Leveling Up: Early Results from a Randomized Evaluation of Post-Secondary Aid

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Abstract

Does financial aid increase college attendance and completion? Selection bias and the high implicit tax rates imposed by overlapping aid programs make this question difficult to answer. This paper reports initial findings from a randomized evaluation of a large privately-funded scholarship program for applicants to Nebraska's public colleges and universities. Our research design answers the challenges of aid evaluation with random assignment of aid offers and a strong first stage for aid received: randomly assigned aid offers increased aid received markedly. This in turn appears to have boosted enrollment and persistence, while also shifting many applicants from two- to four-year schools. Awards offered to nonwhite applicants, to those with relatively low academic achievement, and to applicants who targeted less-selective four-year programs (as measured by admissions rates) generated the largest gains in enrollment and persistence, while effects were much smaller for applicants predicted to have stronger post-secondary outcomes in the absence of treatment. Thus, awards enabled groups with historically-low college attendance to 'level up,' largely equalizing enrollment and persistence rates with traditionally college-bound peers, particularly at four-year programs. Awards offered to prospective community college students had little effect on college enrollment or the type of college attended.

1 Introduction

Every year, U.S. government agencies and many private groups distribute billions of dollars in college financial aid. The federal government spends about $32 billion annually on Pell Grants alone (Congressional Budget Office, 2013). A large body of research attempts to determine if this aid affects college choice and attendance (see, for example, Abraham and Clark (2006); Avery et al. (2006); Bound and Turner (2002); Cornwell et al. (2006); Dynarski (2000); Goodman (2008); Kane (2007)).[1] As Deming and Dynarski (2009) explain, however, selection bias and the complicated nature of college aid programs make the relationship between financial aid and post-secondary outcomes hard to interpret. Perhaps not surprisingly in view of these challenges, empirical assessments have produced a wide range of impact estimates, many of which appear sensitive to the underlying assumptions used to identify causal effects.

This paper reports initial results from a randomized evaluation of one of the largest private aid programs in the country. For decades, the Susan Thompson Buffett Foundation (STBF) has offered grants to Nebraska high school seniors who express interest in attending the state's public colleges and universities. The largest STBF awards are worth more than $60,000, covering tuition and fees for up to five years of study at any Nebraska public college. Interested students apply for STBF aid as high school seniors. Awardees are selected on the basis of financial need, high school GPA, and a review of personal statements and reference letters. STBF aid recipients, called Buffett Scholars, can use their awards to cover costs at any University of Nebraska campus (known collectively as NU), any of the six Nebraska community colleges, or at a set of three four-year state colleges outside the NU system. Buffett Scholars who attend NU also participate in Learning Communities (LCs), a Foundation-supported academic services intervention similar to other Learning Communities programs around the country.[2] The Buffett program supports more than 3,000 students each year, with annual spending running more than $25 million.

In an effort to gauge the effectiveness of grant aid and Learning Community access, we implemented a randomized evaluation of the STBF program, awarding more than 2,000 scholarships via random assignment. The results reported here include applicants applying for college entry in the Fall of 2012 and in the Fall of 2013, covering a follow-up window that extends into sophomore year

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[1]Leslie and Brinkman (1988) and Deming and Dynarski (2009) survey this literature.
[2]See Visher et al. (2012) for a review of research on LC impacts.

for the 2012 cohort.

Our first important finding is that STBF scholarship offers substantially increased the amount of financial aid Buffett Scholars received. This result is far from automatic: as a rule, federal and institutional grants fall in response to increased outside financial support, implicitly taxing away the added funds. In this case, however, agreements between STBF and Nebraska's public colleges minimize offsetting reductions in institutional aid. As a result, STBF award offers increased students' grant aid by about $6,200 on average in the first year and $6,400 in the second. This represents a net increase of 91 cents in grant aid for every STBF dollar awarded, with offsetting reductions in government loans and Federal Work Study aid of 29 cents and six cents per dollar awarded, respectively.[3]

STBF support also changed students' enrollment behavior. Aid offers increased the probability that a student enrolled in any college in the first year by only two percentage points, but there was little room for improvement on this margin since 97 percent of control students enrolled in college even without STBF support. At the same time, STBF support substantially altered students' college choices: the fraction of applicants matriculating at four-year colleges rose by almost eight points.

Gains in sophomore enrollment were more substantial: aid offers increased overall sophomore enrollment by 7.2 points, with four-year enrollment gains of 14 points. Persistence increased most among groups that typically have low persistence rates: we find a remarkable 20-plus point gain in four-year enrollment for nonwhite applicants and for those with ACT scores below the state median. Persistence effects were also larger for male applicants and students with low high school GPAs. On balance, STBF scholarships substantially equalized enrollment and persistence rates across groups, enabling students with low expected persistence to 'level up' with their traditionally college-bound peers. In contrast, applicants who targeted community colleges were largely unaffected by STBF awards.

To distinguish the effects of STBF's financial aid from those of LC services, our second experimental cohort included a group that was offered aid without access to LCs. This aid-only treatment, known to applicants as the College Opportunity Scholarship (COS), offered financial support to NU

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[3] Reported offset amounts are from the first year of enrollment. Offsets of grants and government loans were slightly smaller in the second year, while the offset of work-study aid was similar.

applicants in the same amounts and under the same conditions as full STBF awards, but without offering seats in the STBF LC programs operating on NU campuses. Initial findings from the aid-only treatment show effects similar to those generated by full award offers, with some evidence the LC treatment induced applicants to enroll and persist at more selective colleges than would have otherwise been the case. Because the COS cohort enrolled in 2013, comparisons between COS and traditional full STBF awards are still provisional.

Our study contributes to the burgeoning literature on the causal effects of college financial aid on aid recipients. Like the STBF program, much of the new wave of government aid for college is merit- as well as need-based. Dynarski (2004) reviews research on state merit aid programs modeled on Georgia's HOPE Scholarship. Most of this work exploits state-by-cohort variation in access to government aid. Dynarski concludes that the HOPE program had large and significant effects on college attendance. She also reports positive (though smaller) effects for similar merit aid programs across the South. The effects of these programs, however, vary widely across racial and socioeconomic groups, with three out of the four programs studied showing larger gains among minorities and the HOPE program itself seeming to generate smaller gains for minorities.

In contrast with the differences-in-differences style evaluations that feature in many recent impact evaluations of aid, Marx and Turner (2014) uses discontinuities in the Pell Grant formula to evaluate aid effects on City University of New York (CUNY) students. Regression discontinuity estimates suggest Pell aid reduces CUNY students' borrowing without affecting their schooling. Like most regression discontinuity designs, these results are most relevant for students with running variable values near kinks and cutoffs. It's also worth noting that most CUNY students attend campuses that are more selective than the Nebraska schools targeted by our sample.

Our work is also closely related to a recent randomized evaluation of need-based grant aid at Wisconsin's public colleges by Goldrick-Rab et al. (2012). The Wisconsin Scholars Grant (WSG) offered an additional $3,500 to Pell-eligible Wisconsin residents who were already enrolled as full-time freshmen at four-year public institutions. Results from the Wisconsin evaluation suggest WSGs had modest effects on sophomore enrollment, with no evidence of effects beyond the second year. Our intervention similarly uses a randomized research design, but STBF awards are more than twice as large as the Wisconsin grant. In addition, our intervention targets high school students who have yet to make their initial enrollment decisions. Our design therefore reveals aid effects on

whether and where students go to college.

Finally, a large literature examines the value of post-secondary support services. A recent randomized evaluation of Learning Communities interventions at Kingsborough Community College in New York shows only modest impacts (Bloom and Sommo, 2005), though Weiss et al. (2014) find stronger effects. Two randomized evaluations of traditional support services for Canadian college students show some benefits from services combined with merit aid, though only for women (Angrist et al. 2009, 2014). A recent randomized evaluation of mentoring and coaching (Bettinger and Baker 2014) suggests this sort of intervention can be highly cost-effective.

The next section describes the STBF program and our experimental design. Section 3 discusses the scholarships' effects on students' financial aid packages. Section 4 reports reduced-form estimates of the effect of aid offers on college matriculation and persistence, including effects in important subgroups. Section 5 combines the reduced-form and first-stage analysis to estimate and compare cost effectiveness across target institutions. In a calculation that builds on the pioneering evaluation of federal BEOG grants in Fuller et al. (1983), we also show how the experimental estimates can be used to distinguish program spending that changes behavior from infra-marginal spending that amounts to a pure transfer. Provisional results from the aid-only arm of the experiment are discussed in Section 6. Finally, Section 7 summarizes the findings and briefly discusses our work in progress.

2   Background

2.1   The STBF Scholarship Program

The Susan Thompson Buffett Foundation has offered financial aid to Nebraska college students since 1965. The Foundation is the largest private grant provider in the state and among the largest in the country, supporting more than 3,000 students each year. STBF aid can be applied toward expenses at any public undergraduate institution in Nebraska, including two- and four-year colleges.

As with federal Pell Grants, STBF award criteria consider financial need; like many state aid programs, STBF awards are also partly based on merit. The STBF program is distinct from government programs, however, in that the STBF merit assessment considers both quantitative and qualitative inputs, including financial need, high school transcripts, essays, and letters of recommendation. STBF awards are also unusually generous and available to some students who are ineligible

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for federal Pell grants. The STBF-eligible applicant pool consists of Nebraska-resident high school seniors or graduates of in-state high schools who have not yet been to college. STBF gauges financial need using the Expected Family Contribution (EFC) determined by the government's Free Application for Federal Student Aid (FAFSA).[4] EFC cutoffs for Buffett Scholarships were $15,000 in 2012 and $10,000 in 2013, while Pell cutoffs were much lower ($5,081 in 2013). STBF also considers college readiness, requiring a minimum 2.5 high school GPA. The scholarship application asks students to indicate which schools they plan to attend should they receive awards. Although this is a non-binding declaration, in practice, most applicants attend the school they identify as their target. Applicants' target schools also figure importantly in the review process: after applications are scored, students are ranked against those who have indicated the same target.

STBF award amounts vary by campus but are calibrated to match the cost of tuition and fees for a full-time student plus a $500 allotment for books. For example, 2013 awards provided up to $8,500 per academic year for full-time students at the University of Nebraska-Lincoln campus, where full-time resident tuition and fees ran to $8,060. STBF provides an additional semester's worth of funding for summer enrollment, so that the maximum 2013 award was $12,750.[5] The maximum annual award for attending a two-year program was $5,400 in 2013. Though tuition prices determine the value of STBF awards, the award money can be used to cover any of the federally-defined components of cost-of-attendance (COA), including room, board, books, and supplies.[6] This flexibility further boosts the scholarship's value relative to many aid programs, which often cover only tuition and fees. Because most Buffett Scholars qualify for public need-based aid like Pell Grants, STBF awards often cover the remaining balance of students' COA, eliminating the need for loans or out-of-pocket contributions to college costs. Buffett awards are renewable for up to five years provided students meet minimal academic standing requirements, though no more than three

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[4]Home-schooled students are eligible for Buffett aid, as are GED recipients who earned their credentials in Nebraska. Undocumented immigrants are also eligible, but legal residents of other U.S. states are not. Undocumented immigrants can apply for Buffett aid without completing a FAFSA.

[5]As far as we know, the only state program that approaches this level of generosity is California's merit-based Cal Grant A, studied in Kane (2003). See Table 1 of Deming and Dynarski (2009) for a review of financial aid programs. In comparison, the maximum Pell Grant was $5,550 in 2012-13, while the average Pell award was $3,650 (College Board, 2014).

[6]Post-secondary schools that receive federal aid report COA figures to the federal government. COA includes tuition and fees, room and board, books and supplies, and personal costs such as transportation. STBF transfers scholarship funds directly to schools, who then apply the funds to awardees' college bills. Since COA components like off-campus housing and supplies do not appear on college bills, colleges distribute unused STBF award money by writing checks to students with credit balances. The total value of aid received cannot exceed COA, however. Awards are prorated for less than full-time attendance.

years of funding can be paid toward two-year college expenses (Students enrolled for fewer than nine credits per semester or with a cumulative GPA below 2.0 risk losing their scholarships).

Buffett Scholars who attend one of NU's three campuses—Lincoln (UNL), Omaha (UNO), or Kearney (UNK)—are required to participate in the Thompson Scholars Learning Community (LC) programs during their first and second years. These programs are designed to promote academic success and social engagement. While the LC programs differ somewhat by campus, they all include specialized classes with other Buffett scholars, academic and social activities, peer mentoring, and academic advising services from LC faculty and staff. In two of the LC programs (UNK and UNL), the majority of scholarship recipients live together in a residence hall. Buffett Scholars who fail to participate in LC activities risk losing their scholarships.

2.2   Research Design

For the purposes of this research, STBF applicants for 2012 and 2013 matriculation were divided into three groups based on reviewer ranks. The most highly-ranked applicants (301 out of 1,430 eligible applicants in 2012 and 356 out of 2,267 in 2013) were guaranteed awards, while the lowest-scoring applicants (127 in 2012 and 273 in 2013) were removed from consideration. The rest were subject to random assignment, with award rates determined by STBF preferences for award counts at the target schools in each cohort. (The estimated program impacts discussed below control for a full set of target school by year of application dummies—what we call strata dummies—to reflect differential award rates across strata). The 2012 randomization group included 1,003 applicants, 504 of whom were offered aid. The 2013 randomization group included 1,638 applicants, 697 of whom were offered aid. Appendix Table A1 reports further information on sample size and target colleges.

