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What Determines the Amount Students Borrow? Revisiting the Crisis–Convenience Debate

By Natala K. Hart and Shoumi Mustafa

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Recent studies have questioned the wisdom in blaming college costs for the escalation of student loans. It would appear that less affluent students borrow large amounts because inexpensive subsidized loans are available. This study attempted to verify the claim, estimating a model of the amount of loan received by students as a function of net total costs after grants, scholarships, and tuition discounts, and of the availability of subsidized loans. Results showed large effects of net cost, especially for poor students, who used low-interest subsidized loans to replace more expensive loans. In contrast, middle-income students increased borrowing in response to increased availability of subsidized loans, although such responses were small relative to the impact of net costs.

Loans are the largest source of funding for postsecondary students in the United States. In 2005–2006, public and private lenders disbursed a combined total of \$76.8 billion in student loans, equivalent to half of the sum of federal, state, institutional, and private resources channeled to postsecondary students (The College Board, 2006). At the individual level, half of all 4-year college students borrow an average of \$6,200 a year (U.S. Department of Education, 2004).

Although the loan dependence of postsecondary education is commonly considered a crisis fueled by skyrocketing college costs and the inadequacy of need-based grants, the convenience accorded by the availability of inexpensive, subsidized federal loans is also held accountable. For example, King (1999) noted that students with a maximum family income of \$30,000 borrowed because inexpensive loans were available. Redd (2001) similarly reported an increase in borrowing between 1992–1993 and 1995–1996 by students with a family income in the \$40,000–\$60,000 range, although average costs apparently went down for them over the period. Average costs went down for those students because relative to previous years, they attended less expensive colleges in larger proportions between 1992–1993 and 1995–1996 (Redd, 2001).

These conclusions were drawn from observed associations between college costs and average borrowing over time, and from changes in the average amount of loan when policy shifts alter individual specific allocations of loan or allow previously ineligible students to receive subsidized loan. Although useful for illustrating broad trends, the unconditional associations do not control for the influence of time-varying or individual-specific

determinants of borrowing, and may not represent the effect on the individual borrower of either college costs or the availability of subsidized loans. In this study, we identify the impacts of college costs and of the availability of subsidized loans on the amount borrowed by individual students.

Research on the impact of student loans has followed two themes. The first focuses on how loans influence aspects of access to college, including enrollment, retention, and graduation (Dynarski, 2002; Moore, Studenmund, & Slobko, 1991; Reyes, 1995; Schwartz, 1985; St. John, Kirshstein, & Noel, 1991). The second considers the effect of debt on post-college consumption (Baum & O'Malley, 2003), progress to graduate studies (Monks, 2001), and career choices (Colquitt, Zeh, Killian, & Cultice, 1996; Minicozzi, 2005). An important but often overlooked consequence of borrowing that touches on both of the above aspects concerns income inequality. The impacts of net cost and the availability of subsidized loans, and whether those influences vary by family income levels, feature centrally in the resulting unequal consequences of student borrowing.

If net costs have a larger impact on borrowing among the poor because they have less access to alternative resources, an increase in total costs in the absence of offsetting grants will cause them to borrow larger amounts on the margin. For large enough increases in net costs, overall borrowing by the poor may exceed overall borrowing by more affluent students. In that case, the prospect of accumulating larger debt would yield smaller expected returns for the poor, dampening their college attendance incentives even if the gross returns of completing 4 years of college are the same for all.

In light of possible adverse effects of excessive loans on access to college for the poor, the knowledge of the impact of net cost on borrowing has a direct bearing on policy decisions about tuition and the allocation of need-based grants. The impact of loan availability, on the other hand, holds the key to predicting the ability of subsidized loans to reduce attendance costs for the target student body.

Method

The current study estimated a model of the amount of student loan borrowing by individual students as a function of their net cost of attendance (i.e., total costs minus the sum of grants, scholarships, and tuition discounts), the availability of subsidized loans, and individual and family characteristics. Our estimates identify the increase in the average amount borrowed when the net cost of attendance or the availability of subsidized loans increases by a given amount, holding everything else constant. In light of observed differences in borrowing patterns among students from different levels of family income, we posit a model using a pooled sample of students, regardless of family income, and alternatively, with subsamples comprising students from different income groups. Following Brouwer and Spaninks (1999),

we used these estimates to test whether borrowing behaviors of students from diverse economic strata are identical.

Sample

Our sample comprised first-year students from the freshman classes entering in 2000 through 2005 at the Columbus campus of the Ohio State University ($N = 38,398$). In order to establish the determinants of borrowing for students from different income groups, we needed complete records of students' family income, net cost of attendance, expected family contribution (EFC), and the amounts they borrowed. However, this type of information was available only if a student applied for or received financial aid. Between 25% and 30% of the students in each class do not apply for financial aid. After excluding those students, our working sample had a total of 28,059 students.

Our sample was remarkably representative of first-time freshman students attending public 4-year colleges in the nation. However, similar to national statistics, almost 40% the students in our sample did not borrow; that is, they had a value of zero for the amount of loan, the dependent variable in our model. With the dependent variable censored at zero, ordinary least squares (OLS) estimation methods yield inconstant estimates. Our econometric specification, therefore, follows a Type I Tobit model that takes into account the non-linearity of the regression function (in parameters) in the presence of censored dependent variables.

Because our sample students were from 6 different years between 2000 and 2005, we converted all nominal variables, including the amount of loan, into constant 1999 prices using the consumer price index from the Bureau of Labor Statistics.

We used family income levels to divide the sample into four groups. The first group comprised students with a maximum family income of \$32,000; the second group included students with income in the \$32,000–\$60,000 bracket; and students in the third group had a family income between \$60,000 and \$92,000. The most affluent group included students with family income in excess of \$92,000. The groups thus represented low-income, lower-middle-income, upper-middle-income, and high-income students, respectively. The cutoff values were borrowed from a recent report on the financing of postsecondary education (U.S. Department of Education, 2006).

We identified the effect of loan availability by exploiting an increase in the limit of Federal Perkins Loan at OSU. Perkins Loans are allocated to OSU students only if their EFC does not exceed \$5,000. In 2002, OSU increased annual limits of Perkins Loan by \$2,000. We obtained the difference in average (total) loan amounts between students who were Perkins eligible and ineligible, respectively, before and after the change. A comparison of the two differences, known as the difference-in-difference estimator, yields the effect of the increase in loan limits.

Our sample was remarkably representative of first-time freshman students attending public 4-year colleges in the nation.

Model and Estimation Framework

Loans are a means for students to bridge the gap between current costs and available resources. The amount of loan received by an individual, therefore, depends on the cost of attendance, available resources, and the cost of borrowing represented by the availability of inexpensive loans. There may also be variations in the amount of loan among individuals because of differences in preferences and expectations of post-college lifetime earnings. We denote the actual amount of loan for individual i as y_i^* and express it as a linear function of observed determinants of borrowing, included in the vector x :

$$y_i^* = x_i\beta + u_i \text{ for } i = 1, 2, \dots, n. \quad (1)$$

β is the coefficient (vector) of x , reflecting how the determinants influence borrowing; u_i represents the composite influence of determinants not included in x .

