are underrepresented at U.S. postsecondary institutions, in particular at highly selective colleges and universities.

Anthony Marx, the former president of Amherst College, made socioeconomic diversity and the enrollment of low-income students the cornerstone of his initiatives during his term as president at the small, private, highly selective college. In 2003, shortly after Marx arrived at Amherst, only 13% of the student body received Federal Pell Grants (a federal grant program targeted at low-income students). By 2011, over 22% of Amherst's students were Pell Grant recipients. Marx credits this increase in enrollment of low-income students to a very concerted and direct effort to provide greater opportunities to these students via changes in financial aid policies, admission practices, and recruitment efforts.

A 2013 study by Stephen Burd, of New America Foundation, criticized many selective colleges and universities for not doing enough to enroll more low-income students. His primary argument was that too many colleges and universities emphasize selectivity, test scores, and net tuition revenue over socioeconomic diversity. Specifically, he criticized the high sticker price-high aid model, coupled with increasing merit aid, as benefiting upper-income students at the expense of lower-income students who need higher levels of need-based aid. He singled out individual institutions for enrolling low numbers of Pell Grant recipients, implying they were not doing enough to provide opportunities for low-income students.

The above-outlined studies and discussion indicate a growing interest in whether postsecondary institutions are doing enough to enroll low-income students. Unfortunately, most of the discussion and analyses to date have not accounted for the complexity and multitude of factors that influence the level of enrollment of low-income students across institutions. Clearly, price plays an important role in determining an institution's affordability for low-income students, but even here, both sticker price and net price may be important. Similarly, specific financial aid and admissions policies may be important in low-income students' enrollment decisions. Institutional setting is likely to significantly influence an institution's ability to attract low-income students based on the supply of students in the area from lower socioeconomic rungs of the ladder. Additionally, because of the strong correlation between income and precollege academic preparation, particularly as measured by standardized test scores, institutional selectivity and quality are likely to play a significant role in determining an institution's ability to attract and enroll low-income students.

A number of studies, like those discussed above and reviewed in more detail below, have investigated the level of low-income underrepresentation on selective college and university campuses. This paper contributes to this literature by addressing the relationship between the proportion of low-income students at an institution and a number of institutional characteristics and practices. Specifically, this paper examines the following questions:

1. Is the proportion of Pell Grant recipients at an institution correlated with sticker price, net price charged to low-income students, or both?
2. What specific financial aid and admissions policies and practices, such as being need blind in admissions, meeting full need, limiting or capping loan amounts, and "gapping," are associated with a higher proportion of Pell Grant recipients among the student body?
3. What role do selectivity and institutional type (public versus private, Carnegie classification) play in predicting the proportion of Pell Grant recipients on campus?
4. Is institutional setting (rural/suburban/urban, state) associated with the proportion of low-income students at an institution?

This paper investigates these potential correlates of variation across institutions in the enrollment of low-income students. It is important to note that this analysis does not claim to estimate a causal relationship between the control variables included in the regression and the proportion of Pell Grant recipients at an institution. Instead, this paper simply identifies those variables correlated with variation in low-income student enrollment across institutions to improve understanding and contextualize the summary measures of low-income enrollment often reported in the popular media.

Literature Review

A small but growing body of literature relates to socioeconomic diversity in higher education and efforts focused on enrolling low-income students. The primary lines of inquiry on this topic consist of analyses that document the level of underrepresentation of low-income students in higher education, policies aimed at encouraging more low-income students to enroll in tertiary education, the role of information and communication in low-income student enrollment, and the mismatch of high-ability, low-income students and selective institutions. The following literature review summarizes each of these lines of inquiry.

A number of the studies examining enrollment of low-income students have simply attempted to chronicle the number of low-income students enrolled in postsecondary institutions and the percentage of the student body they represent. For example, Carnevale and Rose (2004) reported that 74% of the students at the top 146 most selective colleges and universities came from the top quartile of the socioeconomic status (SES) distribution. Only 3% came from families in the bottom quartile of SES status, and approximately 10% of students at the most selective institutions came from the bottom half of the SES distribution. Similarly, Hill and Winston (2006a and 2006b) examined enrollment data from COFHE, a set of 31 private, highly selective colleges and universities. They found that 10% of students at this set of institutions came from the bottom 40% of the U.S. income distribution. Clearly low-income students are underrepresented at selective colleges and universities in the United States.