Among the 2013 randomized applicants who targeted NU, there were two types of aid offers, as noted above: a full scholarship with mandatory LC participation for those matriculating at NU and an equivalent aid award with no LC requirement. Of the 697 random awards offered in 2013, 210 were aid-only College Opportunity Scholarships (COS). We focus here on the effect of full awards, reporting results primarily from a 2013 analysis sample that includes the 1,428 experimental applicants not offered the COS. Section 6 reports briefly on the ongoing comparison of COS and full awards.

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2.3 Data and Descriptive Statistics

Data for this project come primarily from the STBF scholarship application, the administrative records of Nebraska's public colleges, and the National Student Clearinghouse (NSC). The application provides a rich set of baseline characteristics, including high school transcripts, ACT scores, and detailed demographic and financial information from federal Student Aid Reports. The application did not ask students to report their race; we obtained race data from state driver's license records.

More than 90 percent of applicants who enrolled in college attended a Nebraska public institution. These colleges and universities provided information on their students' enrollment, aid packages, and academic outcomes. To capture enrollment at private and out-of-state colleges, we supplemented school-provided data with information from the NSC, which captures 92 percent of enrollment nationwide (Dynarski et al., 2013). NSC records report institution attended and enrollment status (full-time, half-time, etc.) We provide additional information about data sources and data processing in the appendix.

STBF applicants in 2012 and 2013 were, on average, from substantially poorer households than the general population of Nebraska high school seniors. This can be seen in the first two columns of Table 1, which compare descriptive statistics for scholarship applicants and high school students statewide. STBF applicants were also disproportionately female and less likely to have college-educated mothers. ACT scores among applicants were similar to those of other Nebraska ACT test-takers, though applicants were more likely than other Nebraska seniors to have taken the ACT.

Column 3 of Table 1 reveals that STBF's top-ranked applicants, those who received awards without being subject to random assignment, had academic credentials similar to those in the randomization group. The most important difference between the automatically-funded and randomized groups was socioeconomic status: students who received STBF awards without random assignment had lower family incomes and less educated mothers. This group also contained a higher proportion of Hispanic applicants. At the other end of the applicant pool, those disqualified before random assignment had lower high school grades and ACT scores than those in the randomization group.

Random assignment successfully balanced the characteristics of those in the randomization group

who were and were not offered aid. This is documented in column 6 of Table 1, which reports strata-adjusted differences in treatment and control characteristics, along with the associated standard errors. Appendix Table A2 reports balance estimates separately for the two randomization cohorts, while Appendix Table A3 reports balance estimates within strata. Treatment and control students in the randomization group had family incomes around $50,000 per year and Expected Family Contributions of just over $3,000. Roughly two-thirds of those randomized are white and about 60 percent are female.

3 How Awards Changed Aid Packages

We begin by describing the effect of STBF awards on Buffett Scholars' financial aid packages. This analysis is necessarily limited to the sample of students who attended Nebraska public colleges since our administrative aid data come from these colleges. Because STBF awards affect the likelihood of being part of this sample, the analysis here may be compromised by selection bias. In practice, however, the effect of STBF awards on the likelihood of having detailed aid data is small—awards change the probability of attending a Nebraska public college by no more than six percentage points—and the effects of STBF award packages on aid composition are large. It therefore seems likely that the picture painted here, though in principle more descriptive than causal, still provides a useful gauge of the value of aid for recipients.

As a benchmark, the first column of Table 2 describes the first-year financial aid packages of control group students who attended Nebraska public colleges. Aid amounts averaged over $11,500, of which roughly $7,250 is grant aid, with the remainder divided between government loans (about $3,500) and work study (about $800). Our aid figures omit private loans, a category for which we have limited data; however, subsidized public loans are the primary source of borrowed funds for this low-income population.

Estimates of the effects of scholarship offers on aid packages come from regression models of the form:

$$A_i = \beta S_i + \sum_{s,c} \delta_{sc} r_{isc} + \gamma' X_i + \varepsilon_i, \tag{1}$$

where A_i is the dollar amount of aid student i received and S_i is an indicator for whether student i

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was (randomly) offered an STBF scholarship. The dummies r_{isc} indicate whether applicant i from cohort c listed school s as her intended college. These cohort-specific strata dummies account for differential award rates by target college and application year. The covariate vector, X_i, includes family income, EFC, high school GPA, and ACT composite score. To the extent that selection into Nebraska public colleges varies with these traits, X_i mitigates the associated bias. Finally, ε_i is a person-specific error term. To estimate the effect of a dollar of STBF aid on dollars of other aid received, we replace S_i in equation (1) with the dollar amount of each STBF scholarship.

Scholarship winners received an average of $6,924 in STBF grant aid in their first year (Because a few students turned down STBF scholarships in favor of other named awards, this is an intent-to-treat contrast between treatment and control subjects.) STBF awards increased total grant aid by $6,225, from a base of $7,251 in the control group. The less than one-for-one aid pass-through reflects a $698 decline in institutional awards and private grants and a (statistically insignificant) decrease of one dollar in federal grants. For some students, the reduction in institutional aid reflects the COA cap on total aid disbursed, rather than a discretionary reduction on the part of institutional aid officers.

Increased grant aid substantially reduced students' reliance on student loans and use of work study programs. Column 2 of Table 2 shows that aid offers reduced government loans by $2,220 and Federal Work Study aid by $486 (both around 60 percent of the corresponding control group means). Total aid—the sum of grants, federal loans, and work study—averaged $11,608 in the control group and was just over $3,300 higher in the treatment group. The estimates in column 4 of Table 2 show that each dollar of STBF grant aid increased students' total grant aid by $0.91, while reducing loans by $0.29 and reducing work study by $0.06, for a net gain of $0.53 per dollar awarded.

These results capture two countervailing effects of scholarship offers on the amount of aid received. At any given college, scholarship money crowds out aid from other sources, reducing award effects on total aid received. But awards also change students' college choices. In particular, as we explore in detail below, STBF awards caused many applicants who would have otherwise gone to two-year schools to attend four-year schools at a higher cost. This shift is captured in the first row of Table 2, which shows Buffett Awards increasing students' cost of attendance by $0.24 per dollar of aid received. Though four-year colleges cost more, they also provide more grant aid: the average

control group student attending a four-year college received $7,600 in grant aid, $4,000 more than the average control student attending a two-year college. Scholarship money therefore "crowds in" aid by moving students to more expensive campuses that offer more financial aid.

To disentangle the crowd-out and crowd-in effects, columns 3 and 5 of Table 2 (labeled "campus adjusted") report estimates of a version of equation (1) that includes campus controls, that is, a set of variables that count the number of full-time equivalent terms students attended at each Nebraska public college in the aid year. These campus-adjusted regressions isolate the extent to which, at a given college, STBF aid crowds out other forms of aid. The results in column 5 show that, at a given college, students lost $0.22 in total grants for each scholarship dollar awarded, an effect that's more than twice as large as the loss estimated without campus controls. Of course, these results should be interpreted cautiously, since campus choice is an outcome affected by STBF awards. Results from models with campus controls therefore combine causal effects on aid packages for those whose choices are unchanged by STBF awards with compositional effects that result from treatment-induced changes in college attended. These compositional effects, a form of selection bias generated by conditioning on outcomes, arise if, conditional on observed characteristics like EFC, treatment and control students attending the same college would be offered different financial aid packages in the absence of treatment. Because institutional awards are in large part a mechanical function of student traits like EFC, the extent of selection bias in this case is likely to be modest.

Buffett awards changed financial aid packages even more substantially in year two than in year one, with smaller offsetting reductions in aid from other sources. These and other results for second-year aid packages appear in Table 3, again for a sample of those enrolled in Nebraska public colleges.[7] The net increase in total aid generated by a dollar of STBF money in year two was 73 cents, while the campus-adjusted increase was 41 cents. STBF awards also reduced loans and work study in year two. Appendix Table A4 extends the results in Tables 2 and 3 with an analysis of effects on more detailed aid categories.

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[7]Aid data in year two is necessarily missing for those who leave college. Year two aid data is missing for about ten percent of the year one control sample and for about five percent of the year one treatment sample for which aid is available in year one.

4 Effects on Enrollment and Persistence

4.1 College Enrollment

The vast majority of STBF applicants attended college in the first year after application whether or not they won STBF awards. This is apparent in Table 4, which shows control means for enrollment outcomes and estimated effects of scholarship offers using data from the first year of potential enrollment. Although 97 percent of control students enrolled in college, STBF awards increased this rate by a statistically significant two percentage points. This estimate and others in Table 4 come from a regression model similar to that described by equation (1), where, instead of aid awarded, the dependent variables are enrollment outcomes. All students in the experimental group are included in these regressions regardless of whether they attended Nebraska public colleges. Covariates are included in an effort to increase precision.

Buffett awards increased four-year college attendance by 7.8 points above a control mean of 75 percent. Two-year attendance, in contrast, fell by about six points. The increase in four-year attendance therefore reflects a shift from two to four-year schools. This institutional upgrading is likely a consequence of the tuition subsidy implicit in the STBF award scheme: Buffett awards cover tuition at any Nebraska public college, and the four-year colleges cost twice as much.

STBF awards decreased the fraction of students attending out-of-state or private colleges from seven percent to about three. Importantly, however, and in contrast with findings for the Massachusetts's Adams Scholarship reported by Cohodes and Goodman (2013), the shift to Nebraska public schools was concomitant with a shift towards more selective institutions. Specifically, STBF awards increased the proportion of students attending selective colleges (colleges with admission rates below 75 percent) by nearly four points. The fraction of students attending moderately-selective four-year colleges (with admissions rates between 75 and 90 percent) increased by a similar amount.[8] Most STBF applicants students who chose out-of-state colleges attended less selective colleges close to the Nebraska border; STBF aid pushed some of them to more selective NU campuses.

Effects in target college strata capture differences across groups of applicants with more or less

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[8]UNL's admission rate is below 75%, while UNK and UNO both have admissions rates between 75% and 90%. The remaining Nebraska public colleges have admissions rates above 90%.

ambitious higher education plans. Those targeting relatively-selective UNL were almost certain to enroll in college, so STBF awards changed overall enrollment status little in this group. Even among these relatively ambitious students, however, the scholarship increased the fraction of students attending four-year colleges by 6.5 points and increased the fraction of students attending selective colleges by 12 points.

Overall enrollment effects were larger for applicants targeting UNO and UNK. In this group, STBF awards boosted post-secondary enrollment by 3.4 points and the proportion enrolling on a four-year campus by an impressive 13 points. STBF offers in the UNO/UNK strata also increased attendance in moderately-selective colleges by 15 points. This change is due in part to awardees' shift from two-year programs to their target colleges.

We see little evidence of scholarship-induced changes in first-year enrollment outcomes for applicants targeting state and community colleges. Estimated enrollment effects in both groups are small and none are significantly different from zero. Unlike students targeting NU campuses, few who targeted community colleges chose to attend four-year programs as a result of award receipt.

4.2 College Persistence

Many interventions produce short-lived gains, but STBF awards generated a large and growing impact on students' college enrollment. This can be seen in Table 5, which shows estimates analogous to those in Table 4 for the second year after scholarship application. STBF awards appear to have substantially reduced dropout rates between freshman and sophomore years. Enrollment among treated students decreased just four points, from 99 percent in the first year to 95 percent in the second. The dropout rate was twice as large among control students, whose enrollment rate fell from 97 percent in year one to 88 percent in year two. Thus, STBF awards increased year-two enrollment by more than seven points. The awards also led enrolled students to take more credits. By the end of year two, treated students had amassed an additional 0.37 semester equivalents of college enrollment, about twice the effect we would expect to see if enrolled treated students took the same number of credits as enrolled control students.[9] Year-two effects on four-year college going were even larger: STBF awards increased four-year enrollment by 14 points in year two, twice the effect in year one.

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[9]The data appendix details the link between credit completion and semester equivalents.

As with the first-year results, those for year two show important differences across target-school strata. The largest effects on four-year enrollment are for applicants who targeted UNO and UNK, the less selective of the three NU campuses. STBF awards boosted four-year enrollment for these applicants by a remarkable 24 points in year two, with the entire gain coming from enrollment in moderately-selective colleges (a group which includes these targets). Again, these estimates are about twice as large as the effects on first-year enrollment. Though STBF awards had no impact on initial enrollment in the state college strata, awards increased second-year enrollment in this group by 13 points. By the end of year two, treated students targeting state colleges had amassed about two-thirds of a semester more than the control group. Again, however, awards did little to alter enrollment outcomes in the group targeting community colleges.