When an individual borrows a strictly positive amount, it is a reflection that current costs exceed available resources. However, if available resources actually exceed or equal current costs, an individual has savings (negative borrowing) worth the difference. Although the extent of such savings can be quite heterogeneous, observed data on borrowing inform only that the individual in question does not receive loans (i.e., borrows zero amounts). As a result, the observed amount of loan, the dependent variable in our model, becomes censored at zero.

Denoting y_i as the observed amount of loan, we express the censored nature of the data as follows:

$$y_i = y_i^* \text{ if } y_i^* > 0 \quad (2)$$

$$y_i = 0 \text{ if } y_i^* \leq 0$$

Assuming $u_i \sim N(0, \sigma^2)$, Equations 1 and 2 constitute a censored (at zero) normal regression model, commonly known as the Type I Tobit model. The model is estimated using full information maximum likelihood.

We define *amount of loan* as the sum of federal, state, institutional and commercial student loans received by students. Although OSU provides detailed accounts of loans received by students from the first three sources, official records include commercial loans only if they are reported to the office of student financial aid.

Variables in x include those representing net cost of attendance, the availability of subsidized loan, family wealth, and additional individual and family characteristics likely to capture the influence of preference and expectations of post-college lifetime earnings. We define *net cost* as the difference between total cost of attendance and the sum of grants, scholarships, and tuition discounts. This is the amount that students must combine using their own resources, paid employment, and borrowing.

Poorer students command less of their own resources, and we expected the coefficient of net cost to be larger among them.

Our measure of *loan availability*, based on a recent change in the allocation of federally funded campus-based subsidized Perkins Loan at OSU, is free from the influence of variations in net costs. The federal government requires Perkins Loan allocation to be based entirely on the basis of EFC but leaves the specific cutoff value and the amounts to the discretion of individual institutions. According to the guidelines of the Office of Student Financial Aid at OSU, Perkins Loans are available to students who have a maximum EFC of \$5,000. In 2002, the limit of Perkins Loan at OSU was increased by \$2,000. In our model, we included one dummy variable to indicate the period (either before or after increase), another dummy variable to indicate eligibility (whether $EFC \leq \$5,000$), and another dummy variable—an interaction between the first two—to capture the impact of the exogenous expansion of loan limits. The coefficient of the interaction dummy variable is essentially a difference-in-difference estimator, which identifies the impact of loan limit expansion for all students who satisfied eligibility conditions after the change.

Among family characteristics, we included indicators of family wealth, including parental education. We use two dummy variables: one to indicate whether both parents of the student had 4-year college degrees, and another to indicate if one parent had a 4-year college degree. Students for whom neither parent had a 4-year college degree were the excluded category. We included annual family income in the model as well.

Among individual characteristics, we included students' gender, race, status of financial dependence, and whether the student attended OSU as an in-state or out-of-state student. Gender was indicated with a dummy variable for male students; a set of dummy variables also indicated Black, Asian, Hispanic, and Native American students, with White students used as the excluded race category.

We used the age of the student as an explanatory variable on the ground that older students would be inclined to borrow smaller amounts because they had a small number of active years in the post-college labor market. We also included students' ACT scores as a measure of academic ability. If expectations of post-college earnings motivate students to borrow larger amounts, then ACT scores should increase borrowing due to positive correlations between academic ability and post-college earnings.

Results

Summary Statistics and Loan Amounts

Table 1 reports summary statistics on loan, net cost, expected family contributions, and individual and family characteristics. As seen in Column 1, OSU freshman students are mostly from educated and middle-income families. Average family income

is \$73,913, and at least one parent has a 4-year college degree for almost 70% of the sample. The sample is split almost evenly between male and female students, has a heavy concentration of Ohio residents, and is largely financially dependent (88.0% of the

Table 1
Summary Statistics of Borrowing, and
Individual and Family Characteristics

	All Students Mean (SD)	Income			
		≤\$32K Mean (SD)	\$32K-\$60K Mean (SD)	\$60K-\$92K Mean (SD)	>\$92K Mean (SD)
Proportion of borrowers	0.583	0.649	0.702	0.589	0.419
Loan amount (in constant 1999 dollars)	1,734 (1,864)	2,344 (2,116)	2,375 (2,116)	1,493 (1,470)	992 (1,237)
Loan amount if loan > 0	2,977 (1,505)	3,611 (1,888)	3,383 (1,722)	2,535 (1,014)	2,370 (628)
Net cost (in constant 1999 dollars)	11,785 (4,680)	8,098 (4,716)	11,437 (4,226)	12,572 (4,001)	13,649 (4,346)
EFC	14,399 (16,544)	1,519 (4,391)	5,919 (5,940)	13,840 (8,825)	31,451 (20,304)
Family & Individual Characteristics					
Family income (in constant 1999 dollars)	73,913 (51,832)	19,861 (8,605)	46,548 (8,137)	75,122 (9,066)	133,764 (59,367)
At least one parent a 4-year college graduate	0.694	0.449	0.599	0.741	0.892
Both parents 4-year college graduates	0.403	0.182	0.286	0.422	0.636
Only one parent a 4-year college graduate	0.291	0.267	0.313	0.319	0.256
Student age (years)	18.590 (0.580)	18.669 (0.972)	18.582 (0.579)	18.576 (0.396)	18.564 (0.367)
ACT Score (out of possible 36)	24.892 (3.907)	22.952 (4.200)	24.543 (3.817)	25.315 (3.642)	26.021 (3.542)
Dependent	0.989	0.943	0.998	0.999	1.000
Male	0.484	0.438	0.469	0.506	0.504
White	0.784	0.553	0.769	0.853	0.873
Black	0.115	0.300	0.126	0.063	0.041
Asian	0.056	0.083	0.058	0.046	0.046
Hispanic	0.030	0.046	0.031	0.026	0.024
Ohio Resident	0.880	0.892	0.911	0.896	0.824
N	28,059	4,938 (17.6%)	7,233 (25.8%)	8,289 (29.5%)	7,599 (27.1%)

Note. EFC = expected family contribution.

sample students are Ohio residents, and 99.0% are financially dependent on their parents). The proportion of White, Black, Asian, and Hispanic students was 78.5%, 11.5%, 5.5% and 3.0%, respectively.

The average family income of \$73,913 in our sample is very similar to the median family income of \$72,126 of two-earner families in the nation; in current dollars, the median family income of two-earner families was \$76,814 in 2003–2004 (U.S. Census Bureau, 2008). Similarly, the racial makeup of our sample corresponds to the national proportion of White students (78.5%), for example, is almost identical to the 78.6% proportion of White students observed in samples of first-time 4-year college entrants in the nation (Sax, 1999).

The average OSU student at the time of our study faced net cost of \$11,752, which again is very similar to the average net cost of attendance for students attending doctoral degree granting public four-year colleges in the nation. For example, in 2003–2004, full-time full-year students at doctoral degree granting public 4-year colleges faced average net costs of \$12,207 (U.S. Department of Education, 2006).