In a study that garnered significant attention, Burd (2013) identified individual institutions that enroll a large proportion of low-income students, as measured by Pell Grant receipt, and those institutions that appear to underperform in enrolling low-income students. He posited that colleges spend too many resources attempting to attract and enroll high-ability and wealthy students at the expense of low-income students. He argued that universities use “their institutional financial aid as a competitive tool to reel in the top students, as well as the most affluent, to help them climb up the *U.S. News & World Report* rankings and maximize their revenue” (p. 1).

Other analyses have attempted to estimate the impact of specific policies on low-income student matriculation decisions. First, a number of studies focused on the role of loans in influencing enrollment behavior. Specifically, Linsenmeier, Rosen, and Rouse (2006) analyzed a particular private, research university’s decision to eliminate loans for all students. They found this did not significantly increase enrollment of more low-income students in general, but it did have a positive and significant impact on the matriculation rate of low-income minority students. Waddell and Singell (2011) investigated no-loan policies at a set of public institutions and concluded that eliminating loans from financial aid packages significantly increases the enrollment of low-income students and increases the percentage of the class that received Pell Grants. Hillman (2012) used a difference-in-difference estimation approach to determine if no-loan policies increased low-income enrollment. He focused exclusively on selective colleges and universities. He found that eliminating loans has a statistically significant impact on enrollment of Pell Grant recipients, although the magnitudes of the effects were not particularly large. Introducing a no-loan policy increased enrollment of Pell Grant recipients by 1.3 percentage points at private institutions, and by 1.8 percentage points at public institutions, relative to institutions that continued to package loans with their other financial aid.

Second, a set of studies investigated the importance of grant aid in influencing enrollment decisions, particularly among low-income students. For example, several studies concluded that low-income students are significantly influenced by financial aid awards in making college enrollment decisions (e.g., see Kim, 2012; Hurwitz, 2012; Long, 2008; and Kane, 2003). Other studies examined the impact of specific grant aid policies (Dynarski, 2003, 2004; Avery & Hoxby, 2004; Castleman & Long, 2013) and state aid programs on enrollment rates of low-income students (Cornwell, Mustard, & Sridhar, 2006; Zhang & Ness, 2012; Bruce & Carruthers, 2014; Perna & McLendon, 2014). These studies generally concluded that grant aid and state aid policies have a significant impact on enrollment decisions, and that the more transparent these policies are the larger the impact on enrollment.

Perna, Lundy-Wagner, Yee, Brill, and Tadal (2010) discussed the role and importance of communication strategies in implementing financial aid policies. They outlined various communication and media approaches to ensure that an institution's no-loan and financial aid policies are effectively communicated and have the greatest efficacy in encouraging low-income students to apply and enroll at an institution.

Other recent studies have focused on the supply of high-ability, low-income students. Pallais and Turner (2006) examined the prevalence of high test (SAT and ACT) scores among various income groups. They also scrutinized the likelihood of high-ability, low-income students sending their scores (as a proxy for their likelihood of applying) to a top-tier private or flagship public university. They found that, generally, high-ability, low-income students are less likely to send their scores to a top-tier university than are their high-income peers. The fact that low-income students are less likely to perform well on standardized tests, coupled with the result that low-income students of all ability levels are less likely to apply to a top-tier institution, presents an acute challenge to selective institutions in attracting low-income, high-ability students.

Hoxby and Avery (2013) attempted to determine why so many high-ability, low-income students fail to apply to and matriculate at selective institutions. They grouped high-ability, low-income students into two groups: (a) those who apply to a selective institution (achievement-typical); and, (b) those who do not apply to a single selective institution (income-typical). They concluded that students in the income-typical group are more likely to come from high schools and areas of the country with low concentrations of high-ability, low-income students. This makes the physical recruiting efforts (such as college fairs and high school visits) of selective colleges less cost effective in recruiting these students, relative to recruiting the high-ability, low-income students who are more highly concentrated in urban centers.

Hoxby and Turner (2013) followed up this analysis by performing a randomized controlled trial that provided college admissions and net price information to targeted high-achieving, low-income students. They found that this cost-effective intervention significantly increased the likelihood that these students would apply to and be admitted by more colleges. Specifically, the intervention resulted in students enrolling at institutions with higher graduation rates, stronger academic records, and greater resources. These results suggest that the "undermatching" found in earlier studies may be largely due to a lack of information regarding opportunities and prices at selective institutions. Nonphysical recruitment, such as mailings, emails, and online contact, may provide more cost-effective methods of attracting high-ability, low-income students to higher-quality institutions.