Why do STBF award effects increase so markedly in year two? Table 6 sheds light on this question by reporting effects on the joint distribution of enrollment in the first two years of follow-up for the 2012 cohort. The first column and first row report marginal effects on enrollment in years one and two, respectively, while the remaining rows and columns report joint effects. Control means are reported in braces in each cell. The first cell in row 1 shows that 88 percent of control group students enrolled in post-secondary schooling in the second year of the experiment and that award offers raised this probability by 7.2 points. The estimate in row 2, column 2 shows that the scholarship offer raised the joint probability of any post-secondary enrollment in both year one and year two by 7.6 percentage points. The cell in row 5, column 2 reveals that second year enrollment is effectively zero conditional on non-enrollment in year one. Hence, the treatment-induced gains in year two enrollment seen in Table 5 are due almost entirely to retention of those who start college in year one.

Many control group students drop out of college, especially those enrolling initially in four-year programs. While 76 percent of control group students enrolled in four-year colleges in year one, just 63 percent enrolled in four-year colleges in both years. About 60 percent of four-year college dropouts were not enrolled anywhere in year two, while the remainder were enrolled in two-year colleges. Because STBF awards increased the number of students enrolling in four-year colleges in year one, we would have expected the number of students dropping out of four-year colleges in year two to increase unless awards also raised persistence rates. Row 3, columns 4 and 5 reveal, however, that the fraction of students who started at four-year colleges and dropped out is about

half as large in the treatment group. This implies that the scholarship caused some students who were infra-marginal for four-year enrollment in year one to persist in four-year enrollment in year two.

Table 6 weighs against the view that those induced to attend four-year colleges are ill-prepared for more challenging courses and therefore at increased risk of dropping out, a version of the college mismatch hypothesis (see, for example, Arcidiacono et al., 2013). If STBF awards had induced students to enroll in four-year colleges for which they were ill-prepared, we might have seen an increase in the number of students initially enrolling in four-year colleges and subsequently transferring to two-year schools or dropping out of college entirely. As it turns out, however, the findings go the other way: the odds of starting a four year program and dropping out or transferring in year two decline in the treatment group, with the largest drop seen for the combination of a four-year start and second-year non-enrollment (a 4.4 point decline).

4.3   For Whom Does Aid Matter Most?

Estimates of effects in demographic subgroups reveal important differences in program impacts. This is apparent in Figure 1, which plots year-two enrollment by race, gender, and treatment status. In this figure and those that follow, the treatment group mean was constructed by adding the control mean and treatment effect, estimated from a model that includes strata dummies and covariates as in equation (1). (Whiskers depict the 95 percent confidence interval for the treatment effect.) Nonwhites in the control group were much less likely to attend college in year two than were whites, with an especially large race gap in four-year enrollment (compare 55 percent for nonwhites with 71 percent for whites). Yet STBF awards nearly equalized these rates across races by generating especially large gains for nonwhite awardees. Figure 1 documents a similar, but less stark, pattern for male and female applicants. Among students who were not awarded scholarships, males were less likely to enroll in four-year colleges than females (60 percent versus 69 percent), a gap that disappears in the treatment group.

Figures 2 and 3 reveal similarly striking leveling-up patterns in effects estimated conditional on ACT scores and high school GPA, both strong predictors of enrollment and persistence. In these figures, the darker lines plot enrollment rates for treated applicants, and the lighter lines

depict control group enrollment.[10] Not surprisingly, control students with lower baseline academic achievement were much less likely to attend college in year two than their higher scoring peers. In particular, Figure 2 shows a 23 point gap in year-two enrollment between students in the highest and lowest GPA bins (95 percent versus 72 percent), while Figure 3 shows a 12 point enrollment gap between the highest and lowest ACT bins (91 percent versus 79 percent). STBF scholarships virtually closed these gaps: in the treatment group, the high-low gap in year-two enrollment by GPA is just two points (98 percent versus 96 percent), while the high-low gap by ACT score is just four points (99 percent versus 95 percent).[11]

The lower panels of Figures 2 and 3 show the same general pattern of subgroup effects for four-year college enrollment in year two, though here leveling-up is incomplete. The high-low gap in four-year enrollment by high school GPA is a whopping 57 points in the control group (28 percent versus 85 percent) as compared with 39 points in the treatment group (66 percent versus 95 percent), a one third reduction. Comparing four-year enrollment by ACT score, the high-low gap is 47 percent among controls (42 percent versus 89 percent), but only 29 percent in the treatment group (96 percent versus 67 percent), a reduction of more than 40 points. Thus, while award offers increase four-year college attendance at all levels of baseline achievement, students who are least prepared gain more.

Though award impacts vary by race, gender, and academic achievement, we see little evidence of differential impact by financial need. If anything, effects on four-year enrollment are somewhat larger at *higher* EFC levels, a result that can be seen in Figure 4. This pattern may reflect the interaction between STBF aid and other need-based financial aid systems. Students with EFCs above about $5,000 were ineligible for federal Pell grants in 2012 and 2013. Consequently, among applicants with EFCs low enough to qualify for Buffett aid, STBF awards tended to generate larger net aid gains for those with EFCs above the Pell cutoff.

Our "leveling up" hypothesis is supported by the pattern of subgroup treatment effects showing the largest gains for applicants whose enrollment rates are likely to be lowest in the absence of treatment. We further substantiate this by showing how treatment effects vary with a single index of

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[10]Effects here are estimated in 10 GPA bins of width 0.15 ranging from 2.50-2.64 to 3.85-4.00. The ACT bins correspond to single point scores ranging from the 10th to the 90th percentile of the score distribution in our sample.

[11]Table A5 compares OLS and logit specifications of estimates in subgroups. Logit marginal effects are virtually indistinguishable from the corresponding OLS estimates.

expected college persistence. As suggested by Abadie et al. (2013), such "endogenous stratification" estimates are best computed using leave-out fitted values. (Otherwise persistence outcomes are mechanically correlated with predicted persistence, which may bias estimates of causal effects, particularly at extreme predicted values.) In this case, we use the control group data to fit regressions

$$Y_j = \pi'_{(-i)} W_j + \varepsilon_j; \ j \neq i,$$

for outcome Y_j and covariates W_j in leave-out samples omitting each observation i. The vector W_j contains gender, race, parental education, EFC, family income, high school GPA, and composite ACT score—all strong predictors of persistence. The resulting leave-out fitted values are given by

$$\hat{Y}_i = \hat{\pi}'_{(-i)} W_i$$

for each applicant in the control sample.

Estimates of the effect of STBF awards on four-year enrollment conditional on $\hat{Y}_i$ appear in panel A of Figure 5. This figure plots control group means for a range of $\hat{Y}_i$ running from 0.2 - 1.0 (excluding a small number of applicants with predicted enrollment rates outside this range.) Treatment group means are constructed as in Figures 1 to 4.[12] Figure 5 reinforces the finding that scholarship effects are substantially larger for groups with lower predicted persistence. Among students whose expected year-two four-year enrollment rate falls below 30 percent, awards increased four-year enrollment by 30 points, nearly doubling the 35 percent enrollment rate in the control group. In the highest bin, the estimated treatment effect is a modest six points on a base of 86 percent. Again, we see considerable leveling up: the high-low gap in four-year college enrollment for the control group is 52 points, and Buffet awards cut this roughly in half.

In the same spirit, we also examined the relationship between conditional treatment effects and STBF reviewer assessments. These subjective ratings draw on personal essays and reference letters as well as quantitative criteria like grades and test scores. As Table 1 shows, reviewers tend to favor applicants with higher ACT scores, higher GPAs, and lower family incomes. Here too, therefore, we might expect to see the same sort of negative relationship between reviewer predictions and

---

[12]Note that predictions using leave-out means need not fit empirical conditional means perfectly, even if the underlying conditional mean function is correctly specified. This is evident in Figure 5 for predictions at low and high quantiles.

program impacts seen in the pattern of treatment effects estimated conditional on fitted values from our empirical model of college readiness.

Treatment effects conditional on STBF reviewer scores are, indeed, negatively related with program impact. Scores are reported here on a seven-point scale.[13] Among those ranked one to three (the bottom of the random assignment group), STBF awards boosted four-year enrollment in year two by 14 to 25 points. By contrast, among those ranked five to seven, estimated impacts were just 10 points, and only marginally significantly different from zero.

These results highlight a challenging trade-off between increasing program-induced gains and the desire to reward past achievement. Students who appear most meritorious based on grades and test scores are also those most likely to persist in college *absent* the STBF scholarship; this group is relatively skilled and highly motivated for post-secondary schooling. Conversely, awards made to groups of applicants who appear more likely to struggle in college benefit most dramatically from merit aid when they're lucky enough to get it.

5   Bang for Buck Awarded

STBF awards boosted college matriculation, with even larger effects on sophomore outcomes. Here, we compare these estimated gains with the associated scholarship costs. Specifically, to gauge cost effectiveness (bang for buck), we scale treatment effects using a two-stage least squares (2SLS) procedure that takes the endogenous variable to be STBF program spending. The 2SLS second stage equation in this case can be written

$$Y_i = \beta A_i + \sum_{s,c} \rho_{sc} r_{isc} + \lambda' X_i + \varepsilon_i, \tag{2}$$

where the outcome, Y_i, is cumulative semesters of enrollment (through year two) at a given college type. The endogenous variable, A_i, is STBF aid received, measured in thousands of dollars. For students with full awards who attend NU, this includes the per pupil cost of LC services, estimated to be $2,920 in 2013. As before, the model includes strata dummies, r_{isc}, to account for differential awards rates across strata, and covariates, X_i, to increase precision. The instrument used to con-

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[13]The raw reviewer scores for these students range from 15 to 21; we relabel these as one to seven in the figure. Two percent of students in the experimental group received scores either below 15 or above 21. These students are excluded from the graph.

struct 2SLS estimates of equation (2) is a dummy for an STBF offer. The first stage for this 2SLS procedure is a version of Equation (1), with A_i on the left hand side.

We interpret this 2SLS cost-benefit calculation using the potential outcomes and potential assignments notation introduced by Imbens and Angrist (1994). For each applicant (omitting i subscripts), let S indicate offers as before, and let $D_2(S)$ and $D_4(S)$ count the applicant's semesters of enrollment at two- and four-year schools. These are potential outcomes indexed by S. In other words, $D_4(1)$ counts an applicant's four-year semesters enrolled if offered a scholarship, and $D_4(0)$ counts four-year semesters enrolled if not offered an award. STBF spending, $A(S)$, is a potential treatment indexed by S. Potential outcomes and treatments are independent of aid offers, S, by virtue of random assignment.

Ignoring covariates, the first-stage effect of scholarship offers on program spending is $E[A(1) - A(0)]$. Students not awarded scholarships generate no STBF spending, so $A(0) = 0$. Scholarship winners receive $A(1) = c_2 D_2(1) + c_4 D_4(1)$ each, where c_2 and c_4 are per-term program costs at two- and four-year colleges, respectively (with $c_2 < c_4$). We can therefore write the first stage for the impact of aid offers on program costs as follows:

$$
\begin{aligned}
E\left[A(1) - A(0)\right] &= E\left[c_2 D_2(1) + c_4 D_4(1)\right] \\
&= c_2 E\left[D_2(1) - D_2(0)\right] + c_4 E\left[D_4(1) - D_4(0)\right] + c_2 E\left[D_2(0)\right] + c_4 E\left[D_4(0)\right] \quad (3) \\
&\equiv c_2 \Delta_2 + c_4 \Delta_4 + \phi_2 + \phi_4. \quad (4)
\end{aligned}
$$

Here, Δ_2 and Δ_4 denote treatment effects on semesters enrolled at two- and four-year schools, while ϕ_2 and ϕ_4 capture spending on two- and four-year enrollment that occurs in the absence of awards. The corresponding reduced form effect of aid offers on total semesters attended is therefore

$$
E[D_2(1) - D_2(0)] + E[D_4(1) - D_4(0)] = \Delta_2 + \Delta_4.
$$

As always, a just-identified instrumental variables estimand is given by the ratio of reduced form to first stage estimates. The 2SLS specification in (2) therefore estimates the ratio

$$
\beta_{total}^{2SLS} = \frac{\Delta_2 + \Delta_4}{c_2 \Delta_2 + c_4 \Delta_4 + \phi_2 + \phi_4}. \quad (5)
$$

18

The ratio of treatment effects to spending is readily computed, of course, but the 2SLS version of this calculation neatly adjusts for covariates and immediately provides appropriate standard errors for the ratio. The formulation in equation (5) also highlights the fact that ϕ_2 and ϕ_4—money spent on enrollment that would have occurred with or without scholarships—are key determinants of bang for buck.

The overall first stage estimate for 2SLS estimates of equation (2) shows that STBF spent about $15,000 per awarded applicant in the two years after award receipt. As can be seen in the first row of Table 7, this overall spending figure varies across strata, reaching as high as about $18,000 per applicant in the UNL stratum. (Bang for buck calculations for the community college stratum are not shown separately since treatment effects in this stratum are essentially zero).

The treatment effects generated by these expenditures, reported in panel B of Table 7, show gains in total semesters enrolled ($\Delta_2 + \Delta_4$) ranging from 0.29 in the UNL stratum to a high of 0.68 in the state college stratum. Gains in four-year enrollment (Δ_4) are largest in the UNO/UNK stratum: for these applicants, STBF awards generated nearly a full semester of additional enrollment by the end of year two. Importantly, in two out of three strata, gains in semesters enrolled reflect both an increase in four-year terms and a decline in two-year terms (that is, negative values of Δ_2). The UNO/UNK stratum, for example, experienced almost a half a semester decrease in two-year enrollment. Only the state college stratum saw gains in both two- and four-year terms completed.