Almost three fifths of the students in our study received loans, with an average loan amount for borrowers of \$2,977. In contrast, in 1999–2000, 49.7% of full-time, full-year 4-year college students in the nation received loans, borrowing \$5,700 on average (U.S. Department of Education, 2004).

Average loan amounts are smaller in our sample for the following reasons. First, we included only freshman students in our sample. Students in their sophomore, junior, and senior years may borrow larger amounts. Second, we considered the actual amount of borrowing by students and not the amount offered to them. Although we do not have information on which measure of loans is used in U.S. Department of Education reports, there are considerable differences between the two measures in our sample.

When these considerations are taken into account, the average loan amount in our sample increases considerably and becomes close to the national average. For example, between 2000 and 2005, the average loan borrowed by OSU students in their sophomore, junior, senior, and higher years were \$3,296, \$4,268, \$4,659, and \$4,287, respectively. If one measures loans by the amounts offered to students, the average for OSU students in their sophomore, junior, senior and higher years would be \$3,678, \$4,609, \$5,107 and \$5,039, respectively. We suspect that average loan amounts for OSU students could be even larger if one includes a comprehensive account of commercial student loans.

The average EFC for low-income students in our sample was \$1,520, implying that a large number of them were eligible for varying amounts of Pell Grant. In contrast, the average EFC for students from lower-middle-income families was almost

\$6,000, and a large number of them were ineligible for Pell Grants. As shown in Table 1 (Columns 2–5), net cost of attendance increases along with income, reflecting the reduced eligibility for grants as family income rises.

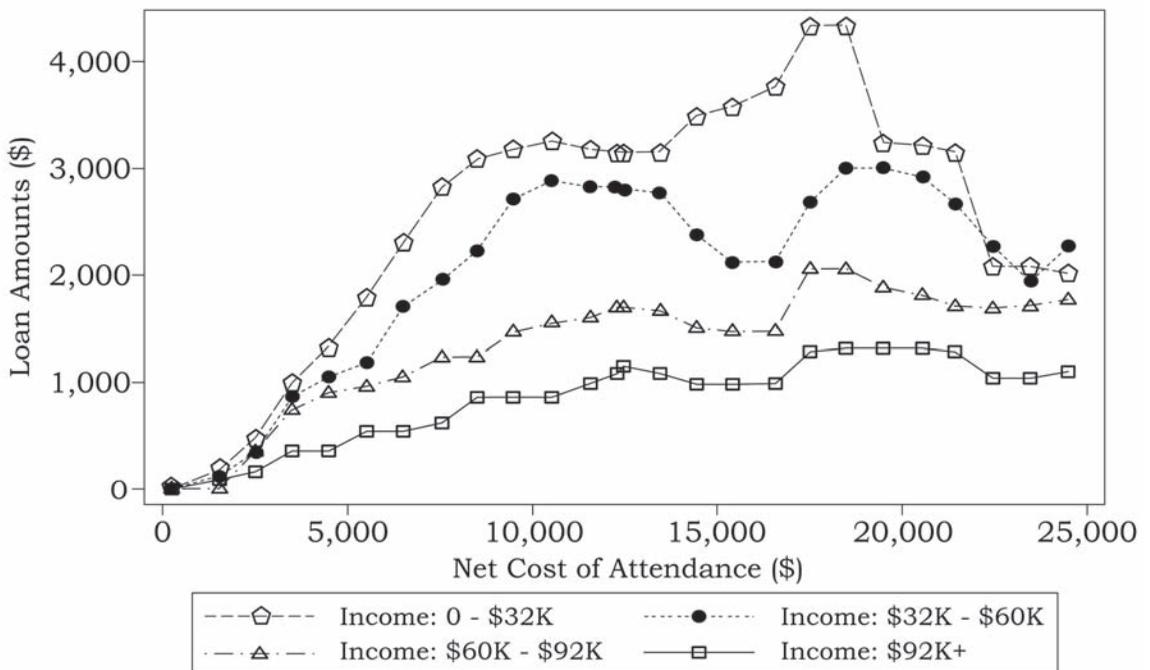
Because net cost rises with family income, we considered the net cost-borrowing association separately for students from each of the income groups, partially abstracting from the influence of family income. Figure 1 plots average loan amounts against net cost of attendance separately for the four income groups, showing mostly positive associations. The dip in the graph for the low-income students for very large values of net cost is due to the presence of too few observations. The associations follow nonlinear patterns, and are the strongest for initial increases in net cost. The figure also illustrates that the amount of loan received at a given value of net cost is largest for the poorest students, and declines with the level of family income.

Impact of Availability of Loans on Student Borrowing

The Ohio State University allocates Perkins Loans to students only if their EFC does not exceed \$5,000. In 2002, OSU increased the limit of Perkins Loans by \$2,000, but did not change the eligibility criteria.

To assess the influence of the increase in loan limits, we plotted the average amount of loan against EFC, before and

Figure 1
Net Cost of Attendance and Average Loan Amount, Freshman Classes 2000–2005
at the Ohio State University



after the limit expansion (see Figure 2). The vertical line at EFC equal to \$5,000 denotes the cut-off value of Perkins Loan. If the increase in the availability of Perkins Loan influenced overall loan amounts, the graph for the post-2002 period (after limit expansion) should be above the graph for the pre-2002 period (after limit expansion) for Perkins-eligible students (i.e., to the left of the vertical line at EFC equal to \$5,000). Moreover, because students with EFCs in excess of \$5,000 were ineligible for Perkins Loan in both periods, the difference between the two graphs should drop sharply to the right of the vertical line.

Figure 2
Average Amounts of Total Loan Received
Before and After Limit Expansion: All Students

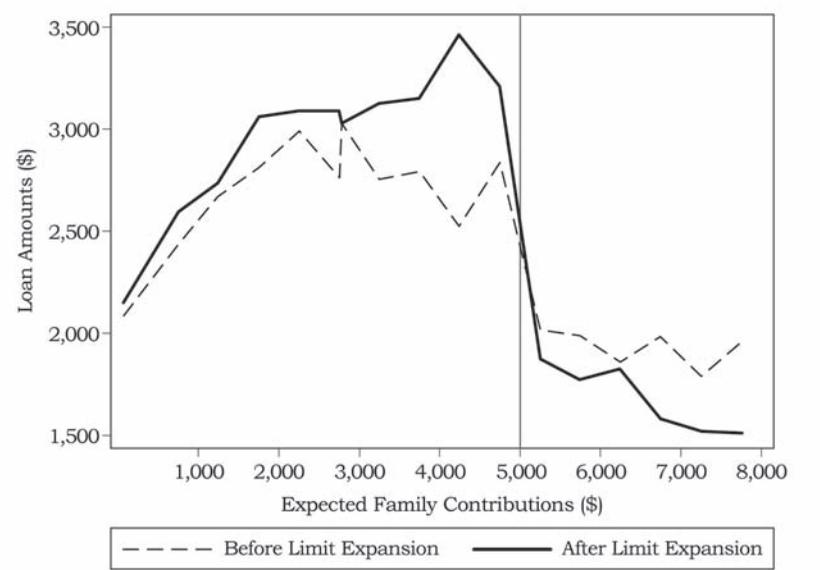


Figure 2 shows that post-2002 average loan amounts exceeded pre-2002 average loan amounts for EFC values less than \$5,000. There is also a sharp decline in the difference between the two lines to the right of the vertical line at EFC equal to \$5,000, suggesting positive effects of the loan limit expansion.