In related studies, Tebbs and Turner (2006) and Turner (2006) discussed the difficulties for public flagship universities in enticing low-income students to enroll. In particular, these studies examined the AccessUVA program designed to increase enrollment of low-income students at the University of Virginia. This program was designed to allow the University of Virginia greater flexibility in setting tuition and pricing policies in exchange for targeting greater resources and recruiting efforts to low-income students. They

reported rather modest increases in enrollment of low-income students, at least in the first few years of the program.

The studies outlined above illustrate increased interest in the enrollment patterns of low-income students. They also reveal that the primary research focus to date has concerned the enrollment patterns of low-income students at highly selective institutions. This paper contributes to the literature by examining enrollment of low-income students across a wider cross-section of tertiary institutions, and not just highly selective institutions. Additionally, rather than focusing on a single financial aid practice, such as eliminating loans, this analysis controls for a number of institutional characteristics and financial aid policies in predicting variation in low-income enrollment rates across institutions.

Conceptual Framework

This analysis assumes that tertiary institutions seek to maximize prestige, subject to a nonprofit budget constraint. This conceptual framework for higher education institutions has been well established and analyzed (e.g., Breneman, 1970; Brewer, Gates, & Goldman, 2002; Clotfelter, 1996; Garvin, 1980; James, 1990; Massy & Zemsky, 1994; Melguizo & Strober, 2007; Zemsky, Wegner, & Massy, 2005)). The implication of this analytical construct for the analysis undertaken here is that institutions seek to enroll the highest-quality class they can and seek to provide the highest-quality educational experience to their students, subject to budgetary limitations. As long as meritorious students can be found along all points of the income and wealth distributions, institutions have an incentive to try to enroll high-ability, low-income students. Additionally, as long as institutions believe that all students benefit from an economically diverse student body, there is further incentive for institutions to seek to enroll low-income students.

Budgetary limitations and a negative correlation between income and other measures of academic ability, such as standardized test scores (College Board, 2013), provide disincentives for enrolling low-income students. Institutions must weigh and trade off the marginal benefits of enrolling more low-income students and their impact on institutional prestige and the educational environment, with the marginal cost of the forgone tuition revenue needed to attract and enroll low-income students. As a result, institutions with greater resources, which can more easily absorb the loss in revenue, would be expected to enroll more low-income students. Institutions of greater selectivity and higher standardized test scores would be expected to enroll fewer low-income students because of their deleterious impact on reported test scores, on average, and thus institutional prestige, *ceteris paribus*. The preceding *ceteris paribus* is vitally important, as high-resource institutions are usually more selective in admissions. It is therefore important to control for both institutional resources and selectivity in order to properly isolate their impact on variation in low-income enrollment rates across institutions.

Similarly, net price (tuition less grant aid) alone may not be the sole correlate with the proportion of low-income students at an institution. Because of information asymmetries and signals that may be inferred by students from financial aid and admissions practices, other aspects of financial aid and admissions policies may be related to enrollment patterns of low-income students. For example, because net price information is often only attainable late in the admissions cycle, students may infer, often erroneously, information about price from the sticker price (total cost of attendance). Similarly, as specific aid and loan policies may not be well known or understood by low-income students, their relationship with low-income enrollment rates may not be as prevalent as might be expected. This study analyzes the conditional relationships of a number of admissions and financial aid practices on variation across institutions on the proportion of low-income students.

Data

This analysis used data from the College Board's 2011 Annual Survey of Colleges (ASC) merged with the 2011 Integrated Postsecondary Education Data System (IPEDS) database. The ASC data set contains survey responses from 3,920 accredited undergraduate colleges and universities across the United States. To be eligible for this survey, an institution must offer at least an associate degree and be accredited by a regional or national accrediting agency recognized by the U.S. Department of Education. The ASC sample represents over 85% of the 4,599 degree-granting institutions in the United States, as reported in the 2011 U.S. Digest of Education Statistics.