Buffett program spending increased net semesters attended by 0.025 per thousand dollars spent. In other words, STBF spent almost $40,000 ($1,000 divided by 0.025) for each added semester. Bang for buck is highest among students who targeted the least selective four-year colleges, a consequence of lower costs and larger treatment effects at these schools. Each semester's gain among applicants targeting UNL cost over $60,000, while each semester gained generated program costs about half as large for those targeting UNO/UNK. Measured in terms of net semesters completed, bang for buck is largest among applicants targeting state colleges, a finding that reflects the fact that the treatment in this stratum increased two- as well as four-year enrollment. As suggested by our subgroup comparisons, the high costs of enrollment gains in the UNL stratum reflect the fact that applicants targeting UNL have high enrollment rates even without scholarship support. In terms of the 2SLS estimand (equation (5)) most spending on these students contributes to ϕ_4 rather than Δ_4.

5.1 Marginal Money

The bang for buck estimates in Table 7 reveal that, because many scholarship awards leave their recipients' enrollment unchanged, the cost of increasing enrollment by a semester far exceeds the nominal award amounts (c_2 or c_4). This feature of college aid was first highlighted in Fuller et al. (1983)'s pioneering analysis of the federal Basic Educational Opportunity Grant (BEOG, later, known as Pell grants). Using a structural model of college choice estimated for a sample of high school seniors in 1972 (the National Longitudinal Study of the High School Class if 1972 data set), Manski and Wise simulate college enrollment rates by income group in the absence of the BEOG program. They estimate that a quarter of BEOG recipients were induced to go to college by the program, while three quarters would have enrolled with or without awards. Disaggregating by family income, 90 percent of BEOG awards made to students from middle and upper income families seem to have gone to students who would have enrolled anyway.

We would similarly like to isolate the marginal share of STBF spending, that is spending that changes behavior, either by increasing total enrollment or by shifting students across schools. At first blush, the terms $c_2\Delta_2 + c_4\Delta_4$ in equation (4) would appear to capture marginal spending. Indeed, $c_4\Delta_4$, is marginal spending on four-year terms. But $c_2\Delta_2$ is a negative number in our data: this term mixes spending on increased two-year enrollment with the savings in two-year tuition from those who shifted from two- to four-year programs. Spending on the four-year enrollment increase generated by the latter group is accounted for in $c_4\Delta_4$. It remains, however, to extract an estimate of spending on new two-year enrollment from the gross change in two-year semesters. Otherwise, we overestimate the extent to which STBF awards are pure transfers.[14]

To facilitate the distinction between marginal and infra-marginal spending, we assume that

1. Aid doesn't reduce total terms enrolled for any applicant: $D_4(1) + D_2(1) \geq D_4(0) + D_2(0)$.

2. Aid doesn't reduce four-year terms enrolled for any applicant: $D_4(1) - D_4(0) \geq 0$.

3. There is no dual enrollment among scholarship winners: $D_2(1)D_4(1) = 0$.

---

[14]Suppose, for example, that the scholarship switches 10 percent of students from two- to four-year schools and another 10 percent from no college to a two-year school. Suppose also that everyone who enrolls completes four semesters by the end of year two. In this case, marginal money is spending on the 20 percent of students who changed their behavior: $c_2 (0.10 \times 4) + c_4 (0.10 \times 4)$ But the net change in two-year enrollment, Δ_2, is zero, so $c_2\Delta_2 + c_4\Delta_4 = c_4 (0.10 \times 4)$ only.

These assumptions allow aid offers to increase total terms enrolled and to shift students from two- to four-year institutions. However, they preclude the possibility that aid offers reduce total enrollment or shift students from four- to two-year programs.

It is useful at this point to define a binary indicator $d_4(1) \equiv \mathbf{1}\{D_4(1) > 0\}$ that identifies students who enroll in four-year colleges when offered scholarships. We use this to split $c_2\Delta_2$ into two pieces:

$$
\begin{aligned}
c_2 E\left[D_2(1) - D_2(0)\right] &= c_2 E\left\{[D_2(1) - D_2(0)][1 - d_4(1)]\right\} + c_2 E\left\{[D_2(1) - D_2(0)]d_4(1)\right\} \\
&= c_2 E\left\{[D_2(1) - D_2(0)][1 - d_4(1)]\right\} - c_2 E\left[D_2(0)d_4(1)\right].
\end{aligned} \tag{6}
$$

The first term here captures increased spending on new two-year enrollment, while the second captures reductions in two-year spending due to shifting from two- to four-year schools. (The second equality follows from Assumption 3, which requires that $D_2(1)d_4(1) = 0$, meaning treated students don't simultaneously enroll in two- and four-year colleges.) Substituting equation (6) into the first stage expression in (3) and combining like terms provides a useful decomposition of the aid first stage:

$$
\begin{aligned}
E\left[A(1) - A(0)\right] &= c_2 E\left\{D_2(0)[1 - d_4(1)]\right\} + c_4 E\left[D_4(0)\right] \\
&\quad + c_2 E\left\{[D_2(1) - D_2(0)][1 - d_4(1)]\right\} + c_4 E\left[D_4(1) - D_4(0)\right].
\end{aligned} \tag{7}
$$

Equation (7) distinguishes four types of spending:

1. $c_2 E\left\{D_2(0)[1 - d_4(1)]\right\}$ is spending on two-year enrollment that occurs with or without awards. (This term is positive when $D_2(0) > 0$ and $d_4(1) = 0$, that is, for students who attend two year-colleges without awards but don't attend four-year colleges with awards.)

2. Similarly, $c_4 E\left[D_4(0)\right]$ is spending on four-year enrollment that occurs with or without awards. (Students for whom $D_4(0) \neq 0$ attend four-year colleges in the absence of awards. By Assumption 2, they must also attend four-year colleges if awarded scholarships.)

3. $c_2 E\left\{[D_2(1) - D_2(0)][1 - d_4(1)]\right\}$ is spending on new two-year enrollment among students who do not attend four-year colleges when awarded scholarships (that is, students for whom

$d_4 (1) = 0)$.

4. $c_4 E [D_4(1) - D_4(0)]$ is spending on the increase in four-year enrollment generated by awards. (This follows from Assumption 2, which says that $D_4(1) - D_4(0)$ must be non-negative.) This term includes new enrollment, enrollment that's shifted from two- to four-year programs, and increased four-year enrollment among students who would have otherwise attended fewer four-year terms.

Terms 1 and 2 above capture spending on enrollment that is unchanged by awards and is therefore infra-marginal. The remaining two terms reflect spending on new two-year and four-year enrollment, that is, marginal money. The sum of these marginal terms is

$$c_2 E \left\{ [D_2 (1) - D_2 (0)] [1 - d_4 (1)] \right\} + c_4 E [D_4(1) - D_4(0)] \equiv c_2 \mu + c_4 \Delta_4$$

Marginal money due to four-year spending is simply $c_4 \Delta_4$, a quantity easily computed. But $c_2 \mu$ isn't non-parametrically identified because we don't observe the joint outcome $\mu \equiv [D_2 (1) - D_2 (0)] [1 - d_4 (1)]$.[15] We therefore construct bounds under alternative assumptions about two-year enrollment in the absence of award offers. In pursuit of these bounds, it helps to rewrite μ as follows:

$$
\begin{aligned}
\mu & \equiv E \left\{ [D_2 (1) - D_2 (0)] [1 - d_4 (1)] \right\} \\
& = E [D_2 (1) - D_2 (0) \mid d_4(1) = 0] E [1 - d_4 (1)] .
\end{aligned}
$$

Given Assumptions 1 and 2, this term is bounded below by zero: the scholarship can only increase two-year enrollment among students who would never attend four-year schools. We obtain an upper bound for μ by assuming that all two-year enrollment among those who would never attend four-year schools is induced by awards. This in turn implies $D_2(0) = 0$ for all those with $d_4(1) = 0$, in which case $\mu = E [D_2 (1) \mid d_4(1) = 0] E [1 - d_4 (1)]$. The resulting marginal money bounds are

$$M(\mu) \equiv \frac{c_2 \mu + c_4 \Delta_4}{c_2 \Delta_2 + c_4 \Delta_4 + \phi_2 + \phi_4} \tag{8}$$

[15]As always, we observe the marginal distribution of potential outcomes, $D_2(S)$ and $D_4(S)$, but not their joint distribution. Here, for example, whether a treated four-year college student would have attended a two-year school in the absence of treatment.

for $\mu \in \{0, E[D_2(1) \mid d_4(1) = 0] \, E[1 - d_4(1)]\}$.

As can be seen in panel C of Table 7, marginal money is estimated to fall between about 14 and 19 percent of total program spending. Thus, like Manski and Wise (1983), most of the financial aid awarded through Buffett scholarships goes to applicants whose behavior is unchanged in response to an award. The largest marginal money share, between 22 and 23 percent of total spending, is for applicants in the UNO/UNK stratum. This finding reflects the especially large program-induced boost in relatively expensive four-year enrollment found for applicants targeting the UNO and UNK campuses. By contrast, the large bang for buck for state college applicants seen in panel C of the table doesn't translate into a large marginal money share for this group. The discrepancy between the bang for buck and marginal money statistics among state college applicants is explained by the fact that half of the bang for buck figure in the state college stratum comes from spending on relatively inexpensive two-year colleges. Spending on four-year support in the state college stratum was mostly infra-marginal. Policy-makers who value four-year enrollment over two-year enrollment might therefore see support of applicants to NU's least selective campuses as being most cost-effective.

6 Distinguishing Aid Effects from Learning Communities

As we've seen, STBF awards made to students targeting NU generated larger initial gains in four-year enrollment than did STBF offers made to students who targeted state and community colleges. To what extent is this result a reflection of the LC support offered to Buffet scholars at NU? The second arm of our randomized evaluation quantifies the contribution of LC by offering a second aid-only treatment, known to applicants as the College Opportunity Scholarship (COS). COS awards, which were first offered to the 2013 cohort, match the aid component of full awards without offering access to the LC services enjoyed by Buffett Scholars at NU. Paralleling the LC-including treatment, COS awards were made only to applicants targeting an NU campus.

Table 8 offers a first look at treatment effects for the COS intervention, comparing these with estimates for the group of 2013 applicants who targeted NU and were offered full awards. This table also reports preliminary results for a few second-year outcomes for the 2013 cohort; we expect to expand the list of outcomes as well as the COS sample in the near future. These initial findings show

COS treatment effects close to, though somewhat below, those generated by full awards. Estimates of the difference in effects generated by full and COS awards are not significantly different from zero.

Because the COS experimental cohort has faced only one full year of potential college enrollment to date, comparisons between COS and traditional STBF awards are provisional. We expect to be able to sharpen these findings in the near future, as more data on enrollments in the academic year 2014-15 become available.

7   Summary and Conclusions

STBF awards induced a clear shift from two- to four-year schools and a marked increase in second-year college enrollment. These gains are driven by strong persistence among award winners, coupled with high rates of attrition in the control group. Second-year gains and shifts into four-year programs are largest for nonwhite applicants, for those with relatively low ACT scores, and for applicants who indicated an interest in four-year programs other than the most-selective Nebraska public college. Scholarships generated the largest enrollment and persistence gains in demographic groups that would otherwise have been predicted to fare poorly—that is, they enabled disadvantaged students to 'level up.' These findings highlight the paradox of merit aid: awards based on past achievement are likely to generate smaller gains than awards made to applicants who appear less likely to be college-ready.

These results are preliminary and limited to outcomes available in a two-year follow-up. As the current cohorts age and new cohorts enter the study, we expect to be able to examine effects on longer-term persistence and college completion. We also anticipate a sharpening of the contrast between estimates of the effects of aid offered with Learning Community services and estimates of the effects of aid alone. Evidence on differential effects across subgroups and, in particular, the pattern that shows larger gains for less well-prepared students, should also grow more conclusive. Ultimately, we expect to be able to measure effects in the labor market as well as on completed schooling.