Figure 3 presents evidence on the impact of increased loan limits for low-income students, dispelling any notion that average borrowing by those students underwent a consistent change after the increase in Perkins Loan limits. The difference between the pre-2002 and the post-2002 graphs is not consistent either to the left or to the right of the vertical line at EFC equal to \$5,000.

Figure 4, in which we plot average loan amounts against EFC for lower-middle-income students, suggests positive impacts of the increase in the limit of Perkins Loan. The post-2002 average loan amounts are consistently larger than the pre-2002

Figure 3
Average Amounts of Total Loan Received
Before and After Limit Expansion:
Students With Income \leq \$32,000

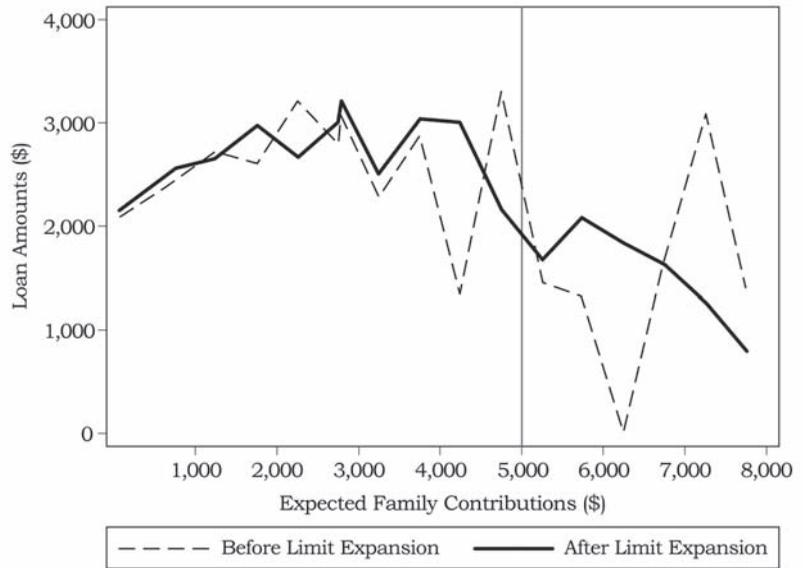
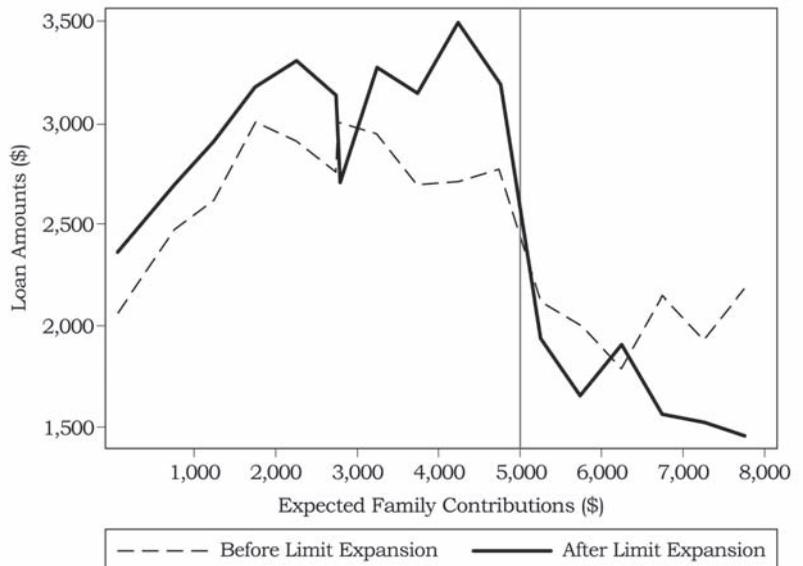


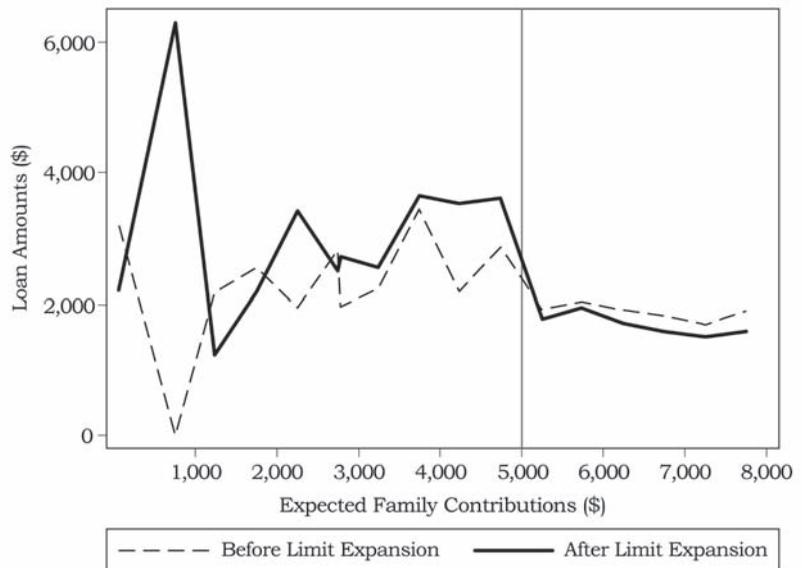
Figure 4
Average Amounts of Total Loan Received
Before and After Limit Expansion:
Students With Income \$32,000-\$60,000



average loan amounts to the left of the vertical line at EFC equal to \$5,000.

In a similar vein, Figure 5 suggests positive effects for Perkins Loan limit expansion on overall borrowing for upper-middle-income students; the average loan amount after the limit expansion generally stays above pre-limit expansion average loan amount to the left of the vertical line at EFC equal to \$5,000, with the difference disappearing abruptly to the right of the vertical line.