To assess the importance of various institutional characteristics on the enrollment of low-income students at traditional four-year institutions, the sample was further restricted. I eliminated for-profit institutions in this survey (892 institutions) and institutions whose highest degree awarded is an associate degree (1,040). I also eliminated observations where important variable values were not reported. Specifically, I omitted observations where the institution did not report the percentage of the class receiving financial aid or reported a percentage greater than 100% (1,004), or the institution did not report the percentage of need met with financial aid and/or the cost of attendance (50). These restrictions resulted in a final sample of 891 accredited four-year institutions that awarded a baccalaureate degree or higher and had valid data on the financial aid profile of their entering classes. These restrictions also resulted in a sample of institutions that slightly overrepresented Carnegie classification research/doctoral universities (24% versus 17%) and master's universities (40% versus 37%), and slightly underrepresented public universities (37% versus 39%).

The primary focus of this analysis concerns enrollment of low-income students at four-year, non-profit colleges and universities. For this analysis, I defined and measured "low-income students" as those who received Pell Grants. According to the 2011-2012 Federal Pell Grant Program End-of-Year Report (U.S. Department of Education, Office of Postsecondary Education, 2012), 74.3% of Pell Grant recipients came from families earning less than \$30,000 a year, and over 92% came from families earning less than \$50,000 a year. Median household income for 2011 was \$50,502 in the United States (U.S. Census Bureau, 2012).

The sample of institutions used in this analysis enrolled an entering class that was 31.18% Pell Grant recipients on average across institutions (see Table 1 for summary measures). This ranged from a low of only 6% to a high of 100% of the entering classes receiving Pell Grants. Among public institutions, the average was 32.9%, while at private institutions the average was 30.2%. According to the College Board (2013), 36% of postsecondary students received a Pell Grant in the 2010-2011 academic year. The College Board figure is likely higher than the sample average in this paper because it includes enrollment at two-year and for-profit institutions. Additionally, the institutions in this sample were more likely to be larger research universities than is nationally representative.

The analysis also used dummy variables indicating whether the institution admitted its 2010-2011 fall class in a need-blind manner (that is, they did not consider an applicant's financial aid profile in determining whether to admit them), and if they met the full demonstrated need of all admitted students. Meeting full need means grant aid, loans, and work-study meet all the difference between the tuition, room, and board of an institution and what a family is expected to contribute for the student's higher education expenses. The opposite of meeting full need is called "gapping." I also used the degree or percentage to which an institution gaps its students, on average, as a control variable in this analysis. I expected that the more an institution gapped its students, the less likely it would be to enroll more low-income students, *ceteris paribus*. As meeting full need can be achieved with varying degrees of loans versus grant aid, I also included a dummy variable indicating whether an institution has a policy of no loans for all students such that all of a student's demonstrated need is met with grant aid, or has a policy of limited loans such that students below a certain income threshold have all of their need met with grant aid, as defined by *The Project on Student Debt*

Table 1

Summary Measures

	Minimum	Maximum	Mean	<i>SD</i>
Percentage of students with Pell Grants ^b	6	100	31.18	14.10
Public institution ^b	0	1	0.37	0.48
Net price for all aid recipients ^b	\$0	\$42,882	\$18,546	\$6,940
Cost of attendance ^b	\$8,986	\$58,334	\$33,303	\$12,520
Expenditures per student ^b	\$5,291	\$270,834	\$25,704	\$21,824
Need blind/meet full need ^a	0	1	0.04	0.20
Meet full need (only) ^a	0	1	0.02	0.14
Percentage of gap ^a	0	99	25.64	17.12
Limited loan policy	0	1	0.062	0.241
No. of FTE undergraduates ^b	129	46,994	5,571	6,733
SAT midpoint ^b	760	1515	1100.34	135.93
Percentage of high-paying majors ^a	0	1	.43	.16
4-year graduation rate ^b	0	92	42.90	22.24
Master's-granting institution ^b	0	1	0.36	.48
Doctoral-granting institution ^b	0	1	0.47	.50
Urban location ^b	0	1	0.29	0.45
Suburban location ^b	0	1	0.48	0.50

Source of data: ^aAnnual Survey of Colleges (ASC; College Board); ^bIntegrated Postsecondary Education Data System, 2011; U.S. Department of Education, National Center for Education Statistics, 2011).

for 2009-2010. While details about these policies and the amount of time they have been in place may have a meaningful moderating effect on the association of these financial aid variables with the proportion of low-income enrollees at an institution, this information is not readily available.