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Figure 1: Effect on Year Two Enrollment by Subgroup
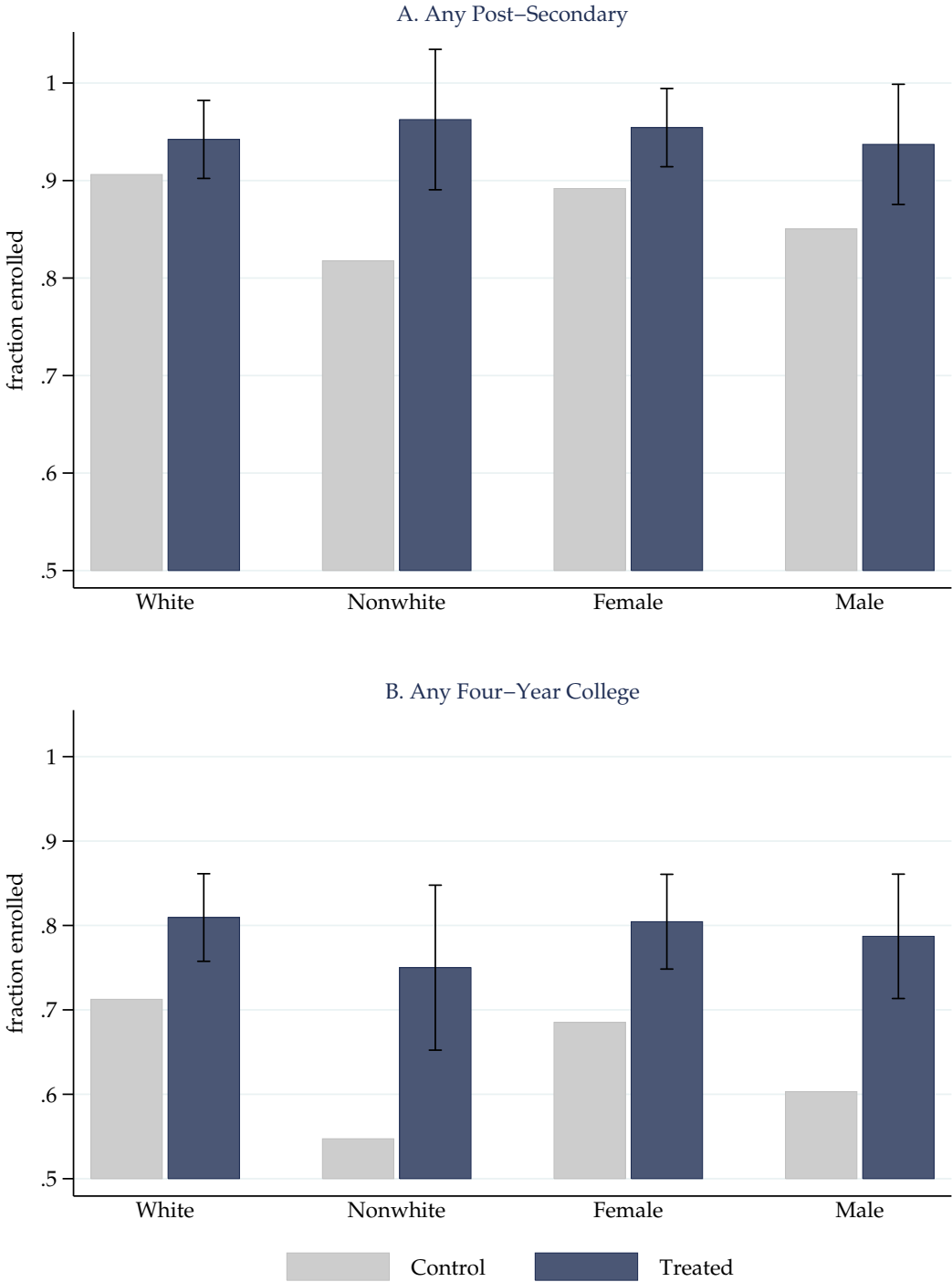
Notes: Results are for the 2012 full award sample. Treated bars plot the sum of the control mean and estimated treatment effect. Whiskers show 95 percent confidence intervals.

Figure 2: Effect on Year Two Enrollment by GPA
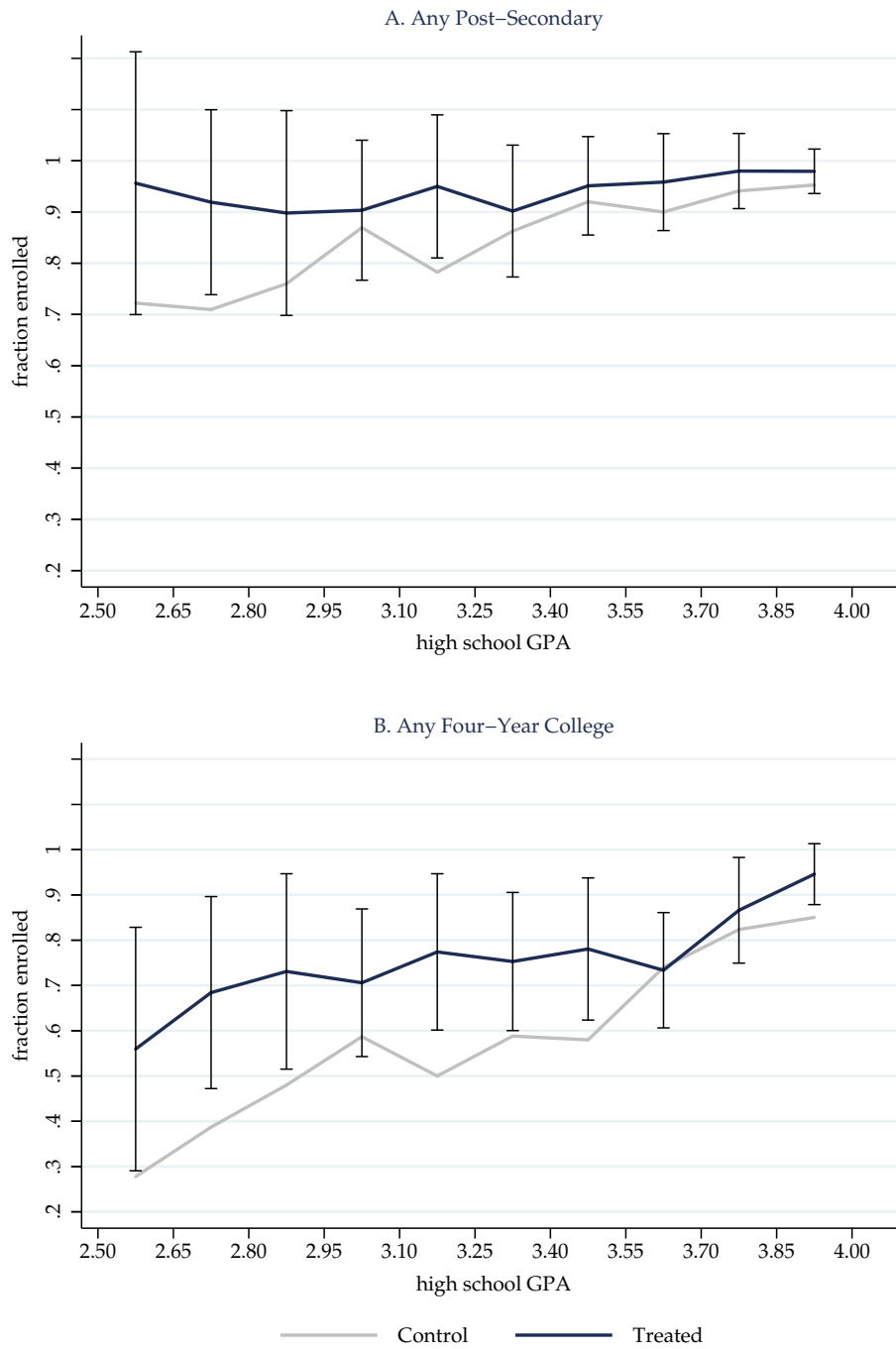
A. Any Post–Secondary

B. Any Four–Year College

Notes: Results are for the 2012 full award sample. Treated points plot the sum of the control mean and estimated treatment effect. Whiskers show 95 percent confidence intervals.

Figure 3: Effect on Year Two Enrollment by ACT
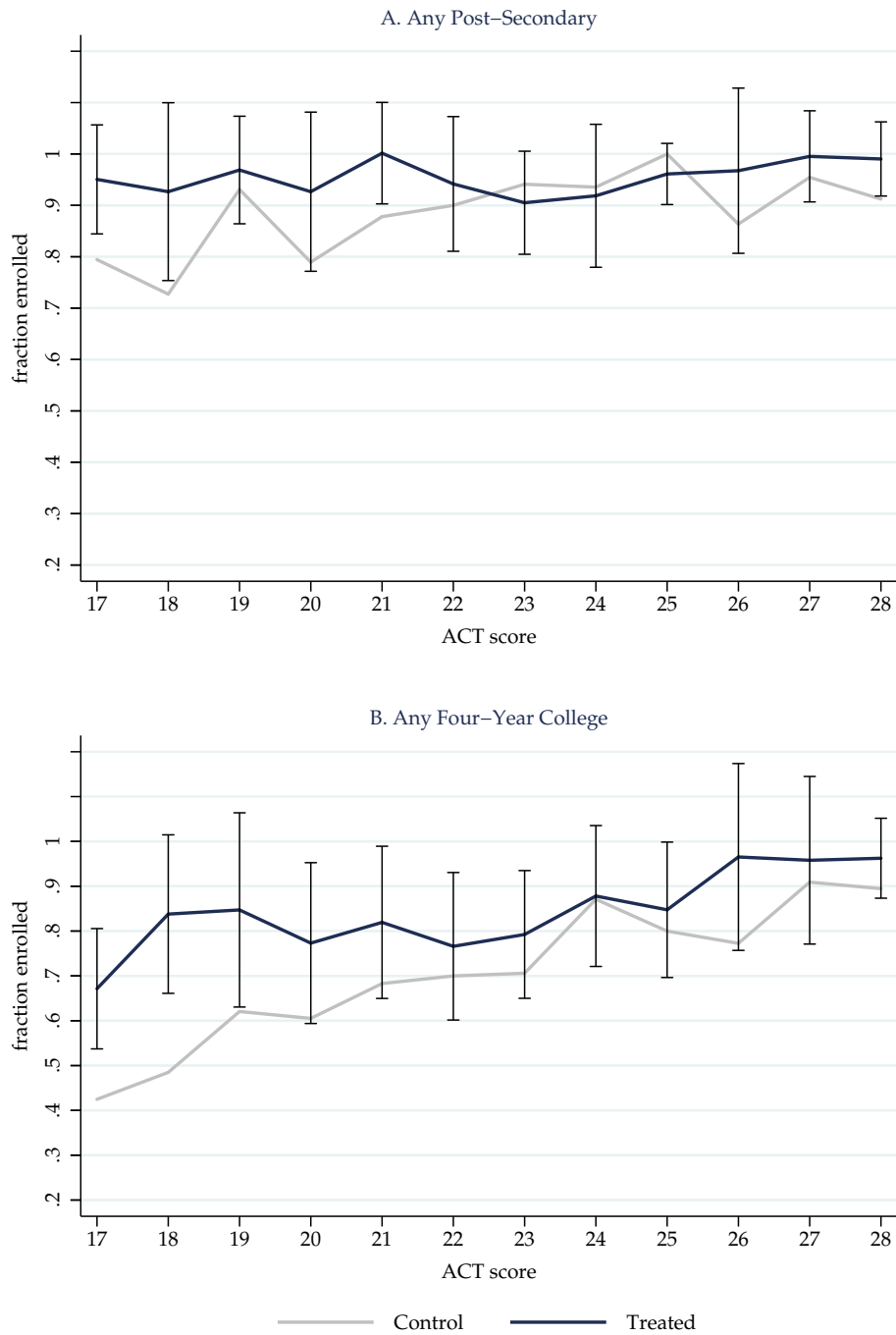
A. Any Post–Secondary

B. Any Four–Year College

Control ——— Treated

Notes: Results are for the 2012 full award sample. Treated points plot the sum of the control mean and estimated treatment effect. Whiskers show 95 percent confidence intervals. The x axis ranges from 17 to 28, the 10th and 90th percentiles of the score distribution among ACT test takers in the sample.