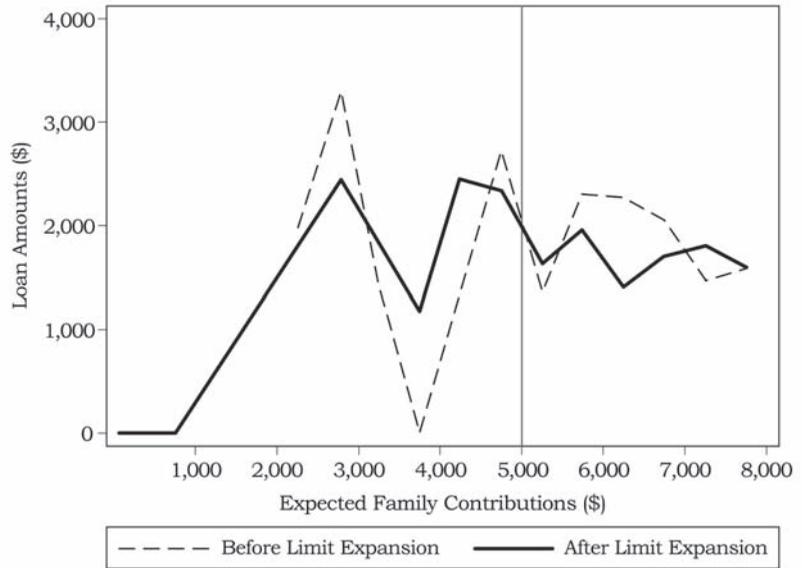
Figure 5
Average Amounts of Total Loan Received
Before and After Limit Expansion:
Students With Income \$60,000–\$92,000



Finally, Figure 6 shows the lack of consistent patterns in the difference between pre-2002 and post-2002 average loan amount for students from high-income families. This suggests that overall borrowing by those students did not respond to the increased availability of subsidized loans. It should be noted that there were only a few students from the group who satisfied the Perkins Loan eligibility criterion ($EFC \leq 5,000$). The apparent lack of an effect of the increase in loan limit for those students could be an artifact of too few relevant observations.

Differences in Borrowing Behavior: Estimates from Tobit Model
 Table 2 reports estimated coefficients and standard errors from the Tobit model. Column 1 contains the estimates for the entire sample; Columns 2–5 present estimates for the low-income, lower-middle-income, upper-middle-income, and high-income students, respectively. As seen in Column 1, net cost of attendance

Figure 6
Average Amounts of Total Loan Received
Before and After Limit Expansion:
Students With Income > \$92,000



had a positive, statistically significant effect. Our model includes a fourth-order polynomial in net cost to accommodate the non-linear nature of the association. The higher order variables are all statistically significant for the entire sample. (See Appendix A for the full set of estimates.) The increase in the availability of subsidized Perkins Loan also caused loan amounts to increase, as shown by the positive, statistically significant coefficient for the interaction dummy “Perkins Eligible × After Limit Expansion.” Column 1 also shows statistically significant effects of indicators of race and parental education.

Following Brouwer and Spaninks (1999), we tested a series of hypotheses on the pooling of samples of students from different income groups. The results, presented in Appendix B, reject the hypothesis that borrowing behaviors of students from low-income, lower-middle-income, upper-middle-income, and high-income families are identical.

The differences in the borrowing behavior across family income groups are evident in the estimates reported in Table 2, Columns 2–5. Although net cost had statistically significant, positive coefficients for all four groups, the magnitude of the coefficients declined as family income increased. Focusing on the role of the increase in the availability of subsidized loans, we found positive coefficients for the interaction dummy variable “Perkins Eligible × After Limit Expansion” only for students

Table 2
Estimates of the Tobit Model of Loan Amounts

	Income				
	All Students Coefficient (SE)	≤ \$32K Coefficient (SE)	\$32K-\$60K Coefficient (SE)	\$60K-\$92K Coefficient (SE)	> \$92K Coefficient (SE)
Net cost (constant \$1,000)	1,670.40*** (64.89)	1,791.18*** (119.95)	1,562.22*** (155.78)	969.60*** (142.13)	717.81*** (169.04)
Perkins Loan eligible	1,763.963*** (63.710)	2,932.162*** (348.069)	1,761.344*** (108.934)	1,762.191*** (160.996)	1,171.764 (1,154.032)
After limit expansion	-322.112*** (45.420)	175.484 (406.962)	-444.053*** (103.319)	-270.798*** (61.515)	-365.548*** (82.526)
Perkins eligible × after limit expansion	232.197*** (69.482)	-452.539 (414.580)	602.348*** (127.600)	607.021*** (214.239)	-290.833 (1,457.494)
Male	21.040 (31.877)	-72.012 (83.076)	57.357 (61.042)	-65.757 (50.761)	112.322* (65.656)
Financially dependent on parents	-155.449 (163.216)	-710.799*** (206.141)	411.279 (907.005)	2,466.038 (1,715.180)	
Age	-571.828*** (183.154)	-393.688 (323.267)	-576.729* (321.469)	-2,911.553* (1,755.341)	-9,304.606** (4,428.469)
Age2	15.954*** (4.265)	12.661* (7.217)	16.316** (7.517)	79.101* (46.546)	248.555** (118.902)
Black	284.779*** (59.854)	-192.364 (118.595)	510.338*** (107.186)	723.288*** (111.681)	714.300*** (167.009)
Asian	-780.131*** (76.032)	-1,136.803*** (169.519)	-990.779*** (140.101)	-551.035*** (131.683)	-317.412* (169.453)
Hispanic	113.539 (94.385)	-281.771 (206.916)	-178.677 (179.888)	486.459*** (160.100)	108.037 (216.048)
ACT score	173.219*** (40.354)	79.689 (83.728)	122.410 (77.858)	169.319** (76.354)	-67.541 (109.955)
ACT2	-4.577*** (0.817)	-2.477 (1.807)	-3.251** (1.589)	-4.461*** (1.518)	-0.576 (2.137)
Ohio resident	-736.347*** (72.955)	-1,714.079*** (182.794)	-737.616*** (153.330)	-576.480*** (125.640)	-432.532*** (139.639)
Income (constant \$1,000)	-11.878*** (0.724)	-5.143 (19.917)	18.788 (46.812)	-97.008* (50.277)	-12.528*** (1.384)
Income2 (constant \$1 million)	0.011*** (0.001)	0.407 (0.543)	-0.138 (0.505)	0.538 (0.332)	0.013*** (0.002)
Both parents 4-year college graduates	-523.510*** (40.556)	-325.308*** (111.592)	-438.334*** (74.257)	-578.506*** (63.242)	-616.011*** (102.902)
One parent 4-year college graduate	-156.944*** (40.321)	-19.347 (94.841)	-206.740*** (70.481)	-181.634*** (64.664)	-300.340*** (112.077)
Log likelihood	-158,768.68	-30,936.515	-48,526.687	-46,933.525	-32,031.748
N	28,059	4,938	7,233	8,289	7,599

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

from lower-middle-income and upper-middle-income families. Similar to findings with respect to net cost and loan availabilities, the coefficients of variables including parental education, states of residence, status of financial dependence, race, age, and academic ability differed in value and statistical significance across income groups.

In order to contrast the effects of the determinants of borrowing—against each other and across income groups—we report corresponding marginal effects. The marginal effect of a determinant shows how the average value of loan changes for a given change in the variable, holding everything else constant. There are two different sample average values of loans: the unconditional average value that represents borrowing by all students in the sample, including those who did not borrow; and the conditional (on borrowing) average value that represents the average amount of loan only for those who borrowed strictly positive amounts.

Following McDonald and Moffit (1980), we obtained the marginal effect of a determinant on the unconditional average value of loan as a (weighted) sum of its marginal effect on the conditional average value of loans, and the marginal effect on the probability of borrowing. Tables 3 and 4 present the marginal effects on the conditional average value of loan and the probability of borrowing, respectively.