I used the median SAT score of the entering class as an additional institutional control variable. Generally, the higher the SAT score of the class, the more affluent the student body (given the high, consistent, and positive correlation between family income and standardized test scores), and thus the lower the expected number of Pell recipients.

I used the total cost of attendance (tuition, fees, room, board, books, and other expenses) to measure the sticker price of an institution. For public universities I used an undergraduate enrollment weighted average of the in-state and out-of-state cost of attendance. Net price is the institution's average net price among students receiving any grant aid. This measure was designed to reflect the actual price paid by those students who are eligible for Pell Grants. I also included total expenditures per student to examine whether institutions with greater resources utilize that wealth to attract low-income students by offering more amenities and services attractive to low-income students. All dollar-based regressors were entered in natural log form to approximate percentage changes in these variables. I also included among the independent variables in the following analyses the percentage of all graduates who obtained degrees in majors with above-median earnings. These majors were identified from the Center on Education and the Work Force's 2012 analysis of earnings by college major (Carnevale, Cheah, & Stroh, 2012). The majors with above-median earnings were engineering, mathematics and statistics, physical sciences, science technologies, social sciences, health professions, and business. I also used controls for public versus private institutions, highest degree awarded, and institutional size in the following analyses.

I controlled for variation in the supply of low-income students available to an institution by including state dummy variables and dummy variables for urban and suburban (versus rural) location of the institution. The state dummy variables captured anything about the state that correlated with the enrollment of low-income students (specifically Pell recipients) across universities within that state, such as state policies, grants, or demographics conducive to low-income enrollment in the state. Similarly, urban and suburban dummy variables captured anything about these settings that correlated with low-income student enrollment.

Empirical Results

A number of institutional characteristics are statistically significantly correlated with an institution's ability to attract and enroll low-income students. Column 1 of Table 2 presents the results of regression of the percentage of the 2011 first-time, full-time entering class that received Pell Grants against the control variables discussed above, for all 891 institutions included in this sample. Columns 2 and 3 of Table 2 limit the sample to public and private institutions, respectively. The equations are estimated using weighted least squares (WLS), where the weights are equal to the number of full-time equivalent undergraduates at each institution, to account for variation in the variance of the error term resulting from substantial variation in the size of institutions included in the sample. Qualitatively similar results were found using OLS and with robust standard errors, but they are not presented here.

The average net price charged to students has a negative and statistically significant (at the 99% level) relationship with the percentage of the entering class receiving Pell Grants. A 10% increase in net price is correlated by over .4% with a decrease in the proportion of the entering class that receives Pell Grants: this estimate is statistically significantly different from zero at the 99% level. So, while low-income net price is statistically significantly related to the percentage of the entering class that receives Pell Grants, the magnitude of the effect is rather small in terms of substantially altering the percentage of the class that is low-income.

Additionally, an institution's cost of attendance, or sticker price, is statistically significantly correlated with the enrollment of low-income students. Even though low-income students would virtually never pay the full cost of attendance, institutions with higher cost of attendance charges have significantly lower percentages of Pell Grant recipients, other things being equal. In this case, the coefficient of -4.781 indicates that a 10% increase in sticker price is correlated with just under a half percentage point decrease in enrollment of Pell Grant recipients as a percentage of the entering class. In fact, the magnitudes of the effect

Table 2

Regression Results: Dependent Variable as a Percentage of the First-time, Full-time Class Receiving Pell Grants

	Total	Public	Private
Constant	169.541 (20.751)	67.916 (44.458)	248.011*** (26.522)
Natural log of net price	-4.216*** (0.473)	-3.816*** (0.693)	-5.379*** (1.170)
Natural log of cost of attendance	-4.781** (2.287)	4.083 (5.038)	-10.717*** (3.441)
Natural log of expenditures per student	4.859*** (0.809)	6.384*** (1.404)	3.288*** (1.183)
Need blind/meet full need	2.640 (1.629)	1.018 (4.228)	2.486 (2.152)
Meet full need only	0.484 (2.632)	—	1.319 (2.243)
Percentage gap	0.002 (0.017)	-0.001 (0.028)	-0.039 (0.027)
Limited loan policy for need-based aid	3.745*** (1.010)	2.800* (1.626)	3.639 (2.302)
Percentage of grads in high-paying majors	3.215 (2.262)	3.009 (4.763)	1.631 (2.367)
No. of FTE undergraduates (in 1,000s)	-.150*** (0.041)	-0.193*** (0.067)	0.027 (0.102)
SAT midpoint (in 100s)	-8.204*** (0.371)	-9.158*** (0.667)	-7.114*** (0.540)
Public institution	-4.711*** (1.592)	—	—
Master's-granting university	-2.406* (1.321)	-0.709 (4.278)	-1.263 (1.180)
Doctoral-granting university	-1.645 (1.312)	-0.904 (4.220)	-0.599 (1.210)
Urban location	1.787** (0.787)	1.647 (1.300)	1.882 (1.203)
Suburban location	-1.736** (0.742)	-1.063 (1.246)	-2.472** (1.105)
R-squared	.684	.749	.698
No. of observations	891	329	562