Figure 4: Effect on Year Two Enrollment by EFC
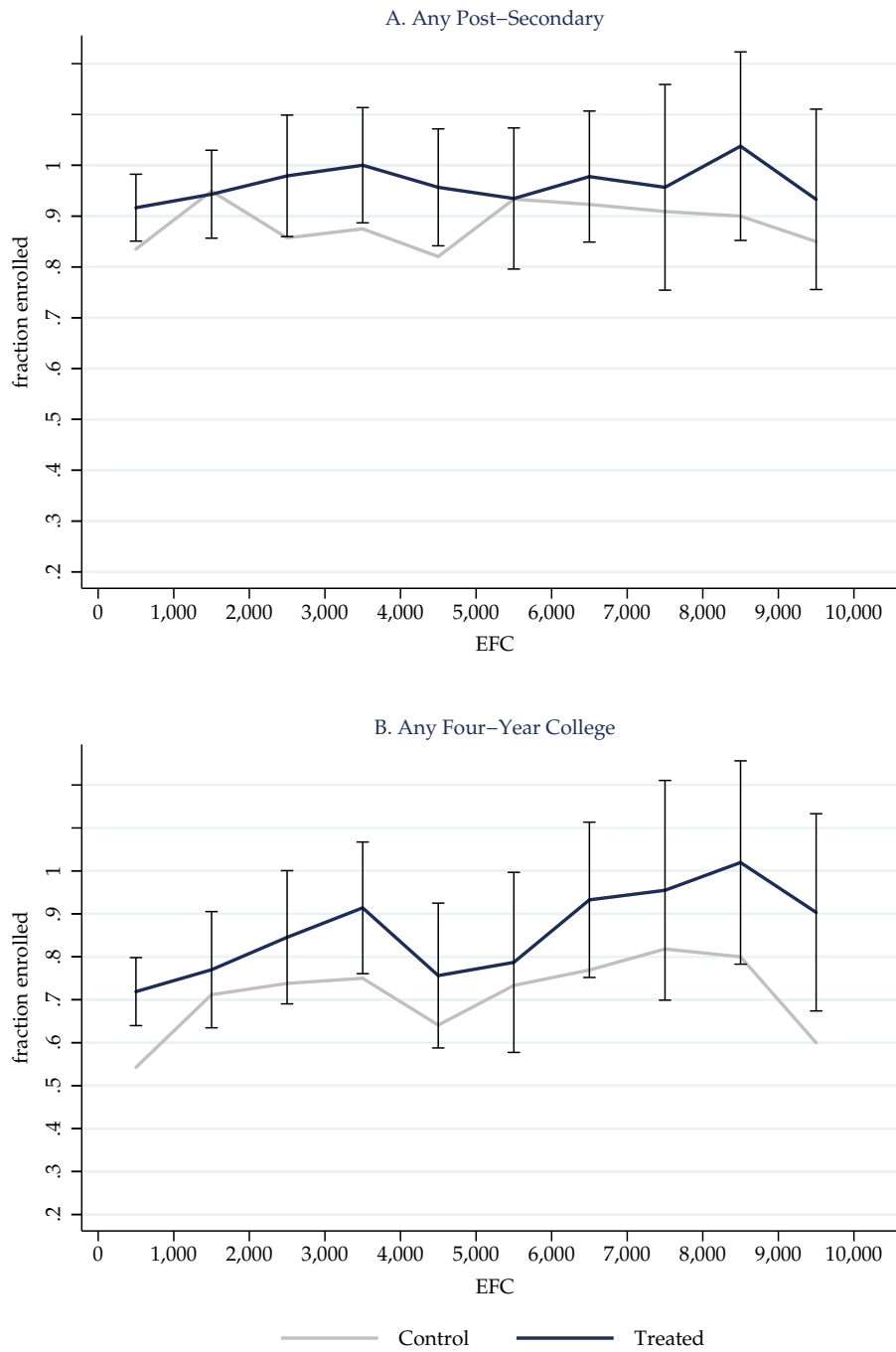
A. Any Post–Secondary

B. Any Four–Year College

Notes: Results are for the 2012 full award sample. Treated points plot the sum of the control mean and estimated treatment effect. Whiskers show 95 percent confidence intervals.

Figure 5: Year Two Enrollment Effects Conditional on Estimated College Readiness
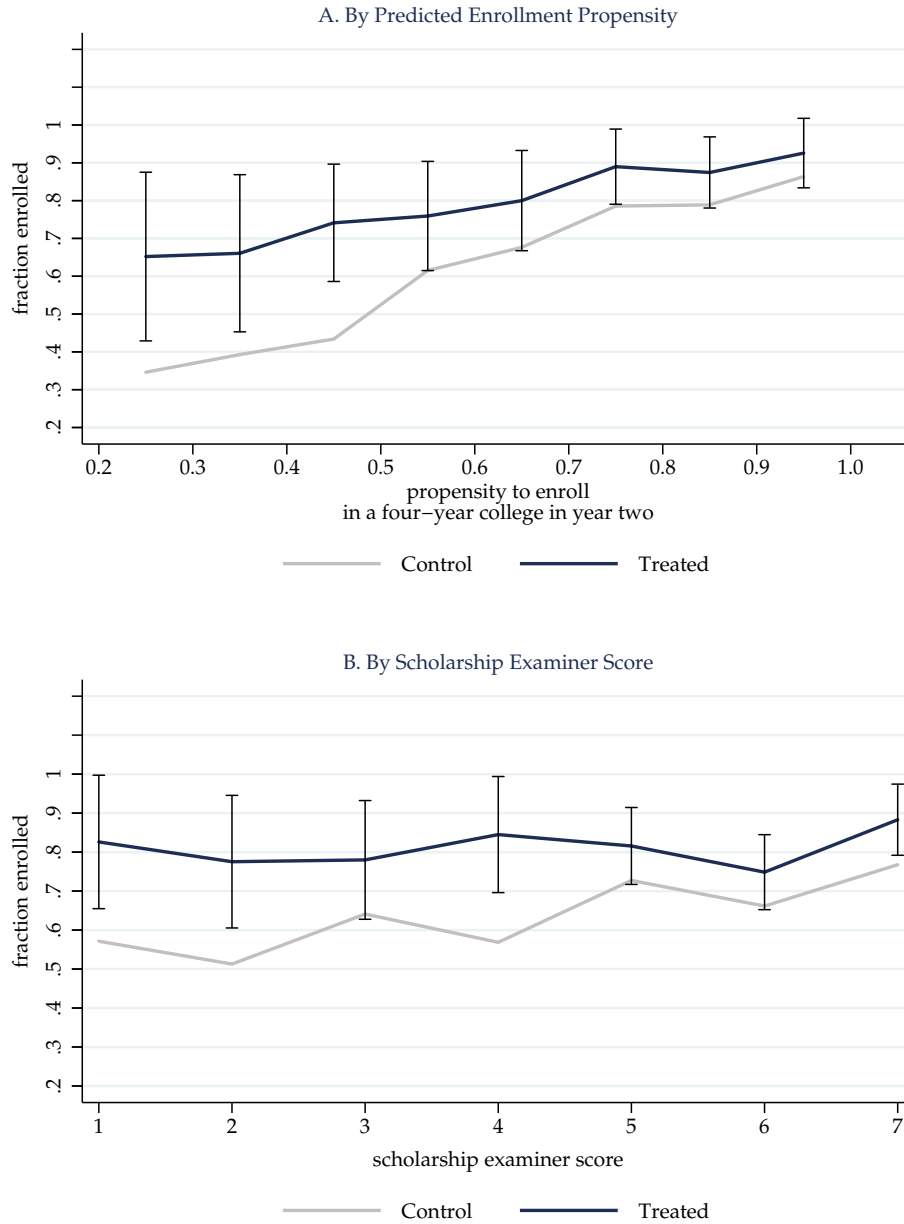
A. By Predicted Enrollment Propensity

B. By Scholarship Examiner Score

Notes: Results are for the 2012 full award sample. Treated points plot the sum of the control mean and estimated treatment effect. Whiskers show 95 percent confidence intervals. In panel A, the x axis is propensity to enroll in a four-year college in year two, estimated using the leave-one-out procedure proposed by Abadie et al. (2013).

Table 1
Descriptive Statistics
(2012 & 2013 Cohorts)

	Nebraska HS Seniors (1)	All Eligible Applicants (2)	Non-Experimental Sample		Experimental Sample	
			Funded (3)	Not Funded (4)	All (5)	Treatment - Control (6)
Female	.50	.62	.67	.56	.62	.017
						(.020)
White	.77	.61	.45	.57	.66	-.009
						(.019)
Black	.07	.06	.06	.10	.06	-.008
						(.010)
Hispanic	.11	.12	.21	.10	.10	.001
						(.013)
Other nonwhite or unreported race	.04	.20	.28	.23	.18	.016
						(.016)
EFC ($)	---	2,890	1,680	3,427	3,127	-69
		(3,293)	(2,474)	(3,924)	(3,298)	(137)
Family income ($)	72,594	48,253	37,922	50,516	50,547	725
		(28,855)	(23,651)	(29,855)	(29,334)	(1,270)
Urban resident	.38	.41	.51	.46	.38	.003
						(.018)
Mother attended college	.57	.41	.29	.42	.44	.001
						(.021)
Parents are married	.58	.58	.47	.57	.61	.014
						(.020)
High school GPA	---	3.45	3.52	3.15	3.48	-.007
		(.42)	(.38)	(.42)	(.42)	(.017)
Composite ACT score	22.0	22.0	21.9	20.6	22.2	-.27
		(4.4)	(4.3)	(4.3)	(4.4)	(.18)
Took ACT	.70	.93	.91	.91	.94	.003
						(.010)
F-statistic						.68
p-value						.76
Sample size		3,487	657	399	2,431	2,431

Notes: Family income is the sum of the applicant's personal, parental, and spousal adjusted gross incomes. Urban residency is defined as attending high school in a city of at least 250,000 residents. Data for Column (1) come from SEER (gender and race), ACS (family income, mother's education, and marital status), NCES (urban residency), and the ACT. Statewide EFC and GPA data were unavailable. Treatment-control differences are from regressions that control for strata (target college by year of application) dummies.

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$

Table 2
Effect on Year One Financial Aid Packages
for Nebraska Public College Students
(2012 & 2013 Cohorts)

| | Per Award | | | Per Dollar Awarded | |
	Control Mean (1)	Covariate Adjusted (2)	Campus Adjusted (3)	Covariate Adjusted (4)	Campus Adjusted (5)
Cost of attendance	17,469	1,129 *** (196)	104 (147)	.24 *** (.02)	.02 (.02)
Total aid	11,608	3,319 *** (234)	2,168 *** (202)	.53 *** (.03)	.30 *** (.03)
Total grants	7,251	6,225 *** (184)	5,467 *** (167)	.91 *** (.02)	.78 *** (.02)
Government grants	3,162	-1 (86)	-226 *** (82)	.02 * (.01)	-.03 ** (.01)
Institutional grants	2,904	-380 *** (111)	-635 *** (111)	-.06 *** (.02)	-.12 *** (.02)
STBF grant	0	6,924 *** (77)	6,744 *** (77)	1.00 *** (.00)	1.00 *** (.00)
Other private grants	1,185	-318 *** (80)	-417 *** (84)	-.05 *** (.01)	-.07 *** (.01)
Total government loans	3,529	-2,220 *** (148)	-2,524 *** (153)	-.29 *** (.02)	-.37 *** (.02)
Subsidized government loans	1,894	-1,488 *** (69)	-1,635 *** (71)	-.20 *** (.01)	-.24 *** (.01)
Unsubsidized government loans	1,635	-732 *** (112)	-889 *** (116)	-.09 *** (.02)	-.13 *** (.02)
Federal Work Study	829	-486 *** (45)	-580 *** (46)	-.06 *** (.01)	-.08 *** (.01)
Campus controls		No	Yes	No	Yes
Sample size	1,093	1,928	1,928	1,928	1,928

Notes: This table reports effects of the STBF scholarship offer on students' financial aid packages. The sample is restricted to students enrolled in Nebraska public colleges. Aid data are currently unavailable for the 309 students at state colleges, Mid-Plains Community College, and the Nebraska College of Technical Agriculture. Columns (2) and (3) report results from regressions of the financial aid awarded in each category on a dummy for winning a scholarship, while Columns (4) and (5) report results from regressions of the same dependent variables on the dollar value of scholarships awarded. The regressions in Columns (3) and (5) control for cumulative enrollment at each campus. All regressions control for target college, cohort, and baseline covariates. Baseline covariates include high school GPA and EFC, as well as bins for family income and ACT composite score. Government grants include federal and state grants. Government loans include subsidized and unsubsidized loans, where subsidized is the sum of Perkins and subsidized Stafford loans, and unsubsidized is the sum of PLUS and unsubsidized Stafford loans.

*** p < 0.01, ** p < 0.05, * p < 0.10

Table 3
Effect on Year Two Financial Aid Packages
for Nebraska Public College Students
(2012 Cohort)

		Per Award		Per Dollar Awarded	
	Control Mean (1)	Covariate Adjusted (2)	Campus Adjusted (3)	Covariate Adjusted (4)	Campus Adjusted (5)
Cost of attendance	17,104	1,650 *** (388)	-30 (277)	.42 *** (.04)	.04 (.03)
Total aid	8,957	4,155 *** (421)	2,619 *** (379)	.73 *** (.05)	.41 *** (.05)
Total grants	5,233	6,439 *** (320)	5,341 *** (294)	1.00 *** (.03)	.82 *** (.04)
Government grants	2,590	-60 (151)	-343 ** (151)	.04 ** (.02)	-.03 (.02)
Institutional grants	2,305	-456 ** (184)	-803 *** (191)	-.03 (.02)	-.12 *** (.03)
STBF grant	0	7,034 *** (144)	6,625 *** (144)	1.00 *** (.00)	1.00 *** (.00)
Other private grants	338	-80 (75)	-138 * (82)	-.01 (.01)	-.02 * (.01)
Total government loans	3,239	-1,674 *** (257)	-2,025 *** (274)	-.19 *** (.03)	-.30 *** (.04)
Subsidized government loans	1,707	-1,134 *** (125)	-1,331 *** (130)	-.13 *** (.02)	-.20 *** (.02)
Unsubsidized government loans	1,532	-540 *** (195)	-693 *** (213)	-.06 *** (.02)	-.11 *** (.03)
Federal Work Study	485	-272 *** (63)	-372 *** (67)	-.03 *** (.01)	-.05 *** (.01)
Campus controls		No	Yes	No	Yes
Sample size	365	777	777	777	777

Notes: Variables and specifications are defined in Table 2. The sample is restricted to students enrolled in Nebraska public colleges from the 2012 cohort, where we have two complete years of outcome data. Aid data are currently unavailable for the 94 students at state colleges, Mid-Plains Community College, and the Nebraska College of Technical Agriculture.