Table 3 Column 1 reports the marginal effects for the entire sample; Columns 2–5 report the marginal effects for low-income, lower-middle-income, upper-middle-income, and high-income students, respectively. Column 1 shows that a \$1,000 increase in net cost increases average loan amounts by \$748 for the borrowers in our sample. (Our Tobit specification includes a fourth-order polynomial in net cost, and second-order polynomials in age, ACT scores, and family income. The marginal effects of those variables are calculated by summing the estimated marginal effects of the relevant terms.) Columns 2–5 show that the same increase in net cost affected average loan amounts by almost identical increases of \$897 and \$871 for borrowers from low-income and lower-middle-income groups, respectively, and by \$442 and \$241 for borrowers from upper-middle income and high-income families, respectively. In contrast to the effect of net cost, the \$2,000 increase in loan availability affected students' borrowing by an increase of only \$106. Moreover, only students from lower-middle and higher-middle-income families increase their loans in response to loan limits increases—by \$344 and \$301, respectively.

Parental education has a large bearing on amount of loan. Table 3 Column 1 shows that if both parents of a student were at least 4-year college graduates, the student borrowed \$233 less than children of parents who did not have a 4-year college degree. Columns 2–5 illustrate that the children from households with two 4-year college graduate parents borrowed

Table 3
Marginal Effects of Determinants on Expected Value of Loans for Borrowers

	Income				
	All Students	≤ \$32K	\$32K–\$60K	\$60K–\$92K	> \$92K
Net cost (\$1,000 increase in constant price)	748***	897***	871***	442***	241***
Eligible for Perkins Loan	858***	1,121***	969***	995***	459
After Perkins Loan limit expansion	-147***	88	-253***	-126***	-126***
Perkins eligible × after limit expansion	106***	-231	344***	301***	-95
Male	9	-36	32	-30	38*
Dependent	-71	-383	221	814	
Age (1-year increase)	-251***	-192	-314*	-1,300*	-3,065*
Black (relative to White)	132***	-96*	298***	362***	263***
Asian (relative to White)	-324***	-519***	-505***	-236***	-104*
Hispanic (relative to White)	52	-138	-98	238	37
ACT score (1-point increase)	78***	40	69**	78**	-23
Resident of Ohio	-355***	-993***	-441***	-281***	-152***
Income (\$1,000 increase in constant price)	-5***	-2	10	-44*	-4***
Both parents have 4-year college degrees (relative to no college)	-233	-161***	-241***	-262***	-213***
One parent has a 4-year college degree (relative to no college)	-70	-10	-115***	-83***	-100***

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

smaller amounts in each of the subsamples as well. Interestingly, the impact of parental education generally increased (in magnitude) with family income levels. We suspect that “4-year college degrees” include larger proportions of postgraduate degrees among more affluent families.

Black and Asian students from the low-income group borrowed smaller amounts relative to White students from the same group (see Table 3). For example, relative to Whites, borrowers among Black, Hispanic, and Asian students borrowed \$96, \$519, and \$138 less, respectively. Anecdotal evidence suggests a similar apparent aversion to borrowing among low-income Hispanics in California (Vera-Orta, 2007). At higher levels of income and for the sample as a whole, students of Black and Hispanic origin, however, borrowed larger amounts relative to Whites.

We find large marginal effects of students’ residence status. In-state students borrowed \$355 less than out-of-state students on average, possibly because proximity to a parent’s home makes available in-kind family contributions. The Congressional Budget Office (2004) estimates that living at home allowed in-state students average savings worth \$3,419 in 1999–2000.

Table 4
Marginal Effects of Determinants on Probability of Borrowing

	Income				
	All Students	≤ \$32K	\$32K-\$60K	\$60K-\$92K	> \$92K
Net cost (\$1,000 increase in constant price)	0.259***	0.233***	0.193***	0.170***	0.116***
Eligible for Perkins Loan	0.256***	0.428***	0.223***	0.246***	0.189
After Perkins Loan limit expansion	-0.050***	0.023	-0.054***	-0.047***	-0.060***
Perkins eligible × after limit expansion	0.036***	-0.059	0.073***	0.100***	-0.047
Male	0.003	-0.009	0.007	-0.012	0.018*
Dependent	-0.024	-0.086	0.054	0.437	
Age (1-year increase)	-0.087	-0.050	-0.070*	-0.499*	-1.476*
Black (relative to White)	0.044***	-0.025	0.059***	0.118***	0.117***
Asian (relative to White)	-0.127***	-0.162***	-0.139***	-0.101***	-0.051*
Hispanic (relative to White)	-0.127***	-0.162***	-0.139***	-0.101***	-0.051*
ACT score (1-point increase)	0.027**	0.010	0.015**	0.030**	-0.011
Resident of Ohio	-0.109***	-0.187***	-0.082***	-0.096***	-0.071***
Income (\$1,000 increase in constant price)	-0.002***	-0.001	0.002	-0.017*	-0.002***
Both parents have 4-year college degrees (relative to no college)	-0.082***	-0.044***	-0.056***	-0.102***	-0.100***
One parent has a 4-year college degree (relative to no college)	-0.082***	-0.044***	-0.056***	-0.102***	-0.100***

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

Although our estimates account for lower residence costs of students living at home, we do not account for family contributions in important categories such as food and transportation. Focusing on the characteristics of students, we found larger borrowing by students with higher ACT scores (the proxy variable for expected post-college earnings).

Finally, we found that a 1-year increase in students' age at time of enrollment at OSU reduced borrowing by \$251. It is possible that older students borrow less because they expect smaller post-college earnings, or have greater access to alternative resources not reflected in student aid packages. The impact of age appears to rise with family income; a 1-year increase in age reduced borrowing by \$314, \$1,300, and \$3,065 among lower-middle-income, upper-middle-income, and high-income students, respectively.

A \$1,000 increase in net cost increased the probability of borrowing by 25.9% for the entire sample, and by 23.3%, 19.3%, 17.0%, and 11.6% for students from low-income, lower-middle-income, upper-middle-income, and high-income families,

respectively (see Table 4). A \$2,000 increase in loan availability, by contrast, increased borrowing probabilities by only 3.6% for the entire sample, and by 7.3% and 10.0% for lower-middle- and higher-middle-income students, respectively.

Among individual and family characteristics, parental education, race, and age at time of enrollment had large effects on the probability of borrowing. Relative to Whites, Asian students were 12.7% less likely to borrow in the entire sample, and 16.2%, 13.9%, 10.1%, and 5.1% less likely to borrow among low-income, lower-middle-income, upper-middle-income, and high-income students, respectively. Age at time of enrollment had large effects on the probability of borrowing: a 1-year increase in age caused borrowing probability to fall by 8.7% in the entire sample, and by 7.0%, 49.9%, and 147.6% among lower-middle-income, upper-middle-income, and high-income students, respectively.