Note: Standard errors are in parentheses. Included among the regressors but not shown are dummy variables for state and missing values for average SAT and expenditures.

* $p < .10$. ** $p < .05$. *** $p < .01$.

of sticker price and net price on the percentage of the entering class receiving Pell Grants are quite comparable. Both prices seem to be related to the percentage of the entering class receiving Pell Grants.

On the other hand, expenditures per student, as a measure of institutional resources, have a positive and statistically significant correlation with enrollment of low-income students. The coefficient on expenditures per student of 4.859 indicates that an increase in expenditures per student, conditional on sticker price and net price for low-income students, is correlated with a higher percentage of low-income students enrolling. This result is consistent with the expectation that wealthier institutions, which can forgo the loss in revenue caused by enrolling more low-income students, would be expected to enroll more Pell recipients, *ceteris paribus*. The Pearson correlation coefficient of the natural logs of cost of attendance and expenditures per student is .212, suggesting adequate independent variation across these two variables such that multicollinearity should not be too problematic a concern in this case.

Conditional on prices and expenditures, being both need blind and meeting full need, or simply meeting full need, are not statistically significantly correlated with the percentage of the entering class receiving Pell Grants. Only 46 institutions in the United States commit to these policies on a consistent basis, but doing so is not significantly related to the proportion of students who are low-income (as measured by Pell receipt). Similarly, the percentage of gapping and the percentage of graduates in high-paying majors are not significantly correlated with the percentage of first-time, full-time students who receive Pell Grants. On the other hand, committing to limiting or eliminating loans from the financial aid package offered to low-income students is significantly correlated with enrollment of Pell Grant recipients. It is worth emphasizing that these effects are conditional on the net price offered to need-based aid recipients. Eliminating or limiting loans for low-income students may send a clear policy signal to applicants that an institution is committed to being accessible and affordable to low-income students.

An institution's selectivity, as measured by average SAT score, has a negative and statistically significant relationship with enrollment of Pell Grant recipients as a percentage of the entering class. Each 10-point increase in the average SAT score (out of the two-test maximum of 1,600 points) is correlated with a .86 percentage-point drop in the percentage of the entering class that receives a Pell Grant. The high correlation of family income with standardized test scores limits the supply of students with high academic ability (as measured by standardized test scores such as the SAT) available to highly selective institutions.

Institutional type also plays a role in enrollment of low-income students. Overall, a higher percentage of the entering class of public universities receives Pell Grants. However, conditional on the factors controlled for in these regressions, public institutions enroll significantly lower percentages of Pell Grant recipients than private institutions do. Similarly, master's universities enroll lower percentages of Pell recipients than baccalaureate colleges, and larger institutions (in terms of undergraduate enrollment) have smaller numbers of low-income students as a percentage of the entering class.

There appear to be significant location effects, as well. Institutions located in urban areas have 1.787 percentage points more Pell Grant recipients than those in rural areas, while colleges and universities located in suburban areas have 1.736 percentage points fewer Pell recipients than rural institutions. Similarly, a subset *F*-test (test statistic = 4.7; $p < .001$) on a set of state dummy variables rejects the null that the coefficients on the state dummy variables are equal to zero. These results suggest that the supply of low-income students, as proxied by the state in which an institution is located and its metropolitan setting, are significantly correlated with an institution's ability to enroll low-income students.