*** p < 0.01, ** p < 0.05, * p < 0.10

Table 4
Effect on Year One Enrollment by Target College
(2012 & 2013 Cohorts)

	All Strata		UNL		UNK & UNO		State Colleges		Community Colleges	
	Control Mean	Treatment Effect	Control Mean	Treatment Effect	Control Mean	Treatment Effect	Control Mean	Treatment Effect	Control Mean	Treatment Effect
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
A. Enrollment and Program Type										
Any post-secondary	.967	.019 *** (.007)	.984	.014 * (.007)	.959	.034 *** (.011)	.965	-.004 (.025)	.949	.010 (.022)
Any four-year college	.753	.078 *** (.011)	.914	.065 *** (.015)	.838	.131 *** (.020)	.905	.011 (.031)	.077	.030 (.030)
Two-year college only	.215	-.058 *** (.010)	.069	-.052 *** (.014)	.120	-.097 *** (.018)	.060	-.015 (.021)	.872	-.019 (.036)
B. Selectivity										
75 - 90% admitted	.297	.037 *** (.013)	.110	-.055 *** (.019)	.755	.151 *** (.026)	.075	.005 (.038)	.026	.022 (.020)
Less than 75% admitted	.322	.039 *** (.011)	.786	.120 *** (.024)	.057	-.018 (.015)	.030	.021 (.025)	.009	.004 (.012)
C. Ownership and Location										
Nebraska public college	.899	.057 *** (.011)	.916	.051 *** (.016)	.876	.088 *** (.018)	.900	-.005 (.039)	.906	.033 (.029)
Public college	.922	.041 *** (.010)	.943	.032 ** (.013)	.895	.074 *** (.017)	.915	-.010 (.038)	.927	.012 (.027)
Out-of-state or private college	.068	-.038 *** (.009)	.068	-.038 *** (.015)	.083	-.054 *** (.015)	.065	.001 (.032)	.043	-.022 (.019)
Private college	.046	-.022 *** (.007)	.040	-.019 (.011)	.063	-.040 *** (.013)	.050	.006 (.030)	.021	-.002 (.016)
Sample size	1,440	2,431	547	876	458	855	201	304	234	396

Notes: Year one enrollment includes any enrollment spells that occur between the July 1 after scholarship application and June 30 of the following calendar year. Selectivity categories are defined by IPEDS according to 2012 admissions rates. UNL admitted less than 75% of applicants; UNK and UNO admitted 75 - 90%; state colleges admitted more than 90%. All regressions control for target college, cohort, and baseline covariates as defined in Table 2.

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$

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Table 5
Effect on Year Two Enrollment by Target College
(2012 Cohort)

	All Strata		UNL		UNK & UNO		State Colleges		Community Colleges	
	Control Mean	Treatment Effect	Control Mean	Treatment Effect	Control Mean	Treatment Effect	Control Mean	Treatment Effect	Control Mean	Treatment Effect
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
A. Enrollment and Program Type										
Any post-secondary	.876	.072 ***	.897	.057 **	.859	.106 ***	.854	.134 **	.887	-.019
		(.018)		(.027)		(.028)		(.055)		(.064)
Semester equivalents enrolled	4.21	.37 ***	4.50	.29 **	3.92	.48 ***	4.23	.68 **	4.35	.18
		(.08)		(.12)		(.12)		(.27)		(.33)
Any four-year college	.653	.144 ***	.806	.069 *	.678	.236 ***	.750	.114 *	.141	.056
		(.023)		(.037)		(.038)		(.069)		(.060)
Two-year college only	.222	-.072 ***	.091	-.013	.180	-.130 ***	.104	.020	.746	-.075
		(.021)		(.029)		(.032)		(.055)		(.084)
B. Selectivity										
Less than 75% admitted	.257	.068 ***	.623	.180 ***	.073	-.010	.021	.022	.042	.013
		(.020)		(.045)		(.026)		(.033)		(.039)
75 - 90% admitted	.315	.065 ***	.177	-.118 ***	.571	.261 ***	.146	-.100	.028	.060
		(.024)		(.034)		(.044)		(.061)		(.037)
Sample size	499	1,003	175	350	205	411	48	98	71	144

Notes: Year two enrollment includes any enrollment spells that occur between the second July 1 after scholarship application and the following June 30. A semester equivalent is 12 credit hours of enrollment. Selectivity categories are defined by IPEDS according to 2012 admissions rates. UNL admitted less than 75% of applicants; UNK and UNO admitted 75 - 90%; state colleges admitted more than 90%. The sample is restricted to the 2012 cohort, where we have two complete years of outcome data. All regressions control for target college, cohort, and baseline covariates as defined in Table 2.

*** p < 0.01, ** p < 0.05, * p < 0.10

Table 6
Effect on Retention
(2012 Cohort)

			Year Two Enrollment				
			Any Post-Secondary (2)	Any Four-Year (3)	Two-Year College (4)	Not Enrolled (5)	Row Total
		Marginal Outcomes (1)	.072 *** (.018) {.876}	.144 *** (.023) {.653}	-.072 *** (.021) {.222}	-.072 *** (.018) {.124}	1,003
Year One Enrollment	Any Post-Secondary (2)		.024 ** (.010) {.964}	.076 *** (.018) {.868}	.144 *** (.023) {.651}	-.067 *** (.020) {.216}	-.053 *** (.016) {.096}	979
	Any Four-Year (3)		.081 *** (.017) {.758}	.125 *** (.020) {.685}	.146 *** (.023) {.631}	-.021 (.013) {.054}	-.044 *** (.014) {.072}	799
	Two-Year College (4)		-.057 *** (.016) {.206}	-.048 *** (.017) {.182}	-.002 (.009) {.020}	-.046 *** (.017) {.162}	-.009 (.009) {.024}	180
	Not Enrolled (5)		-.024 ** (.010) {.036}	-.005 (.005) {.008}	.000 (.003) {.002}	-.005 (.004) {.006}	-.019 ** (.008) {.028}	24
	Column Total	1,003	915	727	188	88	

Notes: Year one enrollment includes any enrollment spells that occur between the July 1 after scholarship application and June 30 of the following calendar year. Year two enrollment includes any enrollment spells that occur between the subsequent July 1 and June 30. This table shows treatment effects on joint year one and year two outcomes, e.g., any four-year enrollment in both years. Standard errors are in parentheses, and control means for the given outcomes are in braces. Row and column totals report counts for year one and year two outcomes, respectively. The sample is restricted to the 2012 cohort, where we have two complete years of outcome data. All regressions control for target college, cohort, and baseline covariates as defined in Table 2.

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$

Table 7
Cost Effectiveness Through Year Two
(2012 Cohort)

	All Strata		UNL		UNO & UNK		State Colleges	
	(1)		(2)		(3)		(4)	
A. First Stage Effect on Program Spending								
Total spending	14.77	***	17.74	***	15.79	***	11.57	***
	(.29)		(.49)		(.44)		(.71)	
B. Reduced Form Effects on Semesters Enrolled								
Total semesters	.37	***	.29	**	.48	***	.68	**
	(.08)		(.12)		(.12)		(.27)	
Four-year semesters	.65	***	.58	***	.97	***	.35	
	(.09)		(.14)		(.15)		(.32)	
Two-year semesters	-.28	***	-.29	**	-.49	***	.32	
	(.09)		(.12)		(.13)		(.27)	
C. Bang Per Thousand Bucks of Program Spending								
	.025	***	.016	**	.030	***	.059	***
	(.005)		(.007)		(.007)		(.021)	
	{40,234}		{61,140}		{32,999}		{17,016}	
D. Marginal Spending Share								
	13.5 - 18.8%		7.2 - 7.4%		21.9 - 23.1%		5.5 - 9.0%	
Sample size	1,003		350		411		98	

Notes: Panel A reports first stage regressions of program spending on a dummy for the STBF scholarship offer. Program spending is measured in thousands of dollars and includes both scholarship money and the per pupil cost of LC services for NU students. Panel B reports the corresponding reduced form effects on semester equivalents, as defined in Table 5, and Panel C reports the associated 2SLS estimates. The average cost of each added semester---equal to $1,000 divided by the 2SLS point estimate---is reported in braces. Panel D presents the marginal money estimates detailed in Section 7. The sample is restricted to the 2012 cohort, where we have two complete years of outcome data. All regressions control for target college, cohort, and baseline covariates as defined in Table 2.

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$

Table 8
Full Awards vs. Aid-Only Awards
(2013 Cohort, NU Strata)

	Year One Enrollment				Year Two Fall Enrollment			
	Control Mean	Treatment Effect			Control Mean	Treatment Effect		
		Full Awards	Aid-Only	Difference		Full Awards	Aid-Only	Difference
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
A. Enrollment and Program Type								
Any post-secondary	.973	.026 ***	.019 *	.008	.898	.055 *	.024	.031
		(.008)	(.010)	(.007)		(.017)	(.022)	(.022)
Any four-year college	.886	.096 ***	.077 ***	.019	.778	.135 *	.108 *	.027
		(.016)	(.019)	(.016)		(.024)	(.027)	(.027)
Two-year college only	.086	-.070 ***	-.058 ***	-.011	.120	-.080 *	-.084 *	.004
		(.014)	(.016)	(.014)		(.018)	(.018)	(.017)
B. Selectivity								
Less than 75% admitted	.490	.069 ***	.048 *	.021	.416	.077 *	.049 *	.028
		(.020)	(.025)	(.024)		(.025)	(.027)	(.029)
75 - 90% admitted	.370	.042 **	.022	.020	.333	.074 *	.042	.032
		(.021)	(.026)	(.026)		(.026)	(.027)	(.032)
Sample size	625	1,180	1,180	1,180	625	1,180	1,180	1,180

Notes: The results reported here are from pooled regressions that distinguish the effects of full aid offers (including financial aid and access to LC services) from those of aid-only awards. These results are available for the 2013 cohort only. Year one enrollment includes any enrollment spells that occur between the July 1 after scholarship application and June 30 of the following calendar year. Year two fall enrollment includes any enrollment spells that occur between the subsequent July 1 and October 31, when the most recent enrollment data were reported. All regressions control for target college, cohort, and baseline covariates as defined in Table 2.

*** p < 0.01, ** p < 0.05, * p < 0.10

Table A1
Sample Selection
(2012 & 2013 Cohorts)

	2012 Cohort					2013 Cohort					
	Non-Experimental Sample			Experimental Sample		Non-Experimental Sample			Experimental Sample		
	All Eligible Applicants	Funded	Not Funded	Control	Any Award	All Eligible Applicants	Funded	Not Funded	Control	Full Award	Aid-Only
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
All Strata	1,430	301	126	499	504	2,267	356	273	941	487	210
University of Nebraska	1,110	242	107	380	381	1,661	285		625	345	210
Kearney	189	36	26	63	64	250	33	27	72	67	51
Lincoln	496	113	33	175	175	840	140	85	372	154	89
Omaha	421	91	46	142	142	560	108	77	181	124	70
NCTA	4	2	2	0	0	11	4	7	0	0	0
State Colleges	114	12	4	48	50	259	33	20	153	53	0
Chadron	20	1	1	9	9	49	3	3	32	11	0
Peru	12	1	0	5	6	38	6	3	21	8	0
Wayne	82	10	3	34	35	172	24	14	100	34	0
Community Colleges	206	47	15	71	73	347	38	57	163	89	0
Central	50	9	1	20	20	72		10	36	20	0
Metropolitan	45	15	5	12	13	68	7	18	28	15	0
Mid-Plains	6	4	2	0	0	10	4	6	0	0	0
Northeast	46	4	2	20	20	79	11	10	37	21	0
Southeast	48	12	3	16	17	100	6	13	53	28	0
Western	11	3	2	3	3	18		0	9	5	0

Notes: This table reports sample sizes by target college. The experimental sample contains applicants who were subject to random assignment.

Table A2
Descriptive Statistics: Cohort Comparison
Experimental Samples

	2012 Cohort		2013 Cohort			
			Full Award		Aid-Only	
	All	Treatment - Control	All	Treatment-Control	All	Treatment-Control
	(1)	(2)	(3)	(4)	(5)	(6)
Female	.62	.009	.61	.024	.60	-.036
		(.031)		(.027)		(.040)
White	.66	.031	.66	-.041	.64	-.055
		(.028)		(.027)		(.039)
Black	.08	-.011	.05	-.006	.06	.006
		(.017)		(.012)		(.020)
Hispanic	.11	-.009	.10	.009	.10	-.001
		(.019)		(.017)		(.025)
Other nonwhite race or unreported race	.15	-.011	.19	.037	.20	.050
		(.022)		(.023)		(.034)
EFC ($)	3,366	-52	2,960	-83	3,032	213
		(235)		(161)		(240)
Family income	50,564	339	50,535	1,026	51,397	4,623 *
		(2,170)		(1,501)		(2,394)
Urban resident	.42	-.007	.35	.010	.41	.006
		(.027)		(.024)		(.037)
Mother attended college	.43	.024	.45	-.017	.47	.033
		(.031)		(.028)		(.040)
Parents are married	.58	-.010	.63	.032	.63	.056
		(.031)		(.027)		(.038)
High school GPA	3.44	.005	3.51	-.017	3.57	.022
		(.026)		(.022)		(.031)
Composite ACT score	21.9	-.37	22.5	-.19	23.3	-.45
		(.27)		(.24)		(.38)
Took ACT	.06	-.002	.06	-.005	.03	-.012
		(.015)		(.012)		(.013)
F-statistic		.44		.84		1.27
p-value		.94		.60		.23
Sample size	1,003	1,003	1,428	1,428	835	835

Notes: Variable definitions and specifications are detailed in Table 1. The 2013 aid-only sample contains the NU strata only and excludes students who were offered full awards.