Discussion

Our results show that net cost of attendance has a large, positive effect on the amount of loan. For a \$1,000 increase in net costs, the borrowers in our sample increased the average loan amounts by \$748. The same increase in net cost raised the probability of borrowing by 25.9%. In contrast, a \$2,000 increase in loan limits, with net costs held constant, led to an additional borrowing of only \$106, and a 3.1% higher probability of borrowing.

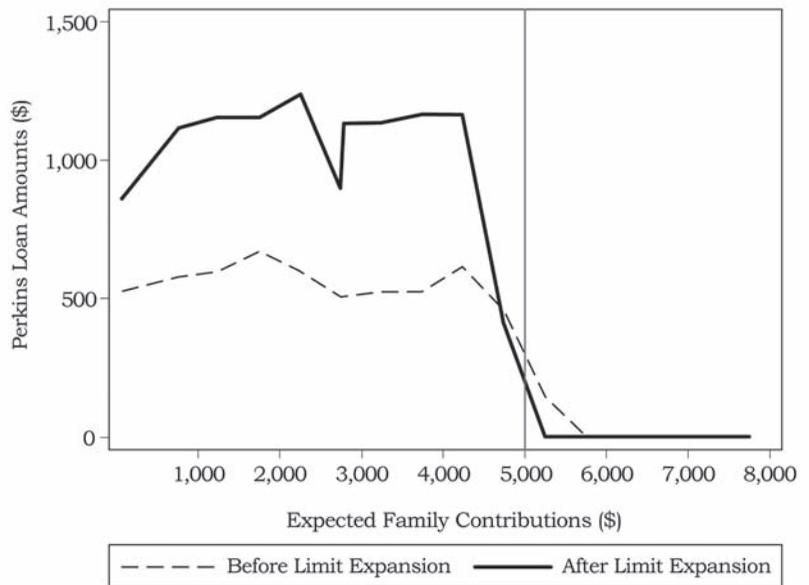
Borrowing behaviors of students from different income groups were statistically different and these differences were particularly large with respect to the effects of net cost. For example, with a \$1,000 increase in net costs, borrowers from low-income (\leq \$32,000) and lower-middle-income families (\$32,001–60,000) increased their average loan amounts by \$897 and \$871, respectively. However, with the same increase in net cost, borrowers from upper-middle-income (\$60,001–92,000) and high-income ($>$ \$92,000) families increased borrowing by only \$442 and \$241, respectively.

The impact of the availability of subsidized loans also differed across family income levels. Most telling, low-income students in our sample did not increase borrowing because of increased availability. Only students from lower-middle-income and upper-middle-income families increased borrowing in response to the \$2,000 increase in loan limits, by \$344 and \$301, respectively.

Although an increase in net cost may force students to borrow additional amounts, an increase in the availability of subsidized low-interest loans provides the opportunity to lower college costs. Subsidized low-interest loans reduce costs: The subsidy value has a direct negative impact on costs, and students can lower total interest costs of borrowing if the low-interest loan in question replaces existing higher interest loans. The lack of a response of low-income students in overall borrowing to an increase in the availability of subsidized loans, therefore, deserves scrutiny.

To investigate this issue, we plotted the average amount of Perkins Loan against EFC for low-income students (see Figure 7). The dashed line represents the average amount of Perkins Loan received by students before the limit expansion, and the solid line represents average Perkins Loan amounts after the limit expansion. A vertical line is placed at EFC equal to \$5,000 to mark the eligibility cutoff value of Perkins Loan. The graphs show a rather large increase in the amount of Perkins Loans following the limit increase for students with $EFC \leq \$5,000$. Coupled with our earlier evidence on the lack of an increase in total loan amounts after the limit increase, it appears that Perkins-eligible students from low-income families use the additional subsidized loan to replace other loans.

Figure 7
Amounts of Perkins Loan Received Before and After Limit Expansion: Students With Income \leq \$32,000



These results strongly suggest that loan dependence of students in postsecondary education is mostly a consequence of rising college costs, and not the outcome of increased availability of loans, especially for less affluent students, contradicting opinions in King (1999) and Redd (2001). In our study, low-income students increased intakes of Perkins Loans in response to the limit increase, but did not increase overall borrowing—in other words, they used the lower interest rate Perkins Loan to replace loans with high interest rates.

Our results suggest that an emphasis in financial aid toward loans and away from grants deepens the loan dependence of postsecondary students across the board and by the largest

margin for the poor. The expansion of low-interest subsidized loans, on the other hand, is nonetheless beneficial because they replace expensive loans and help lower college costs.

If the borrowing decisions of students are made in connection with college choice (i.e., net cost of attendance), our results on net costs apply to students attending OSU or other public 4-year colleges with similar net costs. Our estimates of the effect of increased loan availability, on the other hand, were obtained by exploiting exogenous increases in loan limits, and are not affected by selection problems.

Conclusion

Students borrow to bridge the gap between total cost of attendance and the sum of grants, scholarships, and tuition discounts. One would expect the amount of loan to depend on the size of the gap, levels of family resources, and, additionally, on the cost of borrowing. Our results indicate that for very poor students, net costs and the availability of family resources are substantially more important determinants of student borrowing than are the costs of borrowing. The importance of net cost is evident in its very large marginal effect, especially for the two poorer groups.

The evidence on the role of family resources is twofold. First, parental education, as indicator of family wealth, has large effects on borrowing at all levels of family income. Second, and more importantly, the impact of net cost declines sharply between lower-middle-income and the upper-middle-income students, meaning that a given increase in net cost results in smaller additional loan for more affluent students.

As noted in the Discussion section, Perkins-eligible students from low-income families used subsidized loans to replace other loans following the limit increase for students with EFC \leq \$5,000. Because Perkins is the lowest cost variety of available federal student loans, these students essentially substituted more expensive loans with their less expensive counterparts.

Students from lower-middle- and upper-middle-income families, however, increased overall borrowing after the Perkins Loan limit increase. Summary statistics from Table 1 strongly suggest that those students, especially those from lower-middle-income families, were severely constrained from seeking inexpensive loans prior to the limit increase. For example, lower-middle-income students faced a net cost of \$11,437, and had an average EFC of \$5,919. After subtracting the EFC from the net cost, they needed to raise \$5,528 through a combination of student loans and earned income. Since Stafford loan (subsidized plus unsubsidized) allocations were capped at \$2,625 for financially dependent freshman students, those students were forced to seek alternative, more expensive sources of financing. All of our sample students were in their freshman classes, and 98.9 were financially dependent on their parents. Among lower-middle- and upper-middle-income students, proportions

This is the first study to analyze the borrowing response of low-income students to exogenous increases in the availability of subsidized loans.

of financially dependent students are 99.8% and 100.0%, respectively. The increased availability of Perkins Loans thus allowed them to lower borrowing costs.

The problem with inadequate allocation of inexpensive Stafford loans assumes greater importance once we take into account the inflated nature of the EFC as a measure of actual contributions of the family. In our sample of freshman OSU students between 2000 and 2005, the average family income for lower-middle-income students is \$46,548, yet they have an average EFC of \$5,919, meaning they are expected to contribute \$5,919 toward direct and indirect educational costs—almost 13% of the pretax income of the family. If the family can contribute even 50% of the expected contributions, lower-middle-income students have to obtain an additional \$2,959 without concomitant increases in loan allocations.