Column 2 of Table 2 presents the results restricting the sample to the 329 public universities in the data set. Once again, the natural log of net price for need-based aid recipients has a negative and statistically significant (at the 99% level) correlation with enrollment of Pell Grant recipients. The magnitude of the

effect is, however, once again quite small. A 10% increase in net price charged to low-income families is predicted to reduce their representation among the entering class by just under .4%. The natural log of the cost of attendance (sticker price) does not have a significant relationship with enrollment of Pell Grant recipients at public universities. Sticker prices at public universities, which are usually much lower than sticker prices at private institutions, do not appear to deter low-income enrollment conditional on the net price charged to low-income students.

Expenditures per student have a positive and statistically significant (at the 99% level) correlation with low-income enrollment, and the magnitude at public institutions is even larger than overall. *U.S. News and World Report* (2010) identified only three institutions as being need blind and meeting full need (i.e., SUNY College of Environmental Science and Forestry, University of North Carolina-Chapel Hill, and the University of Virginia), and none that meet full need only, so it is not surprising that these policies are not statistically significant in enrolling low-income students at public institutions. Similarly, the percentage of gapping and the percentage of graduates in high-paying majors once again does not have a significant correlation with enrollment of Pell Grant recipients.

Eliminating loans for low-income students at public universities has a positive correlation with low-income enrollment, but the magnitude is smaller than that found overall, and it is significantly different from zero at only the 90% level.

Average SAT scores once again have an important correlation with the enrollment of low-income students. Public institutions with high average SAT scores enroll substantially lower percentages of Pell Grant recipients than comparable institutions that are much less selective in terms of test scores. The findings show public universities with larger student bodies enroll significantly fewer low-income students as a percentage of the first-time, full-time entering class than smaller institutions, but again, the magnitude of the effect is rather modest.

Among the 329 public universities examined in this sample, only the net price charged to low-income students, expenditures per student, FTE undergraduate enrollment, and average SAT score are statistically significant in predicting the percentage of the entering class that received Pell Grants, at the 95% level of significance. Eliminating or limiting loan levels for low-income students is correlated with the percentage of Pell recipients at public universities, but only at the 90% level of significance.

Column 3 of Table 2 presents the results for the sample of 562 private colleges and universities used in this analysis. Net price among need-based aid recipients has the expected negative and significant (at the 99% level) relationship with Pell Grant enrollment. The relationship of the cost of attendance, or sticker price, with Pell Grant enrollment at private institutions is rather substantial relative to the magnitudes of the other price effects reported here. A 10% increase in the cost of attendance is expected to reduce Pell Grant enrollment as a percentage of the entering class by over one percentage point. The magnitude of the effect of sticker price relative to the estimated effect of net price on low-income enrollment suggests that a practice of high sticker price-high aid may not be effective in enrolling low-income students. The sticker price appears to do more to discourage low-income students from enrolling than a lower net price does to attract them. Higher expenditures per student, *ceteris paribus*, are consistently correlated with increased percentages of Pell Grant recipients.

At private institutions, where being need blind and meeting full need is more prevalent (but still rare), this practice has a positive relationship with enrollment of Pell Grant recipients, although this result is once again not statistically significant. The higher the percentage of gapping an institution practices, the lower the level of low-income enrollment, as expected, but this result is also not statistically significant. While limiting loans for low-income students is estimated to have a positive relationship with Pell Grant enrollment, this

impact is not statistically significantly different from zero at conventional levels in a two-tailed test. If one expects that loans will have a positive impact on Pell enrollment, then a one-tailed *t*-test is more appropriate. Under this assumption, there is a positive and statistically significant (at the 90% level) relationship between limiting loans and the percentage of Pell recipients in the entering class.

Higher average SAT scores are correlated with lower levels of low-income enrollment at private institutions as well, although the magnitude of the effect is less pronounced than at public institutions. Each 10-point increase in average SAT scores is correlated with a .7114 percentage-point drop in Pell Grant recipients as a percentage of the entering class at private institutions, versus a .965 percentage point drop at public universities.

While larger public institutions have lower percentages of Pell Grant representation, the relationship between enrollment and Pell representation at private institutions is not significant. Similarly, institutional type (master's and doctoral versus baccalaureate) and the mix of degrees awarded are not significant in predicting low-income enrollment at private institutions. Suburban institutions are predicted to have a lower percentage of Pell recipients than rural institutions, and this result is significant at the 95% level.