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$

Table A3
Descriptive Statistics by Target College
(2012 & 2013 Cohorts)

	All Strata		UNL		UNO & UNK		State Colleges		Community Colleges	
	All	Treatment - Control	All	Treatment - Control	All	Treatment - Control	All	Treatment - Control	All	Treatment - Control
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Female	.61	.017 (.020)	.59	-.009 (.035)	.62	.027 (.033)	.64	.000 (.060)	.59	.064 (.050)
White	.66	-.009 (.019)	.71	-.053 (.034)	.55	.021 (.033)	.76	.056 (.050)	.71	-.030 (.045)
Black	.06	-.008 (.010)	.07	-.012 (.018)	.08	-.011 (.018)	.03	-.006 (.026)	.03	.007 (.017)
Hispanic	.10	.001 (.013)	.06	.027 (.018)	.17	-.017 (.025)	.06	-.049 *** (.019)	.10	.022 (.033)
Other nonwhite race or unreported race	.17	.016 (.016)	.16	.037 (.028)	.21	.007 (.028)	.15	-.001 (.041)	.17	.001 (.038)
EFC ($)	3,133	-69 (137)	3,247	102 (243)	3,025	-120 (223)	3,389	2 (414)	2,859	-365 (304)
Family income	50,291	725 (1,270)	52,613	-312 (2,553)	48,599	980 (1,824)	52,477	-74 (3,136)	46,117	2,957 (2,880)
Urban resident	.37	.003 (.018)	.42	.031 (.035)	.48	-.014 (.029)	.19	-.046 (.045)	.21	.014 (.033)
Mother attended college	.44	.001 (.021)	.52	.009 (.036)	.36	.008 (.033)	.54	-.098 (.062)	.35	.037 (.049)
Parents are married	.61	.014 (.020)	.63	-.031 (.035)	.59	.024 (.034)	.60	.104 * (.057)	.62	.021 (.050)
High school GPA	3.49	-.007 (.017)	3.60	-.031 (.028)	3.43	-.010 (.028)	3.53	.025 (.052)	3.33	.028 (.041)
Composite ACT score	22.4	-.27 (.18)	23.9	-.25 (.30)	22.1	-.53 * (.30)	21.8	.20 (.48)	19.5	-.01 (.41)
Took ACT	.06	-.003 (.010)	.03	-.009 (.012)	.04	.017 (.014)	.04	-.021 (.017)	.18	-.025 (.039)
F-statistic		.68		.93		.89		1.15		1.23
p-value		.010		.012		.014		.017		.039
Sample Size		2,431		876		855		304		396

Notes: This table reports descriptive statistics by NU target campus or college type. Variable definitions and specifications are detailed in Table 1.
*** p < 0.01, ** p < 0.05, * p < 0.10

Table A4
First Stage Effect on Year One and Year Two Financial Aid Packages
for Nebraska Public College Students
(2012 & 2013 Cohorts)

	Year One Aid Packages					Year Two Aid Packages				
	Control Mean (1)	Covariate Adjusted (2)		Campus Adjusted (3)		Control Mean (4)	Covariates Adjusted (5)		Campus Adjusted (6)	
Cost of attendance	17,469	1,129	***	104		17,104	1,650	***	-30	
		(196)		(147)			(388)		(277)	
Total aid	11,608	3,319	***	2,168	***	8,957	4,155	***	2,619	***
		(234)		(202)			(421)		(379)	
Total grants	7,251	6,225	***	5,467	***	5,233	6,439	***	5,341	***
		(184)		(167)			(320)		(294)	
Federal grants	2,635	25		-135	**	2,255	58		-173	
		(67)		(63)			(131)		(130)	
Pell	2,541	42		-109	*	2,185	74		-141	
		(64)		(61)			(127)		(125)	
Other federal grants	94	-18	*	-26	***	70	-16		-32	*
		(10)		(10)			(16)		(17)	
State grants	527	-25		-91	**	335	-118	**	-171	***
		(42)		(42)			(52)		(55)	
Institutional grants	2,904	-380	***	-635	***	2,305	-456	**	-803	***
		(111)		(111)			(184)		(191)	
STBF grant	0	6,924	***	6,744	***	0	7,034	***	6,625	***
		(77)		(77)			(144)		(144)	
Other private grants	1,185	-318	***	-417	***	338	-80		-138	*
		(80)		(84)			(75)		(82)	
Total government loans	3,529	-2,220	***	-2,524	***	3,239	-1,674	***	-2,025	***
		(148)		(153)			(257)		(274)	
Subsidized Stafford	1,586	-1,241	***	-1,359	***	1,549	-1,017	***	-1,184	***
		(60)		(61)			(114)		(118)	
Unsubsidized Stafford	907	-166	**	-252	***	866	-55		-118	
		(66)		(66)			(111)		(115)	
Perkins	308	-246	***	-276	***	158	-117	***	-147	***
		(21)		(23)			(29)		(32)	
PLUS	728	-566	***	-637	***	666	-485	***	-575	***
		(80)		(86)			(135)		(153)	
Federal Work Study	829	-486	***	-580	***	485	-272	***	-372	***
		(45)		(46)			(63)		(67)	
Campus controls		No		Yes			No		Yes	
Sample size	1,093	1,928		1,928		365	777		777	

Notes: This table reports effects of the STBF scholarship offer on students' financial aid packages, showing results for detailed aid categories. Samples, specifications, and variable definitions are detailed in Tables 2 and 3.

*** p < 0.01, ** p < 0.05, * p < 0.10

Comparing OLS and Logit Marginal Effects on Year Two Enrollment
(2012 Cohort)

	Full Sample	Race		Gender		ACT Score	
		White	Nonwhite	Female	Male	Above Median	Below Median
	(1)	(2)	(3)	(4)	(5)	(6)	(7)

A. OLS

Any post-secondary	.059 ***	.033 **	.125 ***	.039 ***	.090 ***	.027 *	.096 ***
	(.012)	(.014)	(.029)	(.014)	(.021)	(.014)	(.019)
	{2,431}	{1,599}	{552}	{1,496}	{935}	{1,246}	{1,185}
Any four-year college	.125 ***	.094 ***	.191 ***	.105 ***	.151 ***	.067 ***	.188 ***
	(.015)	(.018)	(.037)	(.019)	(.026)	(.019)	(.024)
	{2,431}	{1,599}	{552}	{1,496}	{935}	{1,246}	{1,185}

B. Logit Marginal Effects

Any post-secondary	.063 ***	.034 **	.152 ***	.040 ***	.099 ***	.030 *	.103 ***
	(.013)	(.015)	(.037)	(.015)	(.025)	(.017)	(.022)
	{2,413}	{1,581}	{525}	{1,478}	{921}	{1,153}	{1,178}
Any four-year college	.130 ***	.099 ***	.213 ***	.109 ***	.166 ***	.071 ***	.194 ***
	(.016)	(.019)	(.038)	(.020)	(.029)	(.021)	(.024)
	{2,407}	{1,581}	{502}	{1,485}	{878}	{1,211}	{1,174}

Notes: This table reports OLS and average logit marginal effects for year two enrollment outcomes. The OLS estimates for race and gender are plotted in Figure 1. Figure 3 plots OLS effects by ACT score. All regressions control for target college, application year, and baseline covariates, as defined in Table 2. Standard errors are in parentheses and sample sizes are in braces. The logit estimates exclude strata in which outcomes do not vary in the given subsample. The sample is restricted to the 2012 cohort, where we have two complete years of outcome data.

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$

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A Data Appendix

A.1 Application Data

The STBF scholarship application has three components that provide baseline data for our sample: the high school transcript, the federal Student Aid Report, and the demographic survey. High school transcripts include several measures of baseline academic achievement, including GPA, class rank, and for many students, self-reported ACT scores.[16] For all results reported here, we have converted GPAs to a 4.0 scale using formulae provided by the University of Nebraska-Lincoln.

Most of the demographic data come from federal Student Aid Reports (SARs), which applicants use to demonstrate financial need. The Federal Student Aid Office at the US Department of Education generates an SAR for all students who file the Free Application for Federal Student Aid (FAFSA). SARs contain responses to more than 100 FAFSA questions regarding family structure and financial resources. Roughly three percent of scholarship applicants are undocumented students, who are ineligible for federal financial aid and therefore cannot file the FAFSA. To demonstrate financial need, STBF permits these students to submit an alternative form called the College Funding Estimate (CFE). The CFE is published by the EducationQuest Foundation, a non-profit organization in Nebraska, and offers a similar, though less detailed, set of questions.

We supplement these formal records with demographic information from a short survey that follows the application. Since the Foundation does not permit questions about race on this survey, we collect this information from driver's license data at the Nebraska Department of Motor Vehicles. We were able to match more than 85 percent of the randomization sample to a DMV record.

A.2 College Outcomes

A.2.1 Financial Aid

Each Nebraska public college in our study provides a rich set of student financial aid information, including cost of attendance (COA), grant aid, student loans, and work study. We agglomerate the data from each school into one standardized dataset of student financial aid outcomes.

Cost of attendance is the estimated total cost of attending college for a full-time student, in-

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[16] In Nebraska, the vast majority of students take the ACT rather than the SAT. For the 2012 cohort, 70 percent of Nebraska high school students took the ACT, compared to the national average of 52 percent.

cluding tuition and fees, room and board, books, and other expenses. Different schools report COA on different enrollment scales (annual or term level). We standardize all COA figures at the term level based on the number of terms in each school's academic year. For example, if a school with a semester- (quarter-) based academic calendar reports COA at the annual level, we divide this number by two (three).

Schools provide information on four types of grants—federal, institutional, private, and state. For each type of grant aid, we observe a detailed breakdown of underlying grants that are included in this total. For example, some colleges report the total federal grants figure along with the amount of a student's Pell grant, Federal Supplemental Educational Opportunity Grant, Academic Competitiveness Grant, and other federal grants, which add up to total federal grants. For schools that only report underlying grants, we calculate the aggregated measure. Some schools double count underlying grants in two different types of aggregated measures. For example, private STBF grants can be counted in both total institutional grants and total private grants. In such cases, we remove the double counted component and recalculate total grants.

We track two types of loans—federal and private. While all schools report federal loans, not all schools report private loans, as students typically obtain private loans after all federal aid options are exhausted and are thus not required to disclose this information to be eligible for federal aid. For schools that do not report private loans, we calculate total loans by aggregating federal loans (which include subsidized and unsubsidized Stafford loans), PLUS loans, and Perkins loans. We do not include information on private loans in any of our analysis. All schools report the total Federal Work Study award.

A.2.2 Academic Outcomes

We construct both binary and continuous measures of students' enrollment status. The binary measures indicate the type of institutions that students attended (e.g., four-year, two-year, or any post-secondary). These indicators take a value of one if a student has enrolled at a given type of institution. The continuous measures are constructed based on the cumulative number of academic semesters that a student has attempted at a given college. For each student, we calculate the fraction of each term they were enrolled (i.e., 1 for full-time, 0.5 for half-time, 0 for not enrolled) and compute the running total during the relevant enrollment period.

The underlying variables used to construct these binary and continuous measures come from the administrative records of Buffett-eligible institutions and the National Student Clearinghouse (NSC). Both the school-provided data and the NSC cover similar information on students' enrollment status, but they differ in that only the latter provides information on the students who choose to attend an out-of-state university or private college. There are several steps involved in standardizing these underlying variables across datasets. We briefly describe these steps below.

Since some schools have quarterly academic calendars, we standardize all term-level data by mapping the quarterly-based calendar to semester equivalent. Once all schools have semester-based calendars, we construct year-level enrollment measures by assigning each term to a given academic year, running from July 1st to May 31st of the following year. We obtain each school's academic calendar information from IPEDS and use the scale factor from the Federal Student Aid Handbook when converting quarter credits to semester credits.

To create the institution type variable, we rely on the school-provided records and IPEDS. We classify colleges as four-year or two-year institutions based on their definition in IPEDS. There are some students in our sample who take courses at both a four-year and at a two-year institution in a given term. In this case, we code these students as being enrolled in a four-year college (and not enrolled only in a two-year college) to ensure that our two-year and four-year enrollment outcomes are disjoint.

We obtain information on students' enrollment status from the NSC and supplement this with the school-provided information on completed academic credits. The NSC provided data include four enrollment categories: full-time, half-time, less than half-time, and not enrolled. If the NSC enrollment is missing, we impute this variable from credits by defining "full-time" as enrolling in 12 or more credits, "half-time" as enrolling in six to 11 (inclusive) credits, and "less than half-time" as enrolling in five or fewer credits. For the small number of students for whom we have neither the NSC nor the credits information, we assume a student will be enrolled full-time if more than 85% of the students at the same university are also enrolled full-time.[17]

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[17]There are 36 such cases. Twenty-one of these students attend private colleges, such as Clarkson College, Hastings College, and others.