It should be noted that this is the first study to analyze the borrowing response of low-income students to exogenous increases in the availability of subsidized loans, although results from previous studies suggest positive impacts of exogenous increases in loan availability among middle-income students, similar to our findings. Dynarski (2002), for example, utilized the removal of home equity values from the determination of EFC to investigate effects of increased loan availability on the educational attainment of middle-income students. The positive result in the study suggests that those students also took advantage of an increase in the availability of subsidized loans.

Recent studies have questioned the wisdom of blaming college costs wholly for the escalation of student borrowing, claiming that low-income and lower-middle-income students borrow large amounts because inexpensive subsidized loans are available. In this study, we verified the claim, estimating a model of the amount of loan as a function of net cost, the availability of subsidized loans, and other determinants. Our results showed large effects of net cost, especially for low-income and lower-middle-income students. Increased availability of low-cost federal loans does not lead to additional borrowing by the poor, but allows such students to replace more expensive varieties of student loans. Middle-income students increase borrowing when availability rises, but such effects appear small when contrasted against the impact of net cost.

We also found that parental wealth plays a large role in student borrowing. In conjunction with a dramatic reduction in the effect of net cost in family income, the large role of family wealth suggests that borrowing by students is mostly a function of the cost of attendance and the level of resources they command, and not an outcome of the expansion of federal loan limits. Our findings suggest that curbing the growth of the net cost of college checks the loan dependence of postsecondary education, whereas increased allocations of low-interest subsidized loans allow less affluent students to lower their attendance costs.

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APPENDIX A
Estimates of the Tobit Model of Loan Amounts

	All Students	Income			
		≤ \$32K	\$32K-\$60K	\$60K-\$92K	> \$92K
Net cost (in constant \$100)	167.040*** (6.489)	179.118*** (11.995)	156.222*** (15.578)	96.960*** (14.213)	71.781*** (16.904)
Net cost ² (in constant \$10,000)	-1.196*** (0.080)	-1.301*** (0.167)	-0.961*** (0.194)	-0.568*** (0.158)	-0.439** (0.190)
Net cost ³ (in constant \$1 million)	0.003*** (0.000)	0.004*** (0.001)	0.002** (0.001)	0.001 (0.001)	0.001 (0.001)
Net cost ⁴ (in constant \$100 million)	0.000*** (0.000)	0.000** (0.000)	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)
Perkins Loan eligible	1,763.963*** (63.710)	2,932.162*** (348.069)	1,761.344*** (108.934)	1,762.191*** (160.996)	1,171.764 (1,154.032)
After limit expansion	-322.112*** (45.420)	175.484 (406.962)	-444.053*** (103.319)	-270.798*** (61.515)	-365.548*** (82.526)
Perkins eligible × after limit expansion	232.197*** (69.482)	-452.539 (414.580)	602.348*** (127.600)	607.021*** (214.239)	-290.833 (1,457.494)
Male	21.040 (31.877)	-72.012 (83.076)	57.357 (61.042)	-65.757 (50.761)	112.322* (65.656)
Financially dependent on parents	-155.449 (163.216)	-710.799*** (206.141)	411.279 (907.005)	2,466.038 (1,715.180)	
Age	-571.828*** (183.154)	-393.688 (323.267)	-576.729* (321.469)	-2,911.553* (1,755.341)	-9,304.606** (4,428.469)
Age ²	15.954*** (4.265)	12.661* (7.217)	16.316** (7.517)	79.101* (46.546)	248.555** (118.902)
Black	284.779*** (59.854)	-192.364 (118.595)	510.338*** (107.186)	723.288*** (111.681)	714.300*** (167.009)
Asian	-780.131*** (76.032)	-1,136.803*** (169.519)	-990.779*** (140.101)	-551.035*** (131.683)	-317.412* (169.453)
Hispanic	113.539 (94.385)	-281.771 (206.916)	-178.677 (179.888)	486.459*** (160.100)	108.037 (216.048)
ACT score	173.219*** (40.354)	79.689 (83.728)	122.410 (77.858)	169.319** (76.354)	-67.541 (109.955)
ACT ²	-4.577*** (0.817)	-2.477 (1.807)	-3.251** (1.589)	-4.461*** (1.518)	-0.576 (2.137)
Ohio resident	-736.347*** (72.955)	-1,714.079*** (182.794)	-737.616*** (153.330)	-576.480*** (125.640)	-432.532*** (139.639)
Income (in constant \$1,000)	-11.878*** (0.724)	-5.143 (19.917)	18.788 (46.812)	-97.008* (50.277)	-12.528*** (1.384)
Income ² (in constant \$1 million)	0.011*** (0.001)	0.407 (0.543)	-0.138 (0.505)	0.538 (0.332)	0.013*** (0.002)
Both parents 4-year college graduates	-523.510*** (40.556)	-325.308*** (111.592)	-438.334*** (74.257)	-578.506*** (63.242)	-616.011*** (102.902)
One parent is 4-year college graduate	-156.944*** (40.321)	-19.347 (94.841)	-206.740*** (70.481)	-181.634*** (64.664)	-300.340*** (112.077)
Log likelihood	-158,768.68	-30,936.515	-48,526.687	-46,933.525	-32,031.748
N	28,059	4,938	7,233	8,289	7,599

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

APPENDIX B
Results From Hypotheses Tests on the Equality of Coefficients
Across Income Groups

	Low-Income [b ₁]	Lower-Middle Income [b ₂]	Upper-Middle Income [b ₃]	High-Income [b ₄]
Low-income [b ₁]		b ₁ b ₂ = 242.731***	b ₁ b ₃ = 6,012.968***	b ₁ b ₄ = 3,406.376***
Lower-middle income [b ₂]	b ₂ b ₁ = 365.243***		b ₂ b ₃ = 1,531.935***	b ₂ b ₄ = 3,757.928***
Upper-middle income [b ₃]	b ₃ b ₁ = 4,250.678***	b ₃ b ₂ = 457.379***		b ₃ b ₄ = 650.218***
High-income [b ₄]	b ₄ b ₁ = 999,872.33***	b ₄ b ₂ = 17,385.44***	b ₄ b ₃ = 252,015.46***	
LR ratio test (χ ²)				680.41***

Note. The likelihood ratio test (LR; Brouwer & Spaninks, 1999) uses the following test statistic and has a χ² distribution.

$$2 \times \text{LogLikelihood}_{(\text{entire sample})} - \sum_{i=1}^4 \text{LogLikelihood}_i$$

$$b_1b_2 = (b_1 - b_2)'V^{-1}(b_1 - b_2)$$

$$b_2b_1 = (b_2 - b_1)'V^{-1}(b_2 - b_1)$$

b_i represents the vector of estimated coefficients; V_i is the estimated symmetric variance-covariance matrix. There are no independent students among high-income families. The equality of coefficients involving the high-income group is tested using models that exclude independent students from the other income groups.

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