At private colleges and universities, only net price, sticker price, expenditures per student, average SAT scores, and limiting loans are statistically significantly correlated with the percentage of first-time, full-time students who receive Pell Grants. Across both public and private sectors of higher education, the average net price paid by need-based financial aid recipients, the expenditures per student, average SAT scores, and limiting loans are consistently and significantly related to the percentage of the entering class that are Pell Grant recipients.

Discussion

Too often practitioners and policymakers interested in promoting socioeconomic diversity in higher education inordinately focus on the sticker price of institutions. The primary finding of this study is that variation across institutions in low-income student enrollment is correlated with sticker and net prices, loan policies, and institutional setting. Specifically, the results suggest studies that focus on sticker price or net price alone are inadequate in fully identifying the variables that correlate with low-income student enrollment. The results also support the argument that institutions with no-loans policies for low-income students tend to be institutions with higher percentages of Pell Grant recipients, conditional on net price, consistent with the results of Linsenmeier et al. (2006). The estimated correlation of eliminating loans and Pell Grant enrollment was always found to be positive, but the relationship was only statistically significant in the combined sample of public and private universities and at public universities in a two-tailed test, and only statistically significant at private universities using a one-tailed test, at 90% level of significance. These results suggest that institutions with limited or reduced loans have higher Pell Grant representation, but with limited statistical conviction.

Being need blind, meeting full need, and gapping were not found to be significantly correlated with the percentage of the first-time, full-time entering class that receives Pell Grants. While these policies are to be applauded, their relative scarcity across higher education institutions limits the ability to statistically discern with any meaningful level of confidence their correlation with enrollment patterns.

Implications for Practitioners

While these results do not necessarily imply a strict causal relationship between the financial aid and admissions policies outlined above, these results do suggest that price—both net price and sticker price—may play an important role in identifying variation in enrollment rates of Pell Grant recipients across institutions. These results also suggest that the model of high-price/high-aid practiced by many private institutions may discourage more low-income students from enrolling than it does entice them through generous financial aid packages, at least at private institutions. Private institutions have long adhered to policies of hefty increases in sticker prices offset by commensurate increases in aid for low-income students. This practice of increasing price discrimination across income levels was thought to provide both increased affordability for low-income families and increases in tuition revenue for the university. The results of this analysis suggest that this type of policy might act as a deterrent against low-income enrollment, although the magnitudes of the estimated effects are quite small. Private institutions seeking to develop greater socioeconomic diversity on campus may wish to experiment with alternative pricing models, such as guaranteeing no or low costs for students below an income threshold.

Similarly, the results of this study suggest institutions that eliminated or limited loans for low-income students had high percentages of Pell representation among the entering class. On the other hand, the study did not find any evidence that being need blind and meeting full need (and thus not gapping) has a significant correlation with enrolling a higher percentage of Pell Grant recipients.

One of the most consistent and difficult challenges facing postsecondary institutions is overcoming the Gordian knot between standardized test scores and family income. The results of this study suggest institutions firmly committed to socioeconomic diversity may need to place less emphasis on standardized test scores in admitting students or devote greater resources in seeking out high-ability, low-income students as outlined in Hoxby and Turner (2013).

This paper illustrates that increasing enrollment of more low-income students at an institution may not simply be a matter of lowering net price. Cost of attendance, expenditures, selectivity, and loan policies are all correlated with enrollment rates of Pell recipients. Supply-side factors, such as institutional location, are also important in predicting low-income enrollment. The results of this study, coupled with the results of Perna, et al. (2010) indicating the importance of clear communication to families about financial aid and admissions practices, suggest that college and university administrators seeking greater socioeconomic diversity must develop a comprehensive, multipronged approach to attracting low-income students, and they must communicate and market this approach extensively to targeted students and families.

Nexus: Connecting Research to Practice

- The results described in this paper suggest that price, both net price and sticker price, play an important role in identifying variation in enrollment rates of Pell Grant recipients across institutions, so practitioners should focus on both in attempting to attract more low-income students.
- The model of high price-high aid practiced by many private institutions may discourage more low-income students from enrolling than it entices through generous financial aid packages, at least at private institutions. The indirect effect of high sticker prices on low-income students may be an important but overlooked phenomenon that merits consideration.
- This paper supports the argument that institutions with no-loans policies for low-income students tend to be institutions with higher percentages of Pell Grant recipients, conditional on net price. Institutions seeking to enroll more Pell Grant recipients may want to experiment with means-tested no-loans policies.